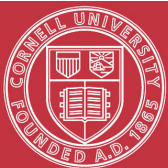


# Pollinators in the Woods

A GUIDE TO UNDERSTANDING AND  
CREATING FOREST POLLINATOR HABITAT



Cornell University  
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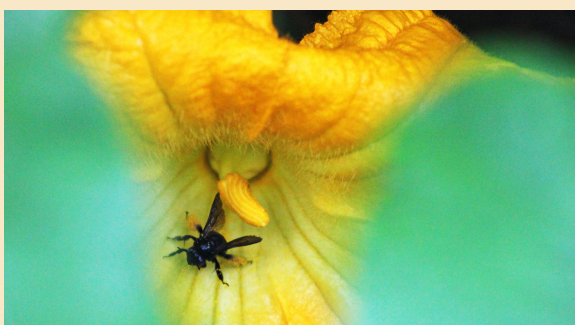
# What are pollinators?

Pollinators are any insect or animal that fertilizes a plant by carrying pollen from one plant to another. This movement of pollen allows plants to reproduce by growing seeds and fruit, which allow new plants of that species to grow.

Many different types of pollinators contribute to our planet's complex ecosystems, including butterflies, moths, beetles, ants, flies, bats, and other small mammals. Bees are some of the best-known pollinators, and there are over 450 native bee species in the Northeast United States alone!

## Why are pollinators important?

Although we do not see it when we buy food from the grocery store, pollinators are a critical part of our food system. We rely on animal pollination for one third of our global food production, and for growing 70% of the world's major crops. In the United States we grow over 100 crops that need or benefit from insect pollinators - the value of the pollination services of just bees alone is estimated to be \$18 billion! Pollinators are important to New York State agriculture too – New York has more than 7 million acres in agricultural production and 35,500 farms, and many of our leading crops like apples, cabbage, berries, and pumpkins rely heavily on insect pollination.



*An insect pollinating a pumpkin flower. Photo by Courtney Celley/USFWS*

## Unsung Pollinators: Beetles & Flies



Beetles were some of the first pollinators of flowers and are still important today – particularly for plant species like magnolias, spicebush, and goldenrods.

They often visit white or green flowers with a strong, fruity smell that are open during the day.

Most flies are not as hairy as bees, and therefore not as efficient at carrying pollen on their bodies, but they are



still important pollinators! Many species of syrphid flies are bee mimics – they have the same black and yellow coloring and can be hard to differentiate from look-alike bees. However, flies only have two functional wings, while bees have four. Some flowers that attract flies have putrid, smelly odors, like purple trillium (*Trillium erectum*).



Pollinators are also a critical part of Earth's ecosystem. Like us, many other organisms rely on pollinators for food – either by eating them directly or eating the fruits and plants they pollinate. Fruit and seeds generated because of insect pollination make up a major part of the diet of 25% of all birds, and of mammals ranging from red-backed voles to black bears.

## Pollinator Populations in Decline

Honey bees, although not native to the United States, are probably the most widely recognized pollinators, and have long been important players in North American pollination. Many farmers rent managed honey bee hives annually to pollinate their crops. In New York State, apple growers depend upon honey bees for pollination. However, since 2006, honey bee populations have been declining due to factors such as pesticide use, disease, pests (parasites), migratory stress from long-distance transport, changes in habitat quality, and habitat loss.

Many factors contribute to declines in bee and butterfly populations:

- habitat fragmentation
- climate change
- non-native plants
- pathogens
- overgrazing by white-tailed deer
- pesticides
- harvesting of wild plants
- loss of open forests and forest clearings



*Photo by Glacier NPS*



*Photo by Bruce Dupree*

During the last decade, beekeepers have been experiencing 50% or greater annual losses of managed honey bee colonies, along with the valuable pollination services they provide. There has also been a decline in native pollinators, like bumble bees, the monarch butterfly, and others. With honey bees on the decline, farmers, gardeners, and conservationists alike are turning their attention to boosting populations of native pollinators to help offset the loss. While honey bees have been popular in the agricultural industry, native bees actually can be more efficient pollinators of certain crops and can bring the same benefits as honey bees to a farmer, without the cost of having to rent or purchase honey bee hives.

