Best Management Practices for Indiana Pollinator Habitat

Pollinator Habitat BMP Committee of the Indiana Pesticide Review Board

Introduction – Why should we care about pollinators?

Pollinators provide **pollination services** for wild plants and many of our crop species too – 1 in 3 bites of food is due to cross pollination by pollinators. Pollination is important for maintaining genetic diversity in plants and insuring adequate fruit and seed production for crops, wildflowers, shrubs, and trees. Our forests, prairies, meadows, gardens, and yes, even lawns, would look much different without the help of our pollinators. Pollinators are also important prey resources for other organisms such as migrating birds, beewolves, praying mantises, and many spiders, which in turn become food for other animals. Furthermore, as a very species-rich group, pollinators are an important component of our state's biodiversity. Indiana's pollinators include 430 species of bees, 144 species of butterflies, over 2000 species of moths, and many species of flower visiting flies, wasps and beetles. We also have one species of hummingbird in Indiana, the ruby-throated hummingbird, which is a pollinator of many of our red flowers with deep nectar tubes.

Unfortunately, pollinator communities are currently suffering from many threats, and reduced populations of honey bees, bumble bees and several butterfly species have been documented over the last 15 years. Major threats include:

- **Habitat fragmentation and loss of habitat.** Indiana was once almost entirely forested and now only 20% of the state is forested. In addition, invasive plant species have outcompeted native plants in many natural areas. The changing dynamics of our plants communities have direct effects on our pollinators.
- **Use of pesticides in agricultural and urban settings.** Many pesticides are directed towards harmful insects but their effects extend to beneficial insects including pollinators. For example, neonicotinoids, a class of systemic pesticides, have known negative impacts on pollinators.
- **Parasites and disease.** Honey bees (which are not native to North America) are attacked by many parasites and diseases, as are many bumble bees and other native bees. *Varroa* mites, tracheal mites, American foul brood, European foul brood, African hive beetle, and twisted wing virus are among the enemies of honey bees. Native bees are susceptible to other bees and insects that are brood parasites, such as *Nosema bombii*. Other parasites of native bees include strepsipterans (beetle-like insects), meloid beetle larvae, velvet ants, and hoverfly larvae. Butterflies and moths are also very susceptible as larvae (caterpillars) to parasitic wasps, fungi, bacteria, and viruses.

Even alone, each of these threats put our pollinators at risk. When all of these threats come together, they interact to cause even worse impacts. For instance, pesticides can significantly weaken our pollinators' natural resistance to disease.

So how do pollinators and plants interact? What is the big picture? Pollinators interact with plants on different levels and each species has a fascinating story.

- Flowers contain pollen and/or nectar which are food resources for adult pollinators. Adult bees, butterflies, many wasps, moths, flies and beetles and ruby-throated hummingbirds depend on nectar and pollen either as their sole food source or as a supplemental or alternative food source. As pollinators travel from flower to flower they carry pollen between plants, resulting in pollination.
- Adult bees also feed pollen to bee larvae: rolling pollen into a ball and laying their eggs on it so that hatched larvae have a ready food source.
- Butterflies and many moths feed on plant foliage as larvae (caterpillars).
- Wasps often feed on nectar as a supplemental energy source.
- Flies exhibit a range of feeding relationships with plants. Some adult flies solely visit flowers. Some fly larvae eat foliage, fruits or seeds.
- Beetle larvae are often seed predators as grubs or larvae.
- Hummingbirds mainly use nectar from flowers but also glean insects from the air as a protein source.

Bees and other pollinators have different lifestyles: **social, solitary** or **parasitic**. Although very few pollinators are social, these are often the ones thought of when the word "pollinator" comes to mind. However, only the honey bee, bumble bees, a subgroup of sweat bees, and several species of wasp are truly social. Most other pollinators, including 70% of the bees in Indiana and most butterflies, moths, flies, and beetles, are solitary, with a single female provisioning offspring. Some bees are parasites on other bees and are called cuckoo bees. These brood parasites generally act as cowbirds do in the bird world.

Different pollinator species vary greatly in the number of different plant species they will use.

- **Specialists** only feed on one plant species or genus, either as adults collecting pollen and nectar, or as larvae feeding on foliage. For example, the spring bee *Andrena erigeniae* only uses pollen from spring beauties (*Claytonia virginica*) to provision its offspring. As another example, monarch butterfly caterpillars will only feed from milkweed (*Asclepias* sp.) plants.
- **Generalists**, on the other hand, use many plant species. For example, honey bees, bumble bees, and adult butterflies, moths, and wasps will often visit many different flower species to obtain nectar and/or pollen.

Our charge

As is clear from the brief overview above, pollinators are essential components of ecosystems. Whether in forest, prairie, black-oak savanna, a crop field, or your backyard, pollinators create many key linkages in food webs, helping to keep ecosystems functioning properly. The intricacies of pollinator-environment interactions mean that a holistic approach must be taken to conserve pollinators. **This document provides information on how to establish effective pollinator habitat, from small-scale backyard improvement to large-scale plantings.**

Meeting the Needs of Pollinators

To have healthy pollinator habitat, you need three ingredients – **food, habitat for shelter and nesting,** and **water**.

