Additional Resources

Websites

- University of Minnesota Bee Lab: *www.beelab.umn.edu*
- Plants for Pollinators: *www.entomology.umn.edu/cues/pollinators/plants.html*
- Gardening for Pollinators: *www.fs.fed.us/wildflowers/pollinators/gardening.shtml*
- Center for Urban Ecology and Sustainability: *www.entomology.umn.edu/cues/*
- Natural Resource Conservation Service: *www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate/*
- Xerces Society for Invertebrate Conservation: *www.xerces.org/pollinator-conservation/*
- Pollinator Partnership Gardening Resources: *www.pollinator.org/gardens.htm*

Apps

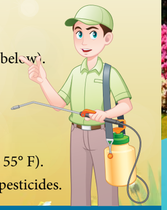
- BeeSmart Pollinator Gardener: *www.pollinator.org/beesmartapp.htm*
- Pollination 2 Plate: For planning an array of public pollinator gardens around your region. *www.bumbleboosters.unl.edu/?q=p2p*
- Waitrose: A game about pollination from the University of Nebraska-good learning tool for all ages. *www.waitrose.com/bees#.U159H1PuMmg*

Articles and books

- Living Landscapes of Minnesota: *www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022410.pdf*
- Plants for Minnesota Bees: *www.beelab.umn.edu/prod/groups/cfans/@pub/@cfans/@bees/documents article/cfans_article_451478.pdf*
- Pollinator Conservation: *www.entomology.umn.edu/cues/pollinators/TenczarKrischik2013bulletin.pdf*
- Making room for native pollinators, how to create habitat for pollinator insects on golf courses: *www.pollinator.org/PDFs/Making_Room_for_Native_Pollinators_pdf.pdf*
- Bees, Wasps and Hornets What You Need to Know: *www.gov.mb.ca/housing/pubs/pests/bees.pdf*
- Removing Honey Bee Swarms and Established Hives: *www.ipm.ucdavis.edu/PDF/PESTNOTES/ pnhoneybeeswarm.pdf*
- Protecting Honey Bees From Pesticides: *www.pesticidestewardship.org/PollinatorProtection/Documents/AA14500.pdf*
- Pollinators of Native Plants by Heather Holm; Pollination Press LLC, 2014. ISBN-13: 978-0991356300.
- Tiny Game Hunting: Environmentally Healthy Ways to Trap and Kill the Pests in Your House and Garden by Hilary Dole Klein, Adrian Wenner and Courtlandt Johnson; University of California Press, 2001. ISBN-13: 978-0520221079.

The Minnesota Department of Agriculture collaborated with the following partners in preparing these Best Management Practices: • Bachman's • University of Minnesota, The Bees Kneez • Hennepin County Environmental Services • Minnesota Division Izaak Walton League of America • Edina Local Food Task Force • League of Minnesota Cities • Minneapolis Park and Recreation Board • Minnesota Association of County Agricultural Inspectors • Minnesota Golf Course Superintendents Association • Rice County Soil and Water Conservation District • Northern Gardener Minnesota State Horticultural Society • University of Minnesota, Department of Entomology • University of Minnesota, Department of Fisheries and Wildlife • University of Minnesota Extension • Minnesota Hobby Bee Keeper • United States Golf Association.

REDUCE negative impacts of pesticides on pollinators



- Use pesticides only when necessary.
- Whenever possible, choose pesticides, especially insecticides, with low toxicity to bees (See chart below).
- Look for the pollinator protection box on insecticide labels and follow the label exactly. **The label is the law.** For information on bee protection label language visit *www.epa.gov/pesticides/ecosystem/pollinator/bee-label-info-lrt.pdf*
- Consider using spot treatments rather than broadcast applications.
- Apply when bees are not foraging (early morning or evening, or when air temperatures are below 55° F).
- Communicate with local bee keepers before applying pesticides and prevent drift when applying pesticides.

Relative toxicity of insecticides available to Minnesota residents for use on flowering plants and turf.