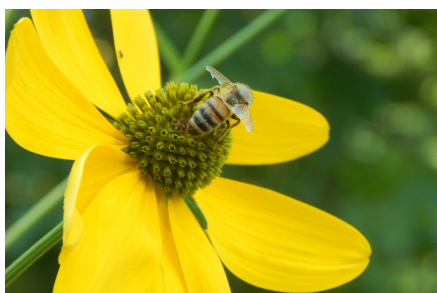
By keeping natural areas such as hedgerows, and managing natural areas with practices that support wild pollinators, pollination can be improved in natural habitats as well as nearby agricultural fields and home gardens. New York State is home to over 450 wild pollinator species, which are important both to our commercial crops and to sustaining a healthy wild ecosystem. With a wider variety of species living in the natural areas, the network of pollinators is more stable – if one species has a bad year, there are many other species that could still pollinate crops. Additionally, native bees are sometimes more efficient pollinators than honey bees. Some native species can ‘buzz-pollinate’ flowers with certain vibrations, releasing pollen from deeper inside the flowers than honey bees can. These native bees can effectively pollinate flowers with fewer pollinator visits. Native fly and bee species like mason and bumble bees also can tolerate colder, wetter conditions than honey bees, and go out to pollinate on days that honey bees will not.



### Did you know?



When bears go after beehives, it is not the honey they are looking for. Although bears will sometimes eat honey, they actually prefer to eat the immature bees – the pupae, larvae, and eggs developing in the honeycomb. These provide much more nutritional value than honey since they are packed with fat and protein!



## Why are pollinators important in our forests?

Forests are an important part of New York's landscape, economy, and identity. Nearly 63% of the state is now forest land, the greatest percentage in 150 years! Everyone benefits from the ecosystem services that New York's forests provide, like clean water and air, habitat for fish and wildlife, flood protection, and reduction of greenhouse gases. Forests also have other benefits including recreational opportunities, scenic beauty, and the economic benefits provided from forest products. Native pollinators pollinate many of our forest plants and make sure that many flowering species like red maple, willows, and hawthorns, can produce fruits and successfully reproduce. Pollinators are also an important food resource for many forest organisms, like birds, amphibians, other insects, and even some mammals.





Photo by Lance Cheung

Pollinators that live in forests can also travel into nearby, non-forested habitat. Agricultural fields near forests see greater pollinator activity than isolated fields, which can lead to more valuable crops at harvest. These forest-adjacent fields see especially high activity of native pollinator species. For example, researchers in the Finger Lakes region found that 93% of the community of bees pollinating strawberry crops were wild bees, which were less abundant when the

landscape lacked forested natural land. More bees present also correlated to heavier fruits and a greater harvest yield! Additionally, researchers in Argentina found that soybean crops closer to forests were visited by more pollinators, and that soybean seeds and pods were twice as heavy when exposed to pollinators even though soybean crops do not need insect pollination to produce seeds.

