

Urban Habitat Planning for Beneficial Insects and Pollinators

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Photo: Xerces blue butterflies by Joel Sartore,
<https://www.altaonline.com/dispatches/a35588986/xerces-blue-butterfly-san-francisco/>

The Xerces Society

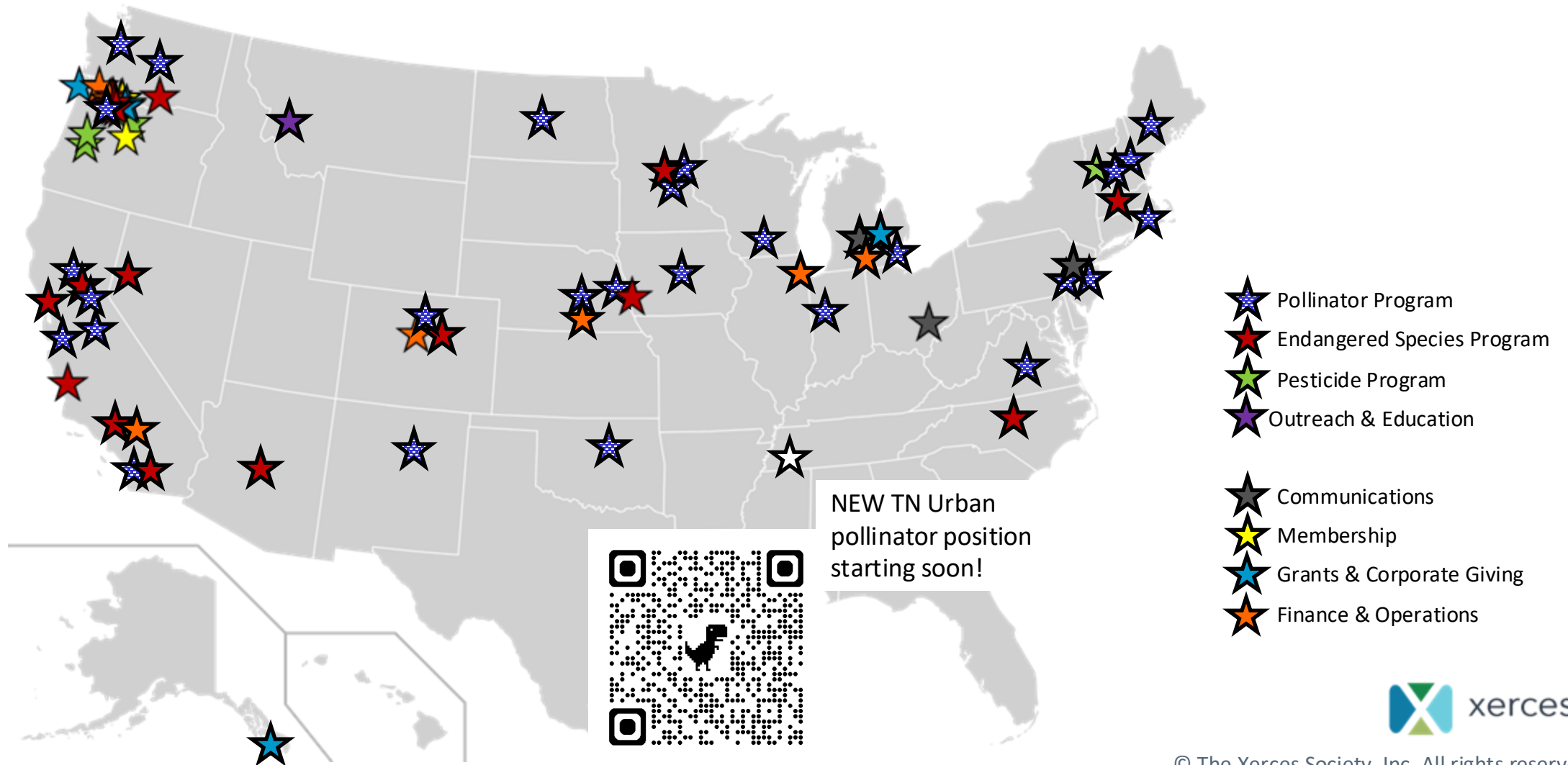
for Invertebrate Conservation

A science-based nonprofit organization that protects wildlife through the conservation of invertebrates and their habitats