SITES	INSECTICIDE CLASS	ACTIVE INGREDIENT	TOXICITY TO BEES	TYPICAL DELIVERY
Ornamentals (Flowering plants) and Turf	Carbamate	Carbaryl	High	Slightly systemic
	Neonicotinoid	Clothianidin	High	Systemic
		Imidacloprid	High	Systemic
	Oxadiazine	Indoxacarb	High	Contact
	Pyrethroid	Beta-cyfluthrin	High	Contact
		Bifenthrin	High	Contact
Ornamentals only	Bacterium	*Bacillus thuringiensis*	Low	Ingestion
	Benzoylacetonitile	Cyflumetofen	Low	Contact
	Botanical	Azadirachtin	Moderate	Contact
	Carbazate	Bifenazate	Moderate	Contact
	Inorganic	Cryolite	Low	Contact
		Kaolin clay	Low	Contact
		Spinosad	High	Contact
	Macrocyclic lactone	Acetamiprid	Moderate	Systemic
	Neonicotinoid	Dinotefuran	High	Systemic
		Thiamethoxam	High	Systemic
	Oils	Canola oil	Low	Contact
		Garlic oil	Low	Contact
		Mineral oil	Low	Contact
		Neem oil	Low	Contact
		Soybean oil	Low	Contact
	Organophosphate	Acephate	High	Contact
		Malathion	High	Contact
	Pyrethroid	Cyfluthrin	High	Contact
		Lambda cyhalothrin	High	Contact
		Permethrin	High	Contact
		*Tau fluvalinate	High	Contact
		Zeta cypermethrin	High	Contact
		Fenazaquin	High	Contact
Turf only	Anthranilic diamide	Chlorantraniliprole	Low	Contact
	Insect growth regulator	Halofenozide	Low	Systemic
	Organophosphate	Trichlorfon	Low	Contact
	Pyrethroid	Gamma cyhalothrin	High	Contact

*Sold in combination with other active ingredients but not as a stand-alone active ingredient. These insecticides are active ingredients and are not the product names. This list is not all-inclusive; always check the label. Additional information on these and other pesticides can be found at www.state.ceris.purdue.edu/. The classification for categorizing contact toxicity is adopted from LD_{50} values from the US Environmental Protection Agency (LD_{50} is the Lethal Dose at which mortality is observed in 50% of the test organisms. High toxicity: LD_{50} <2 µg ai/bee; Moderate toxicity: LD_{50} 2-10.9 µg ai/bee; Low toxicity: LD50 ≥11 µg ai/bee. For more information visit www.epa.gov/oppefed1/ecorisk_ders/toera_analysis_eco.htm

A pollinator protection box appears on some insecticide labels

PROTECTION OF POLLINATORS
APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators. This product can kill bees and other insect pollinators.

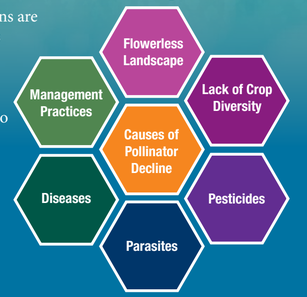
Minnesota Department of Agriculture

Insect Pollinator Best Management Practices for Minnesota Yards and Gardens

It's time to look at our landscapes differently

Insect pollinators are in trouble, populations are declining

More than one third of all plants or plant products consumed by humans are directly or indirectly dependent on insects for pollination. Many plants such as almond, apple, blueberry, sunflower, clover, canola etc. cannot reproduce without the help from insect pollinators. There is increasing evidence that insect pollinators are disappearing at alarming rates. Loss of bees and other insect pollinators can be linked to loss of habitat, diseases, pests, and pesticides.



Seems like a big problem? It is!

A decline in pollinators affects us all. Reversing this trend is important to the ecosystem as well as to human health and well-being. We can all do our part to help. With a little forethought and planning, we can help pollinators rebound from the challenges they face.

According to United States Department of Agriculture, honey bees and wild bees (bumble bees, leaf cutter bees, alkali bees, and mason bees) pollinate more than $15 billion worth of crops in the United States each year. Flies, beetles, butterflies, moths, and wasps are other important insect pollinators. Today we have fewer managed honey bee colonies than at any time in the last 50 years in the U.S.