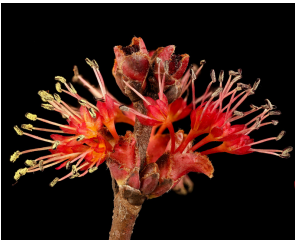
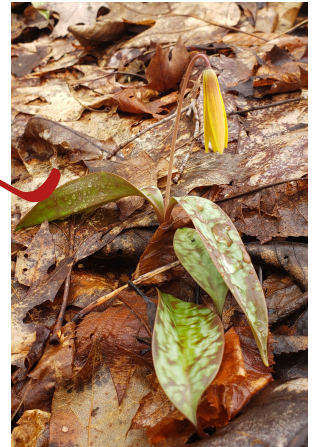
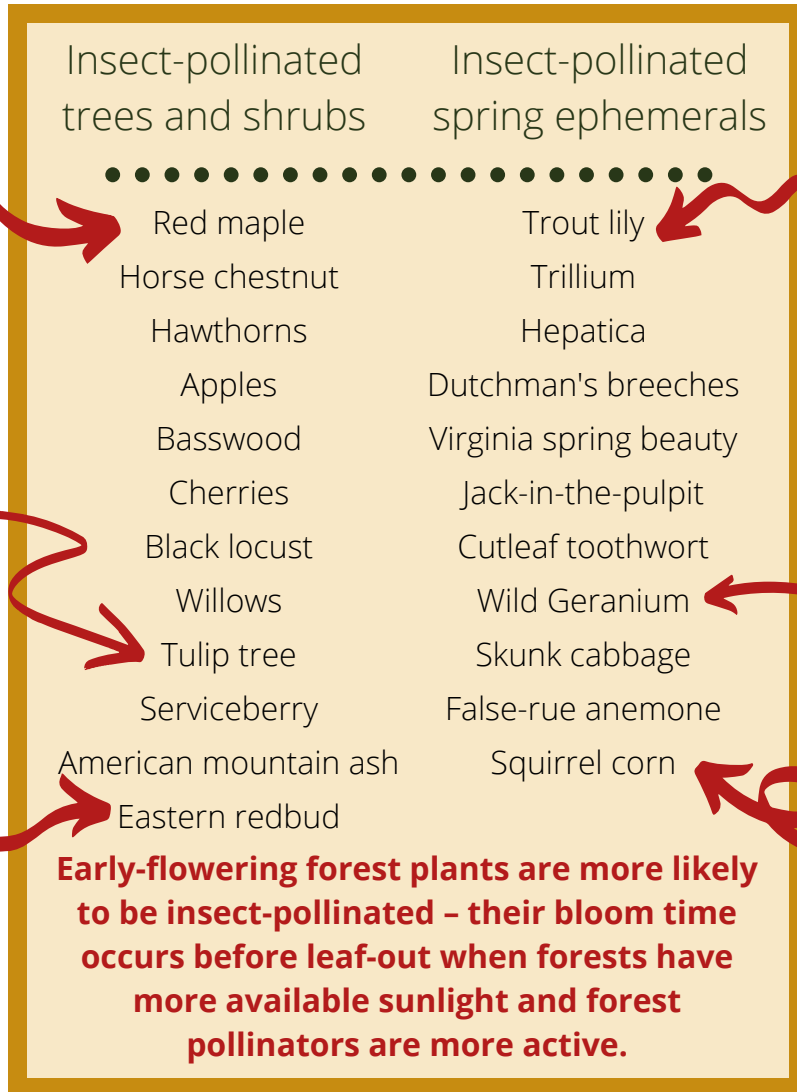


Photo by Helen Lowe Metzman



Photo by Dan Keck





## Why manage for pollinators in your forest?

People can approach pollinator conservation with a wide variety of goals. For example, your goal may be:

- maintaining the greatest number of pollinator species
- seeing many different kinds of pollinators on your land
- promoting habitat for different types of pollinators to support a wider variety of flowering plants
- maximizing the amount of crop pollination provided by wild native pollinators
- sustaining a healthy population of a species in peril, like the monarch butterfly (*Danaus plexippus*)

Because there are so many different types of pollinators, each with different nesting and feeding needs and behaviors, no single management approach can benefit every species of pollinator. Make sure to consider the habitats present and identify your own conservation priorities when you plan pollinator conservation activities for your land.

## What makes good forest habitat for pollinators?

### Habitat Structure

Pollinators like bees and butterflies generally favor open forest habitats, with open canopies and more light availability. Forests with closed canopies over dense, shady shrub layers can limit the growth of other sun-loving, flowering plants, which are the ones pollinators often prefer.

Forest thinning can have positive effects for pollinators because it opens up the forest canopy and allows light to reach the forest floor. The light in turn favors the growth of plants on the forest floor, and promotes flowering. Removing small groups of trees to create canopy gaps can increase the abundance of pollinators after trees have leafed out. These gaps allow more sun-loving flowering plants to grow and attract pollinators. They also benefit soil-nesting bees, which prefer patchy ground with ample sun exposure.