Conservation programs:

- Pollinators & Agricultural Biodiversity
- Endangered Species Conservation
- Reducing Pesticide Use
- Community Engagement

The Xerces Society: Program Structure

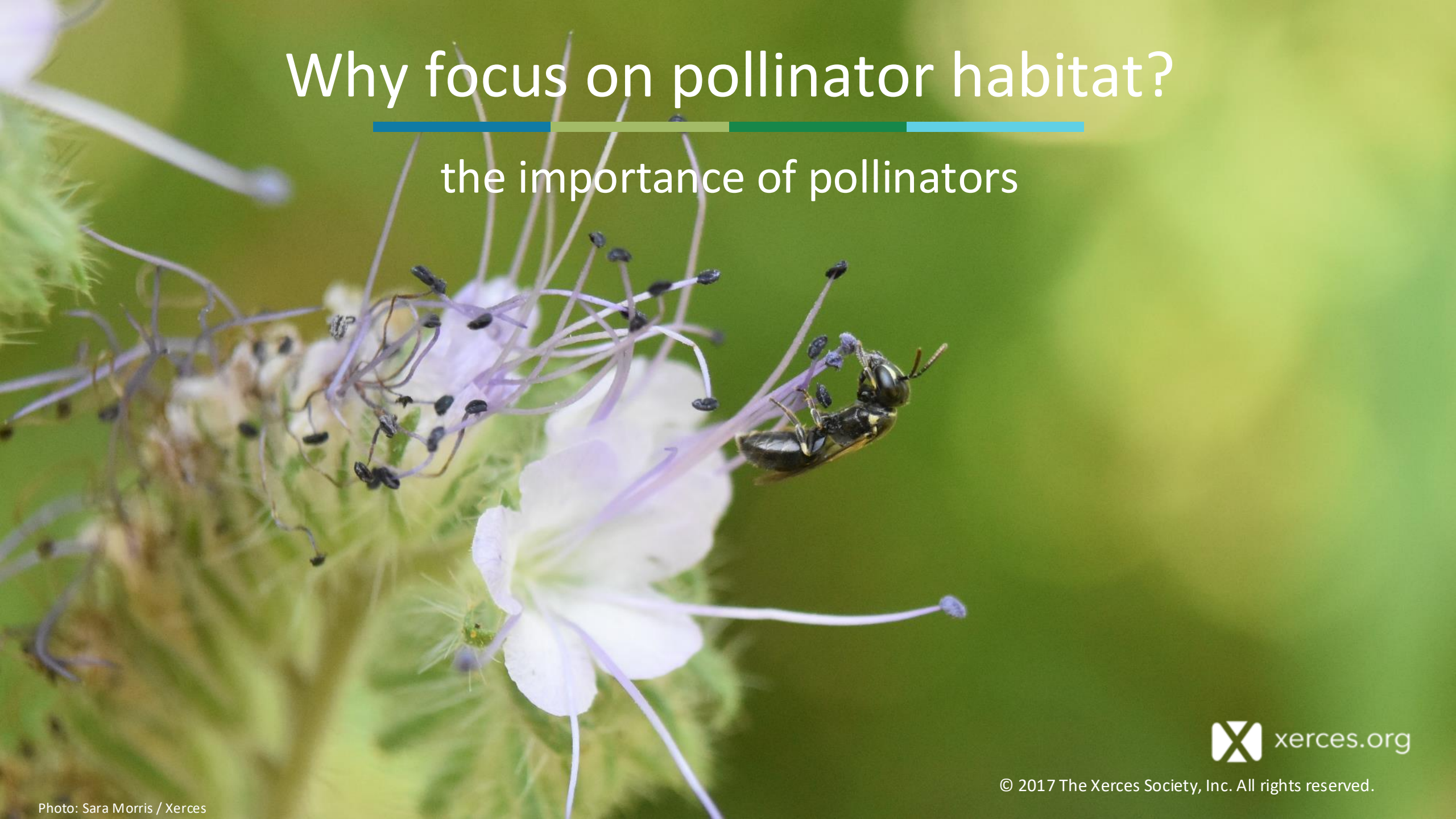


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- White Pine Fund
- Whole Foods Market

Why focus on pollinator habitat?

the importance of pollinators



Why do we need habitat?