Food. For most pollinators, plants are the primary food source, including nectar, pollen, and leaves. As discussed above, different types of pollinators and even the adults and larvae of the same pollinator species may require different plant foods.

To provide nectar and pollen, you need to provide flowers. It is important to provide a diversity of flowering plants, such that there are flowers in bloom throughout the whole season. To do that, you should choose to plant at least three flowering plant species in three seasonal categories – early, mid, and late season bloomers. By choosing at least three, you provide options for different pollinators in each season.

The **Recommended Pollinator Plant List** at the end of this document provides a diverse list of flowering plant species with information on when each species is in bloom, how tall it gets, flower color, and cultural requirements. The last column of this list shows what pollinator groups each plant attracts (bees, butterflies, etc.), and if there are specialist pollinators that are attracted by that plant species (e.g. milkweed as the larval host plant for monarchs). The list also designates "pollinator magnets" – those plants that can reliably attract large numbers of pollinators. You can use this list to help plan your pollinator planting.

Because of the tight connection between caterpillars and the plant species they feed on, you can attract many butterfly species by planting their larval food plant. Since non-native plants are not generally used as food by insect larvae, we have limited the list to plants native to Indiana. An additional benefit is that these native plants are better adapted to the soils and climate of Indiana than non-native plants.

Be careful that plants intended for pollinator habitat have not been treated with neonicotinoid insecticides. These systemic pesticides are often used by growers and sellers of ornamental plants, shrubs and trees, in addition to being used in large scale agricultural settings, and are believed to have negative effects on insect pollinators. Be sure to ask the seller if these products were used on plants before buying. You should also avoid using insecticides in your planting, as they may kill or injure pollinators.

Habitat. Like all our wildlife, bees and other pollinators require a home in which to rest, escape the weather, and most importantly, lay eggs and rear their young. In our desire for tidy lawns, we often inadvertently eliminate suitable shelter and nesting sites for our pollinators. Important nesting sites for bees include patches of bare ground (which allow bees to access underground cavities), logs, stumps, last season's flower stems, and untidy corners with taller grass and flowers. Where possible, leave bare patches of ground and leave dead vegetation standing overwinter to provide dormant season habitat for pollinators. While homemade "bee hotels" can provide nesting habitat, use them with caution. Homemade bee nests are often colonized by wasps, and can harbor predators and pathogens if not properly cleaned and maintained. For more information, see "Providing Nest Sites for Pollinators" from The Xerces Society.

Water. Pollinators need water. Some are adept at getting the water they need from dew on plants, but for times of the year when there is little dew or few rain puddles a shallow basin of water will provide this vital resource. Be sure to place rocks in the basin, so that pollinators can easily access the water without going for a swim.

Putting it All Together - How to Improve or Create Pollinator Habitat

Setting Goals for Your Pollinator Habitat. Every landowner needs to set habitat goals for their planting that meet their personal concerns and objectives. There are many different species of pollinators, so it is likely beyond most land owner's interest or capacity to comprehensively address every need of every pollinator species. While many of the actions described below will benefit several pollinator groups at the same time, deciding up front *which* types of pollinators you most want to benefit will help you refine your pollinator habitat. For example, if your goal is simply to enhance native bees, you may focus on providing a seasonally diverse array of flower species used by generalist bees, bare patches of ground and standing dead vegetation for nesting sites and overwintering habitat, and a shallow basin of water during the growing season. If you also want to increase habitat for selected butterfly species, you will select specific plant species that are appropriate larval hostplants for their caterpillars and plant these in numbers that are likely to attract egg-laying females.

Setting your pollinator habitat goal is typically a two-step process:

1. Identifying the group(s) of pollinators you hope to benefit
2. Designing an appropriate habitat that provides adult food, nesting/larval habitat, and access to water based on the criteria laid out above.

The important thing to remember is that **the principles are the same** *regardless of the scale of your habitat enhancement,* **but the specifics of implementation may be different.** Here are some guidelines for both small-scale and large-scale plantings.

Small-Scale Plantings – Creating Pollinator Gardens.

Food. Diverse pollinator habitat can be created at a small scale in a backyard garden. The challenge in such a small setting is to have enough plants, and enough of a diversity of plants, to provide flowers throughout the season. Use the **Recommended Pollinator Plant List** to choose plants that will fit the space you have and provide flowers through the season. In a garden setting, you are likely to purchase live plants rather than seeds, which has the advantage of creating habitat immediately. Do keep in mind that ornamental plants may have been treated with neonicotinoid insecticides which could harm pollinators; ask the seller to assure this is not the case.

Habitat. Leaving bare patches of ground and standing dead vegetation is often considered messy in a garden setting. If the messiness bothers you, find a way to incorporate these important elements of nesting and overwintering habitat in a little-noticed corner of your garden, or behind shrubs that block the view.

Water. If you have a bird bath in your garden, add some decorative rocks to it to provide more places for pollinators to land and drink. Any kind of shallow basin of water can be used for pollinators.