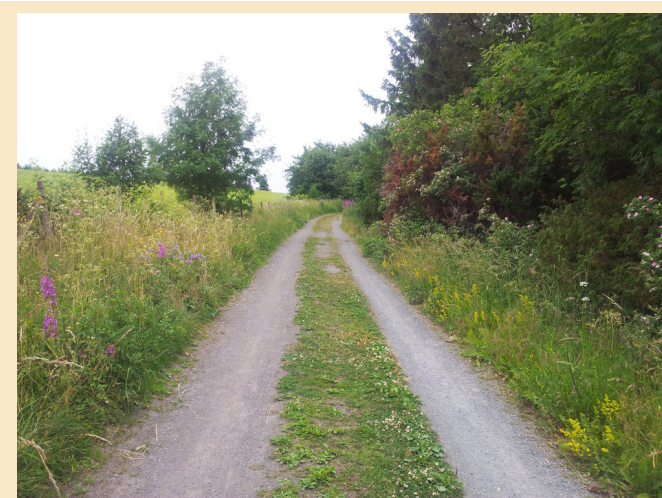


*Gaps in the forest canopy allow sunlight to reach the ground, helping flowering plants grow.*



If your forest already has canopy gaps, it may be helpful to pollinators to remove nonnative plant species in these gaps. You can either replace them with natives or manage the gaps for the natural regrowth of these species. Pollinators usually show an overall negative response to non-native plants, especially when they outcompete native vegetation. If your land is host to any rare flowering plants, you can increase the number of pollinators visiting them by removing invasive plants that compete for pollinators' attention.

Other important places for pollinators in your forest include small meadows, exposed road and reservoir edges, dams, and marshes. Like canopy gaps, these places often also have lots of available light, allowing for the growth of flowering herbs and shrubs that provide the pollen and nectar that pollinators need.



*Photo by runej*

The forest interior is not the only place where you can make changes to benefit pollinators. In fact, forest edges that receive more sunlight show a positive effect on pollinator activity and abundance within the forest. Roads and roadside power-line corridors are a great opportunity to increase open, pollinator-friendly habitat even in places with dense forests. Thinning the forest adjacent to the road, mowing infrequently, and creating native plant communities in places where nonnatives dominate can improve the transition zone between forested and non-forested areas for pollinators. In managed

forests, inactive log landings can also serve as pollinator habitat. Seeding landings with native wildflowers that bloom throughout the seasons can provide floral resources for pollinators to visit.

Butterflies are particularly at risk when roadsides are frequently mowed since their caterpillars are exposed on their host plants. When planning your mowing schedule, it is a good idea to research when butterflies in your area may have caterpillars developing and avoid mowing during these periods. In NYS, mowing should be delayed until late September or early October, after butterflies have developed into adults and are no longer living on their host plants.





## Cover

Leaving brush or log piles, or treetops left on the ground after a timber harvest, can have many benefits for the pollinators in your forest. Increased presence of logs increases the number of bee and butterfly species in your forest by providing a wider variety of habitats for species with different needs.

Tunnel-nesters, such as carpenter bees and mason bees, dig tunnels in wood or use abandoned cavities such as beetle burrows or cracks in stonework. They need stems, trees, rotting logs, wooden structures, or old masonry for nesting. Some small carpenter bees excavate their nests in the pithy stems of plants, such as raspberry and blackberry. Piles of brush and logs can supply pithy stems for tunneling, and often attract other insects that create the tunnels some bees repurpose for their nests.



*Brush piles can provide nesting sites for many different types of bees.*

Cavity-nesting bees, such as honey bees and bumble bees, do not excavate their own nests. Instead, they find existing cavities to house their colonies and honey supplies. Brush piles can also be a great resource for cavity-nesting bees. Small animals seeking protection often construct their dens in and underneath the piles, and when these dens are abandoned they are perfect places for cavity-nesting bees to make a home.

Some butterfly and moth species overwinter as adults. Generally, these species spend the winter months tucked into crevices, under or in between logs or underneath loose bark on trees. These species, such as the mourning cloak, often can be seen flying on the early days of spring. To create a brush or log pile for butterflies, leave the wood in contact with the ground to encourage decay. Place wood near late-season nectar plants and/or host plants. Larger diameter wood pieces often are the most valuable, but smaller diameter twigs can also be used.



