

Native Pollinators

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Introduction

Pollination is an ecosystem process that has evolved over millions of years to benefit both flowering plants and pollinators. Pollinators visit flowers for many reasons, including feeding, pollen collection, and warmth. When pollinators visit flowers, pollen rubs or drops onto their bodies. The pollen is then transferred to another flower or a different part of the same flower as the pollinator moves from one location to the next. This process is a vital stage in the life cycle of all flowering plants and is necessary to start seed and fruit production in flowers. Not only do pollinators provide essential services in nature, they are also necessary for healthy, productive agricultural ecosystems as they ensure the production of full-bodied fruit and fertile seed sets in many crops.

Although some plant species rely on wind or water to transfer pollen from one flower to the next, the vast majority (almost 90%) of all plant species need the help of animals for this task. There are approximately 200,000 different species of animals around the world that act as pollinators. Of these, about 1,000 are vertebrates, such as birds, bats, and small mammals, and

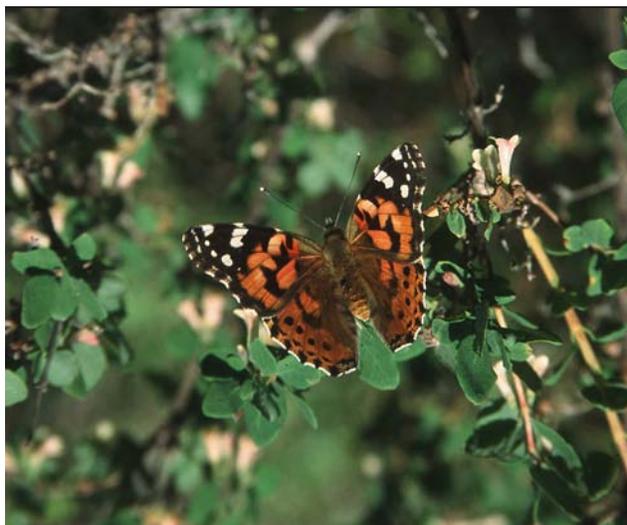
the rest are invertebrates, including flies, beetles, butterflies, moths, and bees.

This leaflet is designed to bring much needed attention to native pollinators. Native pollinators are adapted to local climate conditions, soils, and plant life and, thus, require limited management or maintenance. By reading this leaflet, landowners should gain a better understanding of the great value of native pollinators and that many species face a serious risk of decline. The leaflet presents the habitat requirements of a variety of native pollinators and offers practical ideas for their conservation and management.

Value of pollinators

Animals pollinate approximately 75 percent of the crop plants grown worldwide for food, fiber, beverages, condiments, spices, and medicines. It has been calculated that one out of every three to four mouthfuls of food we eat and beverages we drink is delivered to us by pollinators. As such, agricultural products that are produced with the help of pollinators make a significant contribution to the economy. For example, it has been estimated that insect-pollinated crops directly contributed \$20 billion to the United States economy in the year 2000. If this calculation were to include indirect products, such as milk and beef from cattle fed on alfalfa, the value of pollinators to agricultural production would be raised to \$40 billion in the United States alone. Table 1 shows some of the common agricultural crops that are dependent upon or benefited by insect pollination.

Not only do native pollinators provide us with a significant amount of the food we eat and contribute to the economy, they also perform key roles in natural ecosystem. By helping to keep plant communities healthy and able to reproduce naturally, native pollinators assist plants in providing food and cover for wildlife, preventing erosion, and keeping waterways clean. Pollinated plants produce fruit and seeds which are a major part of the diet of approximately 25 percent of bird species, as well as many mammals. Flowering



Painted lady butterfly

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The apple industry relies on insect pollinators.

plants also provide egg laying and nesting sites for many insects, including butterflies. Pollinators support biodiversity, and there is a positive correlation between plant diversity and pollinator diversity.