The Minnesota Department of Agriculture (MDA) has developed these Best Management Practices (BMPs) to create and improve nesting and foraging habitat for insect pollinators (native and managed) in accordance with 2013 Pollinator Legislation H.F. 976. These BMPs provide practices that will help to reduce negative impacts on pollinator habitat resulting from current yard and garden management practices; improve or preserve existing habitat; and create new habitat in yard and garden landscapes. An electronic copy of this BMP is available at http://www.mda.state.mn.us/pollinators

CREATE new habitat! Help pollinators in your own backyard

An ideal pollinator landscape should support a healthy and diverse population of insect pollinators by providing abundant food sources and nesting habitats while keeping aesthetic appeal of the yard. In addition to helping pollinators, benefits of diverse habitats include improved human health, decreased erosion, improved water quality, and better soil health. Creating and conserving habitat with diverse plant life requires good management practices to prevent harmful effects such as encroachment by invasive plant species. Here are some simple steps you can take in your yard to create habitat and help pollinators survive and thrive while keeping aesthetic appeal of your yard.

Choose plants pollinators love

- Plant a variety of flowers of different colors and shapes that bloom at different times to provide continuous pollen and nectar sources.

The table below lists some of the pollinator attractive plants and flowers that can be integrated into most Minnesota landscapes.

BLOOM TIME	COMMON PLANTS *Source: University of Minnesota, Bee Lab*
March – May	Large beardtounge, Pussy willow, Wild geranium (shady shrub), Hawthorn (tree)
March – July	Lanceleaf coreopsis, Virginia waterleaf, Wild lupine
June – July	Goatsbeard, Blue lobelia, Purple cone flower, Slender mountain mint
June – September	Alsike cover, Anise hyssop, Autumn joy sedum, Beebalm, Bicolor thistle, Borage, Catmint, Common boneset, Culver's root, Cup plant, Ironweed, Jewelweed, Joepye weed, Oregano, Partridge pea, Purple prairie clover, Rough blazing star, Sunflowers, Swamp milkweed, Yellow coneflower
August – September	Calico aster, New England aster, Stiff goldenrod

- Whenever possible, choose native plants that attract pollinators.
- Choose plants that will grow best in your site conditions – soil type, light, planting space, etc.
- Consider choosing plants that have not been treated with systemic insecticides (they can move into pollen and nectar). Work with garden centers and plant nurseries to find plants beneficial to pollinators.
- Plant pollinator "corridors" comprised of pollinator-friendly plants that encourage pollinator movement and connect habitat areas.
- Choose non-flowering plants and prairie grasses, then plant in groups to provide nesting and overwintering habitat.
- Double flowered plants (flowers with extra petals, often containing flower within flower) frequently lack pollen or nectar. They should not be the only plants in your landscape.
- Do not plant invasive plants (plants which quickly crowd other plants and lessen biodiversity). To learn more about invasive species in Minnesota visit *www.mda.state.mn.us/weedcontrol* and *www.dnr.state.mn.us/invasives/index.html*

Undisturbed areas are ideal for pollinator nesting

- Avoid disturbing areas where pollinator activity is already present such as ground nests.
- When possible, leave areas near, adjacent to, or in your landscape undisturbed.
- Leave downed logs, leaf litter, flower stems, and bare spots to provide nesting and overwintering habitat for pollinators. [Check city ordinances for rules about dead wood.]

Photo Credit: Heather Holm

IMPROVE existing landscapes! Lawns can be pollinator friendly

- Leave pollinator attractive plants such as dandelions and clover in lawns for early season blooms full of pollen and nectar. [Such plants could become a nuisance to you or your neighbors; control nuisance plants appropriately when other sources of nectar and pollen are available to pollinators. Also check local ordinances about leaving nuisance plants in your yard.]
- Adjust mowing frequency and timing to help pollinators.
- If you have a lawn service or are considering getting one, talk about your desire to conserve pollinators and protect their habitat.