*Mourning cloak (Nymphalis antiopa). Photo by Jacob W. Frank/NPS*



*Keeping dead standing trees, or snags, in your forest also benefits pollinators. Some solitary bees build nests in beetle tunnels in snags.*

## Food

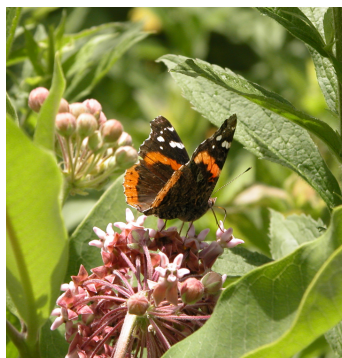
The best forests for pollinator habitat have many herbaceous plants growing on the ground. These plants need lots of available sunlight to flower and supply the pollen and nectar that many pollinators are seeking. Studies suggest that having a variety of flowering plant species available can help improve the overall health of bees. A diverse selection of food sources can also lead to a more diverse bee population. This is especially true if your forest includes plants preferred by diet-specialist bees, who only visit a small subset of different plants. These bees are typically more reliant on open forest canopies than generalist bees.

When assessing whether the plant composition of your forest is good for supporting pollinators, it is important to consider that different pollinators have different resource needs at different times. For example, bees need nectar and pollen throughout their entire life cycle, while butterflies only use nectar as adults. Researching the bloom

periods of the plants that grow in your forest, and when pollinators may be using them for food and habitat, can tell you if there are seasonal gaps in flowering times that may be limiting pollinators' success.

The life history of pollinators is also an important factor in which forest plants they need to survive. Most butterfly and moth larvae feed on leaves, while bees must collect enough pollen and nectar to support both themselves and their offspring. Woody plants, such as trees and shrubs, have been shown to support 10 times more lepidopteran (butterfly and moth) species than herbaceous plants do.

Lepidopterans use native woody species as a source of food and shelter for their larvae, for pupation, and as nectar sources for adults. In fact, 2/3 of host plants for butterflies and moths are trees and shrubs. If you want to support both lepidopterans and bees, a forest ecosystem with a variety of woody and herbaceous plants is ideal.







*Swallowwort (Cynanchum sp.), an invasive plant toxic to butterfly larvae. Photo by Katja Schulz*

Even though non-native plants can provide nectar, pollen, and food for butterfly larvae, they can negatively affect pollinators when they outcompete native plants. Non-native plants can be especially harmful to butterflies. Some non-native plants attract butterflies because they are similar to the native plants on which they lay their eggs, however, are actually toxic to the caterpillars that emerge and eat the plant, killing the butterfly's larvae!

## Conclusion

Pollinators are both a fascinating and important part of our ecosystems, and there is still much more about them to learn! Bees, butterflies, and moths are the best-known pollinators. Beetles and flies are also important, but there is less known about their habitat needs. While fields and gardens are the obvious habitats for pollinators, forests are important, too, and can serve as a population source for nearby agricultural areas. If you are interested in supporting a diversity of pollinators in your forest, whether big or small, you can take thoughtful action to benefit these important insects.

### Large-scale Actions

- Prevent habitat fragmentation – development of natural areas breaks habitat into smaller and smaller pieces
- Reduce deer populations when possible – heavy browsing of plants by deer can reduce the number of different types of flowers and plants available for pollinators
- Minimize or eliminate use of pesticides
- Be careful not to overharvest native, wild plants in the forest

### Create Habitat

- Create small openings in the forest – small gaps in the forest canopy allow sunlight to reach the forest floor which encourages growth of flowering plants
- Encourage or support the growth of many different types of forest wildflowers, plants, and trees
- Foster wildflower growth along roadsides, power-line corridors, water features, and on log landings
- Mow along roadsides in the fall, after butterflies have completed their development
- Leave or construct piles of brush or logs, or leave treetops on the ground after a timber harvest



## Resources

Want to learn more about how to support pollinators in your forest? Explore these resources for more information:

- Xerces Society for Invertebrate Conservation
- US Forest Service
- US Fish & Wildlife Service
- USDA Natural Resources Conservation Service
- Pollinator Partnership
- NYS Department of Environmental Conservation



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