Decline of native pollinators

Human activities have destroyed and fragmented many native pollinator habitats. Many remaining habitat areas are isolated and degraded by invasive plant species, making them less suitable for native pollinators and other wildlife. These changes in habitat can lead to a reduction of native pollinator food sources

and sites for mating, nesting, roosting, and migration. Excessive use and improper application of many pesticides impact pollinators and their habitats. Some insecticides directly kill pollinators, particularly pollinating insects, and herbicides reduce forage plant diversity by killing wildflowers. Non-native pollinators, such as honeybees, can out-compete native pollinators for local nectar resources, placing them at greater risk of decline. The destruction and fragmentation of pollinator habitats have led to significant declines in many populations. At least 185 species of pollinators are considered threatened or extinct by the World Conservation Union (IUCN), and at least 2 bat and 13 bird species listed as endangered in the United States are pollinators.

Native pollinator habitat requirements

Bees

Bees provide an important pollination service for most terrestrial ecosystems worldwide. In the United States, honeybees and thousands of species of native bees are responsible for pollinating crops, as well as garden, meadow, and forest plants. There are about 4,000 species of bees native to the United States, the great majority of which are solitary nesting bees. Bumblebees are the exception, as they live in social colonies. Most bees visit flowers to get pollen and/or nectar, which they use to feed themselves and their offspring.

Table 1 Crops dependent upon or benefited by insect pollination

Legumes and relatives	Beans, Cowpea, Lima Beans, Lupines, Mung Bean/Green or Golden Gram, Soybean
Vegetables	Artichoke, Asparagus, Beet, Broccoli, Brussels Sprouts, Cantaloupes, Carrot, Cauliflower, Celery, Cucumber, Eggplant, Endive, Green Pepper, Leek, Lettuce, Okra, Onion, Parsnip, Pumpkin, Radish, Rutabaga, Squash, Tomato, Turnip, White Gourd
Fruits, berries and nuts	Almonds, Apple, Apricot, Avocado, Blackberry, Blueberry, Cacao, Cashew, Cherry, Chestnut, Citrus, Coffee, Coconut, Crabapple, Cranberry, Currant, Date, Fig, Gooseberry, Grapes, Guava, Huckleberry, Kiwi, Kolanut, Litchi, Macadamia, Mango, Olive, Papaw, Papaya, Passionfruit, Peach, Pear, Persimmon, Plum, Pomegranate, Raspberry, Strawberry, Tung, Vanilla, Watermelon
Herbs and spices	Allspice, Anise, Black Pepper, Caraway, Cardamom, Chive, Clove, Coriander, Dill, Fennel, Lavender, Mustard, Nutmeg, Parsley, Pimento, Tea, White Pepper
Oils, seeds and grains	Alfalfa, Buckwheat, Canola, Flax, Oil Palm, Safflower, Sesame, Sunflower
Clover and relatives	Alsike Clover, Arrowleaf Clover, Ball Clover, Berseem Clover, Black Medic/Yellow Trefoil, Cider Milkvetch, Crimson Clover, Lespedeza, Peanut, Persian Clover, Red Clover, Rose Clover, Strawberry Clover, Subterranean Clover, Sweet Clover, Trefoil, Vetch, White Clover
Other	Cotton, Kenaf



A bumblebee visits a purple coneflower.

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Honeybees are relied upon heavily for crop pollination and honey production. However, honeybees are not native to North America. Many species of native bees do exist in North America, and horticulturists, conservationists, ecologists, and home gardeners are becoming more aware that they are important for pollination. Not only do native bees pollinate agricultural crops, they also play an integral role in the functioning of natural ecosystems.

Among the most common native pollinators are solitary bees, aptly named because most do not assemble in hives or colonies, and those that do aggregate live solitary lives among the others. Solitary bees pollinate valuable commercial crops such as apples, alfalfa, watermelon, sunflowers, strawberries, and blueberries. Solitary bees nest in a variety of interesting places including sticks, dirt mounds, and termite holes. A few species construct domed nests out of mud, plant resins, saps, or gums on the surface of rocks or trees. Many bees use abandoned beetle burrows or other tunnels in dead standing trees, or excavate their nests within the soft central pith of stems and twigs. Most species of solitary bees, however, nest in the ground, digging a tunnel in bare or partially vegetated, well-drained soil. Depending on the species, solitary bees can be generalist feeders or specialist feeders. Generalists are bees that gather nectar and pollen from a wide range of flower types and species. Often these are the more resilient species, able to survive in degraded environments with weedy or non-native plants. Specialists, on the other hand, rely on a single plant species or a closely related group of plants for nectar and pollen, and are more susceptible to the negative effects of landscape or habitat changes.

