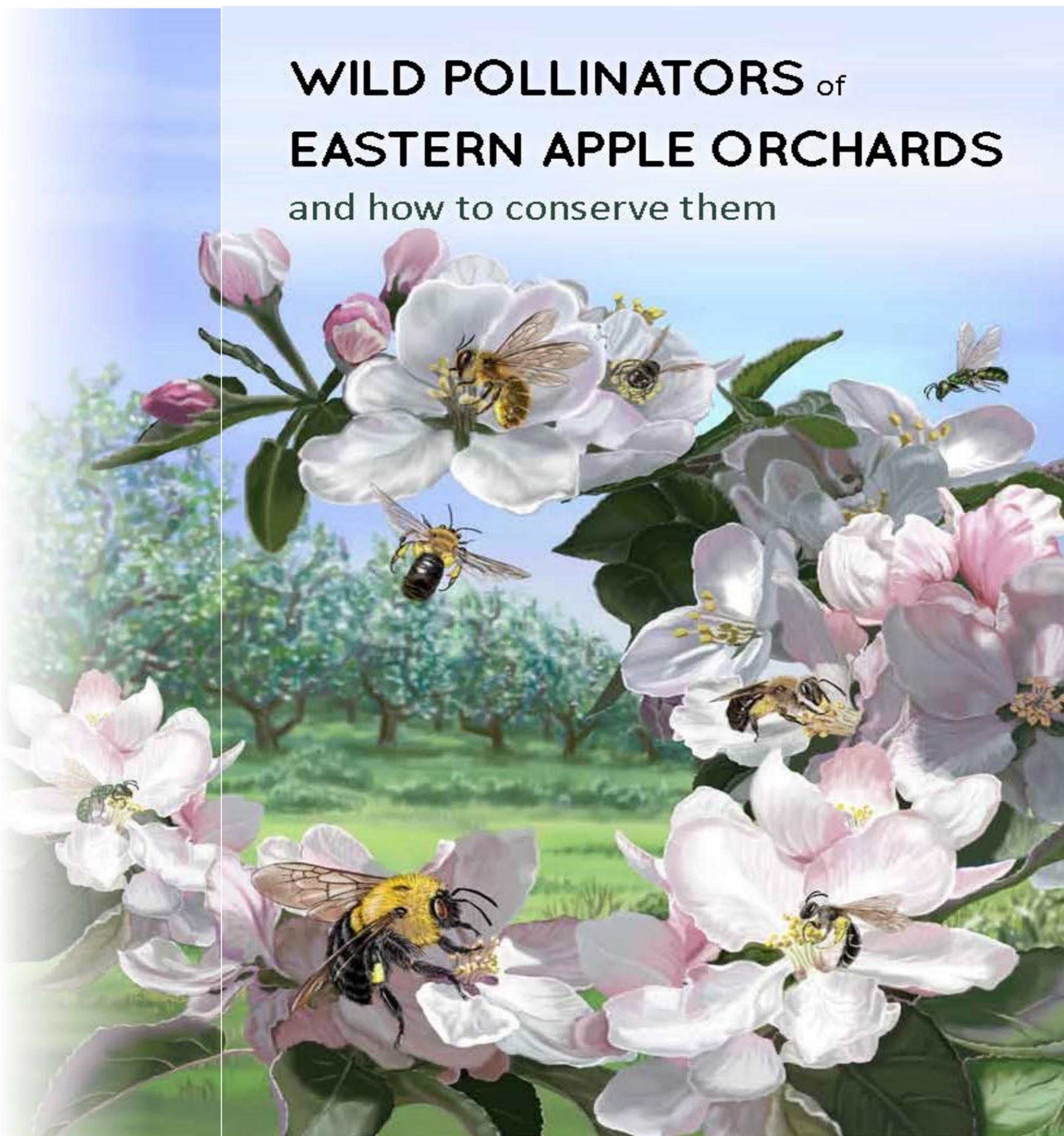




WILD POLLINATORS of EASTERN APPLE ORCHARDS

and how to conserve them



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Mission of the Center: The Northeastern Integrated Pest Management Center fosters the development and adoption of IPM, a science-based approach to managing pests in ways that generate economic, environmental, and human health benefits. The Center works in partnership with stakeholders from agricultural, urban, and rural settings to identify and address regional priorities for research, education, and outreach.

FRONT COVER: Featured Bees



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- 15: Purple coneflower, *Echinacea purpurea*, Joseph A. Marcus, Lady Bird Johnson Wildflower Center; Wild bergamot, *Monarda fistulosa*, Catherine Herms, The Ohio State University, Bugwood.org; Joe Pye weed, *Eupatorium purpureum*, Matthew Shepherd, The Xerces Society; Blue giant hyssop, *Agastache foeniculum*, Andy and Sally Wasowski, Lady Bird Johnson Wildflower Center; White meadowsweet, *Spiraea alba* sub. *latifolia*, J.S. Peterson, USDA-NRCS PLANTS Database; New England aster, *Symphotrichum novae-angliae*, Pennsylvania Department of Conservation and Natural Resources, Forestry Archive, Bugwood.org.