****Crops and wild plants require a diversity of pollinators for effective and sustainable pollination****

1.

Widespread
habitat loss ->
insect decline



2.

> 30% of crop
production
worldwide



3.

> 80% of all
flowering
plants



4.

Help reduce
climate change
effects



Photo: Kelly Gill / Xerces; Stefanie Steele / Xerces; Adam Varenhorst; Nick Dorian / Bee Campus Tufts University

“The fate of the world’s insects is inseparable from our own”

Soil health, pest control, food for wildlife, crop pollination and higher yields...

Recycle
nutrients
throughout
the ecosystem



Offer free
natural pest
control
services



Food sources
for other
animals



Help plants
reproduce



Photos: (left to right): Magnus Robinson; USDA ARS Scott Bauer; Marcel Holyoak via flickr; Emily May / Xerces Society
Quote from NYT Editorial Insect Armageddon October 29, 2017

Native habitat for native bees

More than 3,600 species of native bees in the United States



Photos: Rollin Coville, Betsy Betros, Jason Gibbs, Emily May

NOTE: European Honey Bees - not a typical bee

- **Unusual Biology:** Eusocial bees, division of labor (queen, workers, drones) + cooperative care, perennial colony - overwinters by feeding on honey stores
- **Domesticated Livestock:** Colonies managed for honey + hive products and **crop pollination:** often temporarily brought to farms to provide crop pollination
- **Status:** Non-native, not at risk of extinction, globally secure with localized problems

An agricultural/hobbyist pursuit, **not** a conservation strategy



Pollinator habitat = natural pest control

Conservation Biological Control (CBC)

- “Natural enemies” eat or parasitize pests
- Many natural enemies need pollen and nectar too



Photo: Assassin Bug (top left): John Flannery Flickr Creative Commons; Syrphid flies (lower left): Karin Jokela / Xerces Society; Lacewing (right): Sarah Foltz Jordan / Xerces Society

Multi-Functional, Beautification, Education + Jobs, Food + Herbs



Photo: Stefanie Steele / Xerces, Anna Victoria / River City Garden; Stefanie Steele / Xerces

Habitat & Planning Considerations

for a diversity of pollinators



Where to start with creating habitat? – Assess!



Native Bee Conservation Pollinator Habitat Assessment Form and Guide FARMS AND AGRICULTURAL LANDSCAPES



July 2015
The Xerces Society for
Invertebrate Conservation
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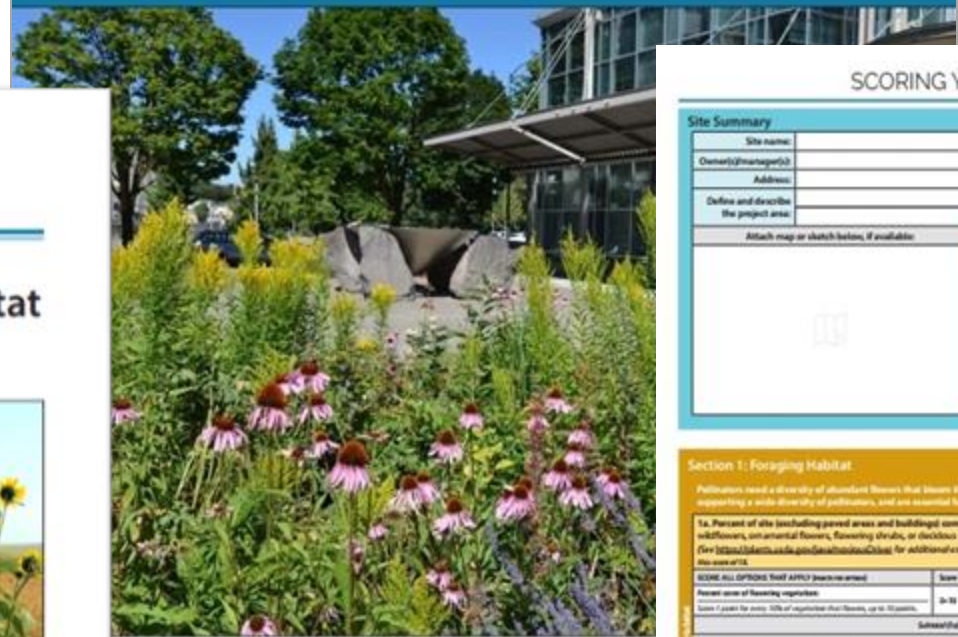