Bumblebees are social bees, meaning they live in colonies, share work, and have multiple, overlapping generations throughout the spring, summer, and fall. Bumblebees need a suitably sized cavity in which to

nest. Sometimes this cavity is above ground, such as in hollow trees or walls, or under a clump of grass, but more often bumblebees nest underground, sometimes in abandoned rodent holes. Bumblebees are generalist feeders and forage on a wide range of plants.

Butterflies

More than 700 species of native butterflies exist in North America. Butterflies, like all pollinators, are closely linked to their environments, such that drastic changes in the ecosystem can be devastating to localized populations or species. A butterfly's life has four stages: egg, caterpillar, pupa, and adult. The habitat needs of the butterfly vary from stage to stage, and each has needs that must be considered to provide suitable habitat.

Leaves and branches of trees and shrubs, wildflowers, grasses, and soil serve as substrates for butterfly eggs. However, most butterfly species are limited to one or a few closely related plant species that can successfully serve as host plants for the caterpillars, and females must lay their eggs on or near the host plant in order for the caterpillar to survive. For example, monarch butterfly caterpillars eat only milkweed, and female monarchs will only lay eggs on or near milkweed plants. Caterpillars feed on the leaves, stems, flowers, or fruits of their host plants, which also serve to cover them from potential predators.

After several weeks of eating and growing, caterpillars begin to transform into their adult forms. This transformation is called the pupa stage, and it is the non-feeding, stationary stage of a butterfly's life. Though they do not require food, pupae do need a protected site, such as a bush, tall grass, or a pile of leaves or sticks, on which to transform into their adult forms.



Butterflies are important pollinators of flowering plants.

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Adult butterflies rely almost solely on nectar for food. In general, butterflies prefer colorful, fragrant flowers with surfaces that are flat and broad enough on which to land. The best nectar choices for adult butterflies are the daisy family (asters, goldenrods, dahlias, marigolds, zinnias), dogbane, butterfly weed, milkweed, ironweed, coneflower (*Rudbeckia*), goldenrod, fleabane, thistle, peony, lupine, vetch, wild yarrow, and phlox. The adult males of some species also obtain nutrients, minerals, and salt from rotting fruit, tree sap, animal dung and urine, carrion, clay deposits, and mud puddles. The leaves, stems, and branches of the host plants provide perching sites on which adult butterflies can feed, sun, and rest. Vegetation and small woodpiles can also provide cover from wind, rain, and predators. To fly, adult butterflies need to be warm, so they will sit on sunny surfaces to warm up before taking flight.

It is well known that monarch butterflies migrate great distances to overwinter. While other butterfly species simply die before winter, many butterfly species hibernate. Hibernation occurs at different life stages, depending on the species. Hibernation can take place under leaf litter or loose bark, or in piles of logs or other debris.

Moths

The vast majority of moths are nocturnal, and some are very important pollinators of night-blooming flowers, particularly in desert regions of the southwestern United States and Mexico. For example, the female yucca moth has mouthparts that allow her to gather a ball of pollen under which she lays her eggs in the stigma of the yucca flower. This process also ensures that yucca cross-pollination occurs. In general, moth habitat needs are similar to those of butterflies.

Beetles and flies

Flies and beetles are two important groups of native pollinators. Some flies resemble bees because they mimic bee coloration and patterns, allowing them to evade predation. Bees and flies both have transparent, membranous wings, but can be distinguished from one another because flies have two wings, while bees have four. Some pollinating beetles are quite small and difficult to see, resembling black specks on flowers, while others are large and colorful. There are hundreds of thousands of species of flies and beetles and many have yet to be identified. Habitat requirements vary from species to species. Flies and beetles require food, water, and cover in sufficient quality and quantity for each of their life stages (egg, larva, pupa, adult).