THE MOST COMMON BEES IN YOUR ORCHARD

GROUND-NESTERS

The most important wild pollinators of apple are ground-nesting bees. Ground-nesters excavate underground nests, comprised of tunnels and egg chambers where the young develop – a nesting strategy shared by 70% of bees worldwide. To avoid moisture-loving microbes that attack food and young, nests are built in well-drained soils. These nests are difficult to find because the entrance is normally a simple hole in the ground, just big enough for the bee to move in and out.

Nest requirements: Well-drained soil with access to bare ground.

Threats: Tilling, mulching, toxic herbicides like Paraquat (trade name Gramoxone), and compaction.

Conservation: Protect nesting sites from above threats and improve access to bare soil; provide floral resources through the growing season.

KEY

FORAGING:

Generalist



Specialist



SOCIALITY:

Solitary



Social



FLIGHT RANGE:

<500 yds



500 yds - 1 mile



1 mile+



actual size



LARGE MINING BEES (*Andrena* spp.)



12mm

At most sites, large mining bees are the most abundant and widespread native pollinators of apple. They deposit 2-3 times more pollen than honey bees per visit.



SMALL MINING BEES (*Andrena* spp.)



8-9mm

Flight ranges are often estimated from body size. The smaller the bee, the shorter the distance it can fly.

Both wild and commercial bees would benefit from increased floral resources on your land. Choose combinations of plants, so that different flower types are available throughout the entire growing season. The species recommended below are all eastern native perennials.

Purple coneflower

Echinacea spp.

forb

Soil: mesic



Wild bergamot

Monarda fistulosa

forb

Soil: mesic, dry



Joe Pye weed

Eupatorium purpureum

forb

Soil: mesic, wet



Blue giant hyssop

Agastache foeniculum

forb

Soil: mesic



Giant sunflower

Helianthus giganteus

forb

Soil: mesic, dry



White meadowsweet

Spiraea alba

shrub

Soil: mesic



New England aster

Symphotrichum novae-angliae

forb

Soil: mesic



SUMMER

FALL

FORAGE PLANTS FOR WILD POLLINATORS

COMMON NAME SPECIES NAME FORM

FLOWERING SEASON:

SPRING

SUMMER



Service berry
Amelanchier spp.
tree
Soil: mesic



Pussy willow
Salix discolor
tree-shrub
Soil: wet



Lupine
Lupinus perennis
forb
Soil: mesic, dry



Basswood
Tilia americana
tree
Soil: mesic



Lance-leaf coreopsis
Coreopsis lanceolata
forb
Soil: wet to dry



Smooth penstemon
Penstemon digitalis
forb
Soil: mesic, dry



Milkweed
Asclepias spp.
forb
Soil: wet to dry

GENERALIST OR SPECIALIST? These terms refer to the diet breadth of the bee. Generalists use many types of plants as a food source, while specialists only use a single species, genus or family of plants. Crop pollinators are typically generalists.



CELLOPHANE BEES
(*Colletes inaequalis*)



12-13mm

Named for the iridescent coating that lines their nest walls, cellophane bees are solitary but nest in large aggregations in grass-covered, sandy soil.



DARK SWEAT BEES
(*Lasioglossum* spp., *Halictus* spp.)



5mm

BLUE-GREEN SWEAT BEES
(*Augochlora pura*, *Agapostemon* spp., *Augochlorella aurata*)



7mm

Unlike the other bees in this group, *Augochlora pura*, pictured here, nests in rotting wood.

THE MOST COMMON BEES IN YOUR ORCHARD

CAVITY-NESTERS

This bee group is most familiar to us and includes honey bees and bumble bees. Such bees do not excavate their own nest, but find existing cavities to house their social colonies and honey supplies. Because these bees are active all summer long, they require constant (or at least long term) floral resources in the vicinity of the hive.

Nest requirements: *Cavities in trees, in wooden structures or below-ground.*

Threats: *Habitat loss (i.e., inadequate nesting and food sites), pesticide drift.*

Conservation: *Protect or enhance adjacent, woody natural areas; provide floral resources through the growing season; establish 20-ft buffer for drift.*

KEY

FORAGING:

Generalist



Specialist



SOCIALITY:

Solitary



Social



FLIGHT RANGE:

<500yds



500yds - 1 mile



1 mile+



actual size



BUMBLE BEES (*Bombus* spp.)