Conservation Biological Control Beneficial Insect Habitat Assessment Form and Guide FARMS AND AGRICULTURAL LANDSCAPES



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Habitat Assessment Guide for Pollinators in *Yards, Gardens, and Parks*



Native wildflowers make it possible for this small urban pollinator garden to support a variety of bees, but trees provide high quality resources for pollinators, wildlife, and people in a small space.

SCORING YOUR SITE

Site Summary		Site Assessment	
Site name:		Assessment Dates	BEFORE
Owner(s)/manager(s):			AFTER
Address:		Optimized Checklist of Actions to Promote Pollinators	
Define and describe the project area:		Score Your Site	BEFORE
Attach map or sketch below, if available:		Section 1: Foraging Habitat	100
		Section 2: Nesting Habitat	50
		Section 3: Perchable Practices	35
		Section 4: Community Action	40
		OVERALL SCORE	225

Section 1: Foraging Habitat

Pollinators need a diversity of abundant flowers that bloom throughout the growing season. Native plants do the best job supporting a wide diversity of pollinators, and are excellent for many species.

1a. Percent of site (including paved areas and buildings) composed of flowering vegetation (Figure 2). This includes native wildflowers, ornamental flowers, flowering shrubs, or deciduous trees. Does not include lawn grass, or shrubs or non-flowering trees (see <https://www.xerces.org/data/habitat-checklist> for additional examples).

SCORE ALL OPTIONS THAT APPLY (maximum score)	Score	Before	After	Treatment to increase score (see table with this page)
Percent area of flowering vegetation:	0-75			
Score 1 point for every 10% of vegetation that blooms, up to 10 points.				
Subtotal				

Figure 2: Examples of percent area of flowering vegetation (left) count all plants that provide flowers, whether or not they are currently in bloom.

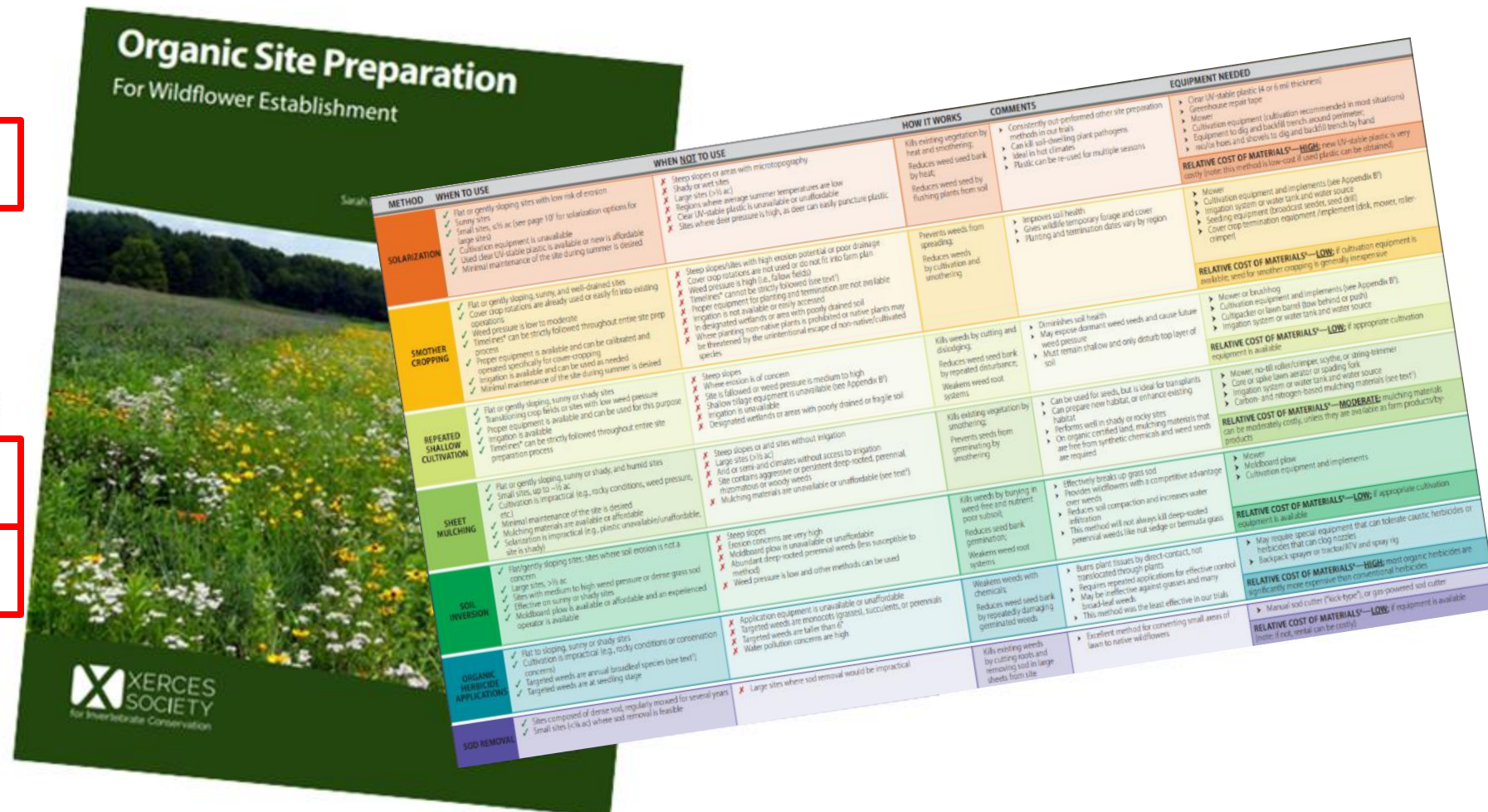
- <10% flowering vegetation
- ~40% flowering vegetation
- >80% flowering vegetation