Charlie Rewa, NRCS

Syrphid flies are important pollinators and the larvae of some species eat insect pests such as aphids.

Bats

Some plants with nocturnal blossoms are pollinated by bats. Bananas, mangoes, dates, figs, peaches, cashews, guava, avocados, and agaves (used to make tequila) rely on bats for pollination. Forty-five species of bats occur in the United States; the greatest concentrations live in Texas, New Mexico, Arizona, Nevada, and southern California. It is estimated that 40 percent of American bat species are either endangered or suffering significant declines. The primary causes for the decline of bat species is the loss of roosting habitat and the degradation of natural desert habitats in the Southwest. Loss of roosting habitat is due to cave and mine closure, vandalism and intentional habitat destruction, development and deforestation, and the removal of live trees, snags, and hedgerows from agricultural fields, farmlands, and other rural landscapes.

Bats roost by hanging inverted from tree branches or in tree cavities, caves, mines, or rock crevices. They may also roost in tangled hedgerow thickets, under tree bark and bridges, or in attics, roofs, barns, or other structures that provide an overhang. Bats use roost sites for hibernation, to raise their young, to rest during the day, and for migratory stopovers.

The diets of bats vary from species to species. Many species are generalists and display opportunistic feeding behavior, feeding on whatever is available at the time. Frugivorous and nectivorous bats eat fruit, pollen, or nectar from plants or flowers. Insectivorous bats feed primarily on night-flying insects such as moths, beetles, fruit flies, mosquitoes, mayflies, caddisflies, and midges. Foraging habitat for bats includes woodlot canopies and understory, over streams and other bodies of water, in open fields and agricultural cropland, over desert landscapes, and in lighted, residential areas in which large populations of insects



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Many fruits rely on bats for pollination.

exist. Bats require open bodies of clean water large enough for them to skim the surface to drink.

Hummingbirds

Hummingbirds play an important role in the pollination of numerous species of shrubs and vines, some of which are specifically adapted to pollination by hummingbirds. Hummingbirds are adapted to drinking nectar from tubular-shaped blossoms, which they help pollinate while feeding. For example, the ruby-throated hummingbird's long, thin bill is perfectly adapted to the deep tubular flower of plants like the trumpet creeper, allowing it to reach deep within the flower to the nectar.

Hummingbirds are primarily woodland birds, occupying mixed woodlands, eastern deciduous forests, gardens, orchards, yards, overgrown pastures, citrus groves, scrub communities, hedgerows, and fence rows. They need trees, shrubs, and vines for shelter, shade, and nesting cover. Hummingbirds make their nests from downy plant fibers, such as thistle, dandelion, milkweed down, ferns, fireweed, young leaves, or moss, held together by spider silk and coated on



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Hummingbirds pollinate as they drink nectar from flowers.

the outside with lichens. Nests are constructed about 5 feet above the ground, usually on branches of oak, birch, maple, beech, hornbeam, hemlock, poplar, hackberry, pine, or spruce trees.

Hummingbirds feed on nectar from wildflower blossoms and flowers of many species of shrubs and vines. Hummingbirds will try to feed at any flower with nectar, no matter what its shape, color, size, or position. Insects, such as mosquitoes, gnats, fruit flies, and small bees form a large part of hummingbirds' diets. They also eat tree sap, spiders, caterpillars, aphids, insect eggs, and willow catkins. Hummingbirds derive water from the nectar and insects consumed, and so do not require a source of water for drinking. However, they will bathe in water, if it is available.

In the winter, hummingbirds migrate to tropical regions where they use habitats similar to those used in summer.

Hummingbird feeders can be made to attract hummingbirds to backyards and gardens. To make artificial nectar, use four parts water to one part table sugar. Never use artificial sweeteners, honey, or fruit juices. Feeders must be cleaned with hot soapy water at least twice a week to keep them free of mold.