19mm

Queen bumble bees are, generally, the only individuals active during apple bloom. In the wild, workers are produced later once the colony is established. In contrast, commercial colonies are raised indoors and contain both queen and mature workers.



HONEY BEES (*Apis mellifera*)



10mm

Honey bee color ranges from the familiar orange-brown to black like the bee pictured here.



- Follow label guidelines.
- Minimize drift and direct exposure of chemicals to foraging bees. Apply sprays at night or very early when winds are usually calm and bees are not active. Non-toxic when dry, surfactants can physically drown pollinators if applied while bees are active.

In general, be mindful that wild bees are present on farms before and after the apple bloom and may even be nesting within tree rows. On pages 16 and 17, you will find a table that ranks bee toxicity of pesticides most commonly used in orchards.

MORE POLLINATOR CONSERVATION RESOURCES...

WEBSITES:

- The Xerces Society, www.xerces.org, provides a wealth of information on pollinator conservation, including downloadable factsheets and publications, as well as links to other sources.
- Pollinator Partnership, www.pollinator.org, is a non-profit coalition dedicated to the conservation of North American pollinators. Check out their resources for farming.
- Penn State University's Center for Pollinator Research, ento.psu.edu/pollinators, conducts research and outreach for wild and managed pollinators. Latest news on CCD and outreach information are found here.
- Cornell University's Wild Pollinator Program, entomology.cornell.edu/wildpollinators, serves as a portal to research and outreach about non-honey bee pollinators of New York crops and native plants.

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CONSERVATION

PROVIDE SAFE NESTING SITES

The best way to provide safe nesting is to maximize undisturbed areas around your farm. Ground nesters benefit most if areas with semi-barren, sandy soils are protected from compaction or tilling. Both tunnel- and cavity-nesters nest in or at the edge of woody semi-natural or natural areas, as well as in old stone walls and sheds.

HOW TO CREATE NEW NESTING SITES

BEE GROUP

GROUND-NESTERS	Shallow till well-drained areas once and maintain bare ground with glyphosate.
TUNNEL-NESTERS	Pile old trees that are pulled near orchard. Place self-made or purchased stem nests made from tubes or drilled wood close to orchard but safe from pesticide drift. Start small to see if tunnel-nesters are in your area. See Mader <i>et al.</i> 2010 ¹⁰ for further information.
SOCIAL CAVITY-NESTERS	Pile old trees that are pulled near orchard. Do not destroy rodent holes



Cellophane bee at the entrance of her ground nest.



Block nest for mason bees by a pear tree.



Bumble bee nest in a pile of old leaves and grass.

PROTECT BEES FROM PESTICIDES

Pesticides, including fungicides and even some herbicides, are a general danger to bees, but wild bees are more impacted because they reproduce more slowly than honey bees and each wild bee is not only a worker but also a reproducer. Here are some general guidelines to protect bees from pesticides:

- If you have a choice, use the least hazardous formulation.
- Avoid dusts and microencapsulated sprays; bees easily pick them up on their hairs or mistake them for pollen.

TUNNEL-NESTERS

As their name implies, these bees either excavate tunnels in wood (e.g., carpenter bees) or use abandoned cavities, such as beetle burrows, or even cracks in masonry (e.g., mason bees). Among the most important native (and sometimes managed) pollinators are mason bees (genus *Osmia*). Mason bees are effective apple pollinators and populations can be increased through the use of artificial nesting materials. For more information on mason bee biology and management, see Bosch & Kemp 2001 (listed below under section entitled "MORE POLLINATOR CONSERVATION RESOURCES").

Nest requirements: Stems, trees, rotting logs, wooden structures or old masonry.

Threats: Habitat loss (i.e., not enough nesting sites) and pesticide drift.

Conservation: Protect or enhance adjacent, woody natural areas and old stone walls; provide nesting materials; maintain floral resources through the growing season; establish a 20-ft buffer for drift.



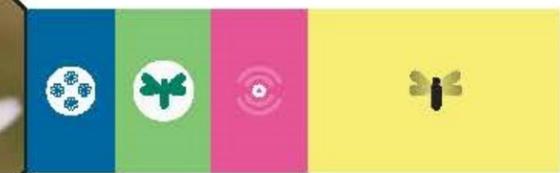
LARGE CARPENTER BEES
(*Xylocopa virginica*)



Often considered pests because they tunnel in structural wood, carpenter bees are effective pollinators of apple.



SMALL CARPENTER BEES (*Ceratina spp.*)



Small carpenter bees excavate nests in pithy stems, such as bramble.



MASON BEES (*Osmia spp.*)



Mason bees use mud to partition cells within their nest. Out West, the blue orchard bee, *Osmia lignaria*, is managed for orchard pollination. In the East, the introduced hornedfaced bee, *O. cornifrons*, is a more common pollinator of apple.