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Organic Site Prep Methods

- Smother Cropping
- Solarization
- Repeat Cultivation
- Soil inversion
- Organic Herbicides
- Sheet Mulching
- Sod Removal
- Weed barriers
- Livestock Rooting
- Burning/Grazing



Organic Site Preparation For Wildflower Establishment

XERCES SOCIETY for Invertebrate Conservation

METHOD	WHEN TO USE	WHEN NOT TO USE	HOW IT WORKS	COMMENTS	EQUIPMENT NEEDED	RELATIVE COST OF MATERIALS
SOLARIZATION	<ul style="list-style-type: none"> Flat or gently sloping sites with low risk of erosion Sunny sites Small sites, <1/2 ac (see page 10 for solarization options for large sites) Cultivation equipment is unavailable Used clear UV-stable plastic is available or new is affordable Minimal maintenance of the site during summer is desired 	<ul style="list-style-type: none"> Steep slopes or areas with microtopography Shady or wet sites Large sites (>1/2 ac) Regions where average summer temperatures are low Regions where UV-stable plastic is unavailable or unaffordable Cow (UV-stable plastic is high, as deer can easily puncture plastic) Sites where deer pressure is high, as deer can easily puncture plastic 	<ul style="list-style-type: none"> Kills existing vegetation by heat and smothering. Reduces weed seed bank by heat. Reduces weed seed by flushing plants from soil 	<ul style="list-style-type: none"> Consistently outperformed other site preparation methods in our trials Can kill soil-dwelling plant pathogens Ideal in hot climates Plastic can be re-used for multiple seasons 	<ul style="list-style-type: none"> Clear UV-stable plastic (4 or 6 mil thickness) Greenhouse repair tape Mower Cultivation equipment (subcultivation recommended in most situations) Equipment to dig and backfill trenches around perimeter Wheel/hoe and shovel to dig and backfill trenches by hand Wheel/hoe and shovel to dig and backfill trenches by hand 	<p>HIGH: new UV-stable plastic is very costly (note: this method is low-cost if used plastic can be obtained)</p>
SMOTHER CROPPING	<ul style="list-style-type: none"> Flat or gently sloping, sunny and well-drained sites Cover crop rotations are already used or easily fit into existing operations Weed pressure is low to moderate "Timelines" can be strictly followed throughout entire site prep process Proper equipment is available and can be calibrated and operated specifically for cover-cropping Irrigation is available and can be used as needed Minimal maintenance of the site during summer is desired 	<ul style="list-style-type: none"> Steep slopes/sites with high erosion potential or poor drainage Cover crop rotations are not used or do not fit into farm plan Weed pressure is high (i.e., fallow fields) "Timelines" cannot be strictly followed (see text) Proper equipment for planting and termination are not available In designated wetlands or areas with poorly drained soil In designated wetlands or areas with poorly drained soil Where planting non-native plants is prohibited or native plants may be threatened by the unintentional escape of non-native/cultivated species 	<ul style="list-style-type: none"> Prevents weeds from spreading Reduces weeds by cultivation and smothering 	<ul style="list-style-type: none"> Improves soil health Gives wildlife temporary forage and cover Planting and termination dates vary by region 	<ul style="list-style-type: none"> Mower Cultivation equipment and implements (see Appendix B) Irrigation system or water tank and water source Seeding equipment (broadcast seeder, seed drill) Cover crop termination equipment (implement disk, mower, roller-crimper) 	<p>LOW: If cultivation equipment is available, seed for smother cropping is generally inexpensive</p>
REPEATED SHALLOW CULTIVATION	<ul style="list-style-type: none"> Flat or gently sloping, sunny or shady sites Transitioning crop fields or sites with low weed pressure Proper equipment is available and can be used for this purpose Irrigation is available "Timelines" can be strictly followed throughout entire site preparation process 	<ul style="list-style-type: none"> Steep slopes Where erosion is of concern Site is followed and weed pressure is medium to high Shallow tillage equipment is unavailable (see Appendix B) Irrigation is unavailable Designated wetlands or areas with poorly drained or fragile soil 	<ul style="list-style-type: none"> Kills weeds by cutting and dislodging Reduces weed seed bank by repeated disturbance. Weakens weed root systems 	<ul style="list-style-type: none"> Diminishes soil health Must remain shallow and only disturb top layer of soil 	<ul style="list-style-type: none"> Mower or brushhog Cultivation equipment and implements (see Appendix B) Cultivation equipment or water tank and water source Irrigation system or water tank and water source 	<p>LOW: If appropriate cultivation equipment is available</p>