Nectar corridors

The migration of pollinators, including monarch butterflies and some bat and hummingbird species, is a significant phenomenon. Certain species migrate over paths that stretch thousands of miles while pursuing blooming plants — north to south in fall, south to north in spring. To ensure the survival of migratory pollinators, three types of habitat needs must be considered. These are summer breeding and foraging areas, secure overwintering sites, and between the two, nectar corridors and rest stops. Nectar corridors are patches of nectar-rich plant habitat, which act as stepping-stones for the pollinators on their long migratory journeys. Due to development and land use changes, many nectar corridors are no longer intact. Migrating pollinators must attempt to survive their journey through scattered habitats that contain little food. The lack of fuel (nectar) along migratory routes is much to blame for dramatically decreasing populations of migratory pollinators.



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Clumps of flowers will attract more pollinators than individual plants.

Attracting native pollinators

To attract native pollinators, an area must have adequate sources of food, shelter, water, and nesting sites (table 2). Habitat management activities can be undertaken to ensure that habitat needs are met. For example, landowners can purchase, build, or plant additional nest sites or shelter for bats, bees, and butterflies. The North American Pollinator Protection Campaign (NAPPC), in partnership with the Wildlife Habitat Council and the Xerces Society, has created a list of *Pollinator Friendly Practices*, which consider six different areas of land use management: foraging habitat, reproduction, shelter, invasive/exotic species control, chemical use, and monitoring. Habitat management practices vary depending on the type of native pollinator targeted. However, there are a number of habitat management practices that will benefit most, if not all, groups of native pollinators. These include planting appropriate vegetation, providing water, and using pesticides carefully.

Table 2 General native pollinator habitat requirements

Pollinator	Food	Shelter
Solitary bees	Nectar and pollen	Most nest in bare or partially vegetated, well-drained soil; can also construct domed nests of mud, plant resins, saps, or gums on the surface of rocks or trees; nest in tunnels in dead standing trees, or excavate nests within the pith of stems and twigs
Bumblebees	Nectar and pollen	Nesting cavity is most often underground but can be in hollow trees or walls, or under a clump of grass
Butterflies and Moths – egg	Non-feeding stage	Usually larval host plant
Butterflies and Moths – Caterpillar	Leaves of larval host plants	Larval host plants
Butterflies and Moths – Pupa	Non-feeding stage	Protected site such as a bush, tall grass, or a pile of leaves or sticks
Butterflies and Moths – Adult	Nectar; some males obtain nutrients, minerals, and salt from rotting fruit, tree sap, animal dung and urine, carrion, clay deposits, and mud puddles	Leaves, stems, or branches of larval host plants; also other vegetation and small woodpiles
Bats	Many species are generalists; others eat fruit, pollen, nectar, or night-flying insects	Tree branches, tree cavities, caves, mines, rock crevices, tangled hedgerow thickets, under tree bark, under structures that provide an overhang
Hummingbirds	Nectar, insects, tree sap, spiders, caterpillars, aphids, insect eggs, and willow catkins	Trees, shrubs, and vines

Plant-appropriate vegetation

The easiest way to attract native pollinators is to plant gardens or meadows that contain a diversity of native wildflowers, trees, and shrubs. A variety of wildflowers and native grasses will provide native pollinators with food (nectar, pollen, and/or larval host plants). Trees and dense shrubbery provide important shelter, nesting, and overwintering areas for pollinators. To maximize food and shelter, landowners should include gardens, fruit-bearing trees and shrubs, thickets and hedgerows of flowering shrubs, and set-asides (areas that are not mowed) in their plans. Due to differing preferences among pollinator species, planted areas should contain varying levels of vegetation and areas of sun, partial shade, and full shade. Plantings should be done in locations that are sheltered from the wind.

Plants native to the region should be selected. Native plants are adapted to the local climate, soils, and the native pollinators with which they co-evolved. Native plants should comprise at least 75 percent of a habitat area. Invasive species should not be planted because they will degrade pollinator and other wildlife habitat by interfering with the natural structure and composition of the ecosystem. For information on native plants, landowners should consult with their local native plant society. Contact information for state and provincial native plant societies can be found at <http://www.nanps.org/associations/frame.shtml>.