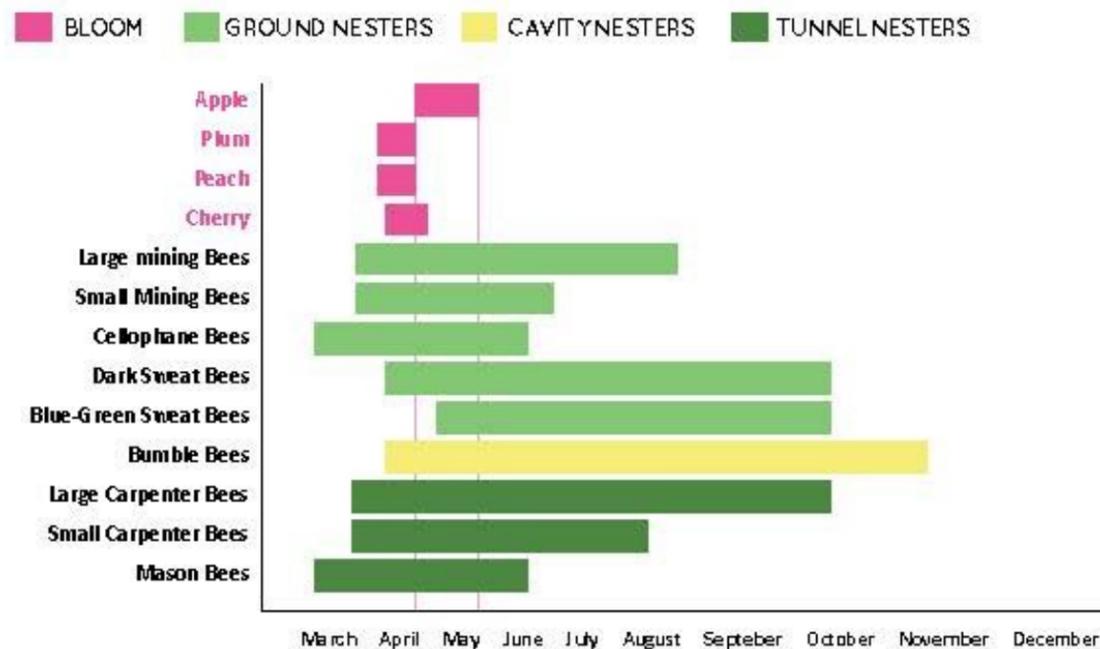
CONSERVATION

IN ORDER FOR WILD BEES TO THRIVE, THREE BASIC NEEDS MUST BE MET:

1. adequate food,
2. safe nesting sites, and
3. protection from pesticides.

You may already take great care to provide these needs for honey bees, but wild bees are unique in that they cannot be taken in and out of the orchard at will, so they must be considered beyond the short bloom period. Moreover, wild bees are more vulnerable because, unlike honey bees that send workers to forage, wild bee foragers are the reproducing individuals for that population.

BEE & BLOOM PHENOLOGY*



* Timing is generalized for the eastern U.S. and will vary according to your latitude and microclimate.



PROTECT AND ENHANCE POLLINATOR FOOD SOURCES

Wild bees require a continuous and diverse source of pollen and nectar to sustain themselves and their young. Because they live longer than the short apple bloom, it is critical that other floral resources are available within flight distance from your orchard.

Here's what you can do...

First step, protect floral resources already available on your land:

- wild blooming trees and shrubs, like willow, red maple, and basswood
- flowering weeds along roadsides and on lawns
- other early blooming fruit, such as cherry, plum and raspberry
- hedgerows
- your home garden

Next step, increase floral resources on your property to build pollinator populations. Floral plantings come in various forms:

- strips or scattered blocks at orchard margins
- cover crops
- expanded home gardens

USDA Plant Materials Centers, Xerces Society and university researchers are developing region-specific plant mixes for pollinators; funding is available for such plantings on farms (discussed below). Flip to pages 14 and 15 for a guide to plants that benefit orchard pollinators.



Pollinator planting jointly established by the Xerces Society, USDA NRCS, and the University of New Hampshire Extension.

GOVERNMENT COST-SHARE PROGRAMS

USDA's Farm Service Agency (FSA) and Natural Resources Conservation Service (NRCS) provide funding opportunities for individual farmers to defray the costs of improving lands for pollinators:

1. Conservation Reserve Program (CRP) is a land retirement program that aims to enhance wildlife habitat.
Website: www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=copr. Contact your local USDA FSA service center to apply.
2. Environmental Quality Initiatives Program (EQIP) supports conservation practices that improve environmental quality of land.
Website: www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip. See website for state-specific application instructions.
3. Wildlife Habitat Incentives Program (WHIP) funds establishment and improvement of wildlife habitat.
Website: www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/whip. Contact your local USDA NRCS service center to apply.