Large-Scale Plantings – Fields, Forests, Farms, Grasslands, Right-of-Ways (ROW's)

Providing pollinator habitat at larger scales (greater than ½-acre) requires providing the same elements as small scale habitats, but establishment and maintenance can require more patience, effort, and resources. It is recommended that technical assistance be used when planning and implementing large-scale plantings to make sure your planting is successful. A list of free technical assistance resources for site preparation, establishment, and maintenance in Indiana are listed below. In some cases, these resources can provide cost-share or rental payments for pollinator habitat.

Commented [EJ1]: Equipment rental payments?

Keep in mind that other than in the very northwest corner of the state and certain barrens areas to the south, both historically maintained by natural fires, our soils and climate support forest. While grassland plantings are possible, they take a great deal of maintenance to keep them from turning into forest communities. In reality, it can be argued that forests in Indiana provide more for pollinators than grasslands do. Grasslands may provide a six-foot-tall mix of diverse flowering plants for pollinators, but forests provide a *70-foot-tall* mix of flowering plants! The distinct layers of forest vegetation, including the understory, shrub, and tree canopy layers, collectively provide more flowering species and more pollinator habitat than grassland. Consider planting forest as pollinator habitat if appropriate for your site.

Establishment. Careful planning, thorough site preparation, and patience are key to achieving your pollinator habitat goals in large-scale plantings. Because of the expense of live plants, large-scale grassland pollinator plantings are generally created from seed. This means that a seed bed must be prepared, and it will typically be 2-3 years until most of the species planted will bloom. Forest plantings, on the other hand, are planted with tree and shrub seedlings, coupled with understory plantings of seedlings and/or seeds. The basic steps of habitat establishment are:

1. Determine the acreage of the area on which you would like to establish habitat.
2. Determine goals for habitat planting (see **Setting Goals for Your Pollinator Habitat** above)
3. Contact local technical assistance provider (below) for initial planning assistance, cost-share potential and management plan.
4. Eliminate the existing vegetation and nearby invasive species through burning, mowing, herbicide, or disking. Depending on the current vegetation you have, proper site preparation can take months to a few years.
5. Select a native seed mix of grasses and wildflowers, or mix of trees and shrubs to plant for reforestation. Refer to the **Recommended Plants for Pollinators** list to select the species, using the same guidelines shared above in **Meeting the Needs of Pollinators**.
6. Determine the ideal planting method and timing for your specific site.
7. Plant seeds or trees and shrubs.

Maintenance. Just like you would weed a garden, some level of maintenance is necessary to keep your pollinator planting diverse and useful to pollinators. Undesirable weeds will dominate a site quickly if

not controlled from the start and throughout the life of the planting, so it is important to start maintenance the first year after planting. Scout the land and adjacent roadsides early in the season (May-June) for invasive weeds and, if possible, remove by hand before they spread. Targeted herbicides can be used on weed species if infestations are beyond what can be pulled. If herbicides are used, always follow the product label exactly for application timing and dose. A recent Purdue Extension publication, What Gardeners Should Know About Pesticides, is very helpful in understanding the appropriate use of pesticides.

Because the climate and soils in Indiana tend to favor forests over grasslands, over time grassland plantings tend to be heavily invaded by woody species. Regular mowing or fire are needed to keep grassland plantings open, and in some cases, cutting woody stems and treating them with herbicide is required to keep the site open. Be aware that the timing of mowing and fire maintenance has substantial implications for conserving birds. Consult XXXX for information on how to best time your maintenance practices to avoid harming grassland birds.

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Indiana Technical Assistance Providers

Indiana Department of Natural Resources-Wildlife Biologists:
http://www.in.gov/dnr/fishwild/2716.htm

Indiana Natural Resource Conservation Service-District Conservationists:
http://www.nrcs.usda.gov/wps/portal/nrcs/main/in/contact/local/

U.S. Fish and Wildlife Service-Partners for Private Lands:
https://www.fws.gov/midwest/partners/
620 South Walker Street State
Bloomington, IN 47403
812-334-4261
indianaplo@fws.gov

Pheasants Forever, Quail Forever, NRCS, IN DNR-Farm Bill Biologists:
http://pheasantsforever.org/getdoc/d68502f8-71ec-423c-a8a0-dbaf1e2851b2/Farm-Bill-Biologists.aspx

Southwestern Indiana counties	(812) 827-1087
Northeastern Indiana counties	(260) 484-5848 x124
Northwestern Indiana counties	(574) 952-0169
Southeastern Indiana counties	(812) 346-3411

Other Useful Resources

National Wildlife Federation's Backyard Wildlife Habitat and Butterfly Heroes Programs.
http://www.nwf.org/

The Xerces Society. http://www.xerces.org/

References

Botias, C., A. David, E.M. Hill, and D. Goulson. 2016. Contamination of wild plants near neonicotinoid seed-treated crops, and implications for non-target insects. Science of the Total Environment, Volumes 566-567, 1 October 2016, Pages 269-278.

Hopwood, J.L. 2008. The contribution of roadside grassland restorations to native bee conservation. Biological Conservation 141: 2632-2640.