SHEET MULCHING	<ul style="list-style-type: none"> Flat or gently sloping, sunny or shady, and humid sites Small sites, up to ~1/2 ac Cultivation is impractical (e.g., rocky conditions, weed pressure, etc.) Minimal maintenance of the site is desired Mulching materials are available or affordable Solarization is impractical (e.g., plastic unavailable/unaffordable, site is shady) 	<ul style="list-style-type: none"> Steep slopes or arid sites without irrigation Large sites (>1/2 ac) Hot or semi-arid climates without access to irrigation Site contains aggressive or persistent deep-rooted, perennial, rhizomatous or woody weeds Mulching materials are unavailable or unaffordable (see text) 	<ul style="list-style-type: none"> Kills existing vegetation by smothering. Prevents seeds from germinating by smothering 	<ul style="list-style-type: none"> Can be used for seeds, but is ideal for transplanting Can prepare new habitat, or enhance existing habitat Herbicides well in shady or rocky sites On organic certified land, mulching materials that are free from synthetic chemicals and weed seeds are required 	<ul style="list-style-type: none"> Mower, no-till roller/crimper, sledge, or string-trimmer Cole or spike lawn aerator or spading fork Irrigation system or water tank and water source Carbon- and nitrogen-based mulching materials (see text) 	<p>MODERATE: mulching materials can be moderately costly, unless they are available as farm products/by-products</p>
SOIL INVERSION	<ul style="list-style-type: none"> Flat/gently sloping sites where soil erosion is not a concern Large sites, >1/2 ac Sites with medium to high weed pressure or dense grass sod (Effective on sunny or shady sites) Mid-board plow is available or affordable and an experienced operator is available 	<ul style="list-style-type: none"> Steep slopes Erosion concerns are very high Mid-board plow is unavailable or unaffordable Abundant deep-rooted perennial weeds (less susceptible to method) Weed pressure is low and other methods can be used 	<ul style="list-style-type: none"> Weakens weeds with chemicals Reduces weed seed bank by repeatedly damaging germinated weeds 	<ul style="list-style-type: none"> Effectively breaks up grass sod Provides winterflora with a competitive advantage over weeds Reduces soil compaction and increases water infiltration This method will not always kill deep-rooted perennial weeds like nut sedge or bermuda grass 	<ul style="list-style-type: none"> Mower Mid-board plow Cultivation equipment and implements 	<p>LOW: If appropriate cultivation equipment is available</p>
ORGANIC HERBICIDE APPLICATION	<ul style="list-style-type: none"> Flat to sloping, sunny or shady sites Cultivation is impractical (e.g., rocky conditions or conservation concerns) Targeted weeds are annual/broadleaf species (see text) Targeted weeds are annual/broadleaf species (see text) Targeted weeds are at seedling stage 	<ul style="list-style-type: none"> Application equipment is unavailable or unaffordable Targeted weeds are monocots/grasses, succulents, or perennials Targeted weeds are taller than 2' Water pollution concerns are high 	<ul style="list-style-type: none"> Kills existing weeds by cutting, roots and removing soil in large sheets from site 	<ul style="list-style-type: none"> Burns plant tissues by direct-contact, not non-located through plants Requires repeated applications for effective control May be ineffective against grasses and many broad-leaf weeds This method was the least effective in our trials 	<ul style="list-style-type: none"> Manual sod cutter ("lick type"), or gas-powered soil cutter 	<p>HIGH: most organic herbicides are significantly more expensive than conventional herbicides</p>
SOD REMOVAL	<ul style="list-style-type: none"> Sites composed of dense sod, regularly mowed for several years Small sites (<1/2 ac) where sod removal is feasible 	<ul style="list-style-type: none"> Large sites where sod removal would be impractical 		<ul style="list-style-type: none"> Excellent method for converting small areas of lawn to native wildflowers 		<p>LOW: If equipment is available (note: if not, sod can be costly)</p>