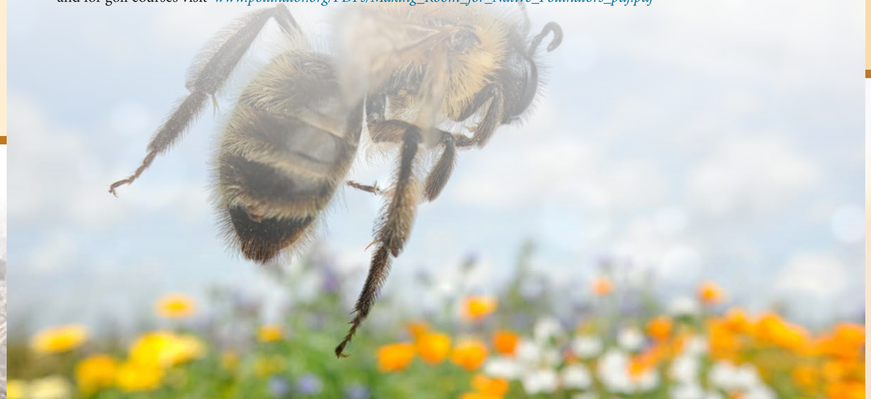
Management practices influence pollinator activity

- Identify and understand pests and beneficial insects. To identify Minnesota insects visit *www.extension.umn.edu/garden/diagnose/insect/*
- Accept some insect damage on plants.
- When using a pesticide, especially an insecticide, choose a product that won't harm bees and still be effective. Apply when bees are not foraging. Follow the label exactly. **The label is the law.** (See the information box on minimizing impacts of pesticides on pollinators and the accompanying insecticide toxicity chart).
- Adopt Integrated Pest Management (IPM) in your garden. IPM uses information about pests to manage pest damage with the least possible hazard to people, property, and the environment. For more information on IPM in landscapes and homes visit: *www.mda.state.mn.us/news/publications/pestsplants/pestmanagement/ipm/home-ipm-guide/home-ipm-guide.pdf*

Create partnerships and spread the word

- Tell your neighbors why you are creating a pollinator friendly landscape, and encourage them to join in.
- Post signs to tell others about your pollinator protection efforts.
- Share your story and pictures with the community.
- Create partnerships with other entities that can support pollinator habitats, for example, public parks, golf courses, cemeteries, schools, etc.

For more information on pollinator habitat management on public land and parks visit *www.dnr.state.mn.us/index.html* and for golf courses visit *www.pollinator.org/PDFs/Making_Room_for_Native_Pollinators_pdf.pdf*



Distinguish between bees and wasps

Wasps are beneficial insects that eat harmful insects and can participate in pollination. Wasps look similar to bees and are related (they are both in the insect order Hymenoptera). People often mistake yellowjacket wasps for honey bees because both can sting. Both groups of insects are generally not aggressive towards people unless the insects or their nests are threatened. Yellowjackets do become more aggressive during late summer and fall when they scavenge human food, which can increase the likelihood of stings.

The easiest feature to distinguish between yellowjackets and honey bees is their hair. Bees have hairy bodies while yellowjackets have only sparse hairs on their bodies. In addition, the coloration of wasps is always directly on their body, while a bee's coloration is usually derived from a combination of hair color and body color. Yellowjackets are smaller than bumble bees and similar in size to honey bees. Yellowjackets also have a pinched abdomen, narrowed bodies, and carry little or no pollen. For more information on bees, wasps and hornets visit *www.extension.umn.edu/garden/insects/find/wasp-and-bee-control/*

HONEY BEE

Photo Credit: Jeff Berg

BUMBLE BEE

Photo Credit: Scott King

YELLOWJACKET

Photo Credit: Scott King

PAPER WASP

Photo Credit: Scott King

POTTER WASP

Dealing with a bee swarm

Swarming is the honey bee's method of colony reproduction. The old queen and about half of the worker bees leave their nest and seek a new home, usually in the spring or other times when local conditions permit. The sight of a swarm may be frightening, but if the bees are not disturbed their behavior is not aggressive towards humans. If a swarm is moving on without establishing a hive or a swarm on a tree or shrub, you do not need to do anything. If the location of the swarm is near a high pedestrian traffic area, seek help from a local experienced bee keeper. Bee keepers usually do not charge for removing swarms, but may charge if the hive is difficult to reach. Swarm removers can be reached by contacting the Minnesota Hobby Bee Keeper Association at: *www.mnbeekeepers.com/about-bees/honey-bee-swarms*