Mowed lawn area should be minimized in favor of patches of native wildflowers, shrubs, and grasses. Lawn areas that do exist should be mowed less frequently to allow the vegetation to provide habitat for pollinators. Perennials should be chosen over annuals. Perennials are generally richer in nectar and, because they bloom year after year, provide a more dependable food source than annuals. Horticultural plants bred as “doubles,” such as marigolds and roses, should also be avoided because they have been bred for appearance rather than for pollen and nectar availability. Each species of flower should be grown in a clump, as this will attract more pollinators than individual plants.

Both nectar and pollen flowers should be available throughout the growing season. A variety of flower shapes and colors will provide nectar and pollen for a variety of pollinators. Birds and butterflies favor bell, tube, or trumpet shaped flowers or those with clusters of tubular florets, especially when rimmed with a flat surface for perching. They prefer brightly colored flowers, including reds, oranges, and yellows. Bees are most attracted to purple, blue, and yellow flowers. Also, remember that night-blooming flowers will support moths and bats.

Provide water

Many groups of native pollinators need water to survive, whereas, others will simply be attracted to fresh water. Providing a source of pesticide-free water and mud will attract bees, butterflies, and hummingbirds. A birdbath, fountain, dripping faucet, small pond, or mud puddle will attract bees, butterflies, and other beneficial insects. Although not required for drinking, providing a source of running water for bathing can make a wildflower garden more attractive to hummingbirds. A damp salt lick can be created for butterflies and bees. Create a damp area on the soil using a dripping hose, drip irrigation line, or birdbath. Mix a small bit of sea salt or wood ashes into the mud, which will provide butterflies and bees with their mineral requirements.

Use pesticides carefully

Pesticides, including herbicides and insecticides, do not discriminate between good species and bad species. An insecticide applied to eliminate a crop-eating insect may also kill valuable native pollinators. All groups of pollinators, as well as other wildlife, can be negatively affected or killed by pesticide use. Poisoning of pollinators may result from contaminated food (pollen and nectar), or directly from florets, leaves, soil, or other materials that may have come into contact with pesticides. Insecticide use should be reduced and herbicide use should be kept to a minimum to support the full range of native pollinators. Landowners should choose non-chemical or organic solutions to combat insect problems. If an insecticide is absolutely necessary, use the least toxic material possible, use it according to package directions, and treat plants at the time of day or period in the season when their flowers are not in bloom. Integrated Pest Management (IPM) is a critical component of safe habitat management for pollinators. For more information, see *Fish and Wildlife Habitat Management Leaflet Number 24: Integrated Pest Management and Wildlife*.



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If natural sources of water are not available, birdbaths can provide water for many types of pollinators.

Conclusion

Because of the ecosystem services they provide and their unique adaptations to local climate, soils, and vegetation, native pollinators are immensely valuable to the environment and the economy. Despite their value, native pollinators are declining and often under-appreciated in terms of their services to healthy ecosystems. Human activities have destroyed and fragmented native pollinator habitat. However, land-owners can work to increase native pollinator habitat on privately-owned lands by planting appropriate vegetation, providing water, limiting pesticide use, and providing the habitat needs for specific groups of pollinators (bees, butterflies, moths, flies, beetles, bats, or hummingbirds).

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Natural Resources Conservation Service

Mailing address:

P.O. Box 2890
Washington, DC 20013

Street address:

14th and Independence Avenue SW
Washington, DC 20250

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www.nrcs.usda.gov

Wildlife Habitat Council

8737 Colesville Road, Suite 800
Silver Spring, Maryland 20910
(301) 588-8994

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Primary author: **Raissa Marks**, Wildlife Habitat Council. Drafts reviewed by: **Rob Pauline**, Wildlife Habitat Council; **Marcia Maslonek**, Wildlife Habitat Council; **Charlie Rewa**, Natural Resources Conservation Service; **Kimberly Winter**, North American Pollinator Protection Campaign; **Constance S. Stubbs**, University of Maine; **Matthew Shepherd**, The Xerces Society for Invertebrate Conservation; **Doug Holy**, Natural Resources Conservation Service; and **Stephen Buchmann**, The Bee Works.

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