Starting Habitat from Seed

Lower Cost

More pre-planting weed control needed, since native seeds can easily get out competed by weeds

Requires high mowing for weed management during establishment

Flowers usually not blooming/thriving until 3rd or 4th year of project (year 1: weed control, year 2: mowing....)

Seed mix can be **highly diverse** (but not always realized in plant community)

Less control (design is limited to seed mix)

Better for large areas

Irrigation only needed in dry climates

Starting from Transplants



Higher Cost. Can bring cost down if you grow some yourself

Less weed control needed, since native plants will have more of a competitive advantage

No mowing needed. Spot weeding as needed

Blooming flowers can be realized the **1st year** of project, abundant blooms by second

Plantings are generally **lower diversity**

More control & design (desired plants can be selected, clustered, evenly distributed, distributed by height, etc.)

Better for small areas (1/10 acre / ~4356 sqft = ~2k to 4K plants or 600 sqft = ~ 260 to 600 plants at 1.5ft to 1ft spacing)

May require irrigation at time of transplant, during establishment, and dry periods

Small-Scale Site Prep & Planting

Passive smother tarps, sod removal, plant augers, community members!



Photos: Marty Post / Hillside Village; Loretta Powell / Detroit Little Community Garden; Micah Kloppenburg and Sarahrda / Xerces; Erma Leaphart / VOJ

Three Requirements for Quality Habitat

- 1. Food:** Nectar, pollen, host plants
- 2. Shelter & Nesting:** Nest sites, overwintering sites, refuge
- 3. Protection:** Protection from pesticide risk, habitat disturbance

Supporting pollinators throughout their life cycle is critical



Photo: Elizabeth Sellers / Flickr

Where do native bees nest???

~70% Solitary
Ground Nesting



~30% Solitary
Stem/Wood Nesting



~1% Social Nesting
(Bumble Bees)



Photos: Kent McFarland (Flickr-CC), Sara Morris and Nancy Lee Adamson (Xerces Society)

Ground Nest Sites: ~ 70% of Native Bees

- AVOID:

Permanent landscape plastic/fabric, heavy mulch, regular tillage or other ground disturbance

- ADD:

Pebbles/light rock mulch encourage nesting of some species

- Reminder:

Solitary and not aggressive = don't defend nests



Photos: Hillary Sardinas, Kelly Gill, Jennifer Hopwood (Xerces Society)

Stem/Wood Nest Sites: ~ 30% of Native Bees

- AVOID:

Cutting + removing all plant stems & dead wood

- ADD:

Plants w/hollow or pithy stems, dead + rotting wood: logs, stumps, branches, snags, and stones to create crevices

- REIMINDER:

Cell partitions constructed with mud, leaf or petal pieces, resin, sawdust, pebbles, or plant hairs



Photos: Photos: Ruaa Brahran, Edward S. Ross, Darrin O'Brien, Clay Bolt, Sarah Foltz Jordan, Stefanie Steele

How to Create Habitat for Stem-Nesting Bees

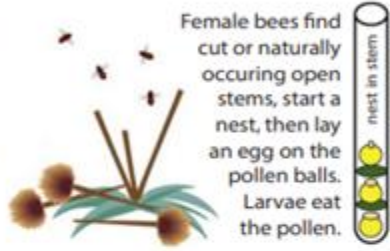


WINTER

Leave dead flower stalks intact over the winter

SPRING

Cut back dead flower stalks leaving stem stubble of varying height, 8 to 24 inches, to provide nest cavities.



Female bees find cut or naturally occurring open stems, start a nest, then lay an egg on the pollen balls. Larvae eat the pollen.

SUMMER

New growth of the perennial hides the stem stubble.



Bee larvae develop in cut dead stems during the growing season.

FALL



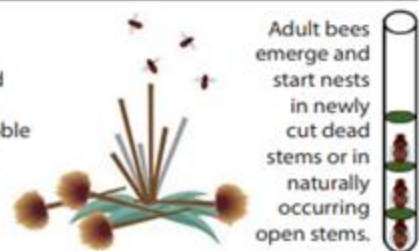
WINTER



Bees hibernate in stems during the winter

SPRING

Cut back dead flower stalks. Old stem stubble will naturally decompose.



Adult bees emerge and start nests in newly cut dead stems or in naturally occurring open stems.

Photo: A Sarar Foltz Jordan/ Xerces, B Heather Holm



How to create habitat for stem-nesting bees, by Colleen Satyshur and Elaine Evans, with contributions from Sarah Foltz Jordan and Heather Holm.
<https://www.beelab.umn.edu/sites/beelab.umn.edu/files/stem-nesting-bee-handout-v5.pdf>

A few highly-used plants for stem-nesting bees

Common Name	Plant Genus
Hyssop	<i>Agastache</i>
Echinacea	<i>Echinacea</i>
Sunflowers	<i>Helianthus</i>
Blazing Star	<i>Liatris</i>
Bee balm	<i>Monarda</i>
Goldenrods	<i>Solidago</i>
Asters	<i>Symphotrichum</i>
Raspberry & other brambles	<i>Rubus</i>
Sumac	<i>Rhus</i>
Elderberry	<i>Sambucus</i>

Plant Selection Overview: Perennials!



For regional plant lists visit
Xerces Pollinator Conservation Resource Center

- Focus on native perennial plants: herbaceous flowers + bunch grasses / sedges and flowering woody species
- Locally adapted, matched to site conditions
- Succession of bloom periods – at least 3 species per period, diversity of families, flower shape, and color
- Species with high pollinator value (nectar, pollen, nesting, free of pesticides)
- Butterfly host plants
- Harvestable products
- Culturally significant plants
- Availability and cost



Bloom	Common Name	Scientific Name	Flower Color	Max. Height	Water Needs	Notes
	Forbs					
				Feet	Low, Medium, or High	All species perennials, unless otherwise noted. Monarchs are present June through October in the Great Lakes Region.
Summer	1 Butterfly milkweed	<i>Asclepias tuberosa</i>	Orange	2	L	Host plant for monarch caterpillars and excellent nectar plant for adults. Very showy flowers. Prefers dry soils and full sun.
	2 Common milkweed	<i>Asclepias syriaca</i>	Pink	5	L/M/H	Host plant for monarch caterpillars and excellent nectar plant for adults. Fragrant flowers. Thrives in a wide range of soils.
	3 Culver's root	<i>Veronicastrum virginicum</i>	White	6	M	Excellent landscaping plant. Beautiful flowers attract butterflies, bumble bees, and other insects.
	4 Swamp milkweed	<i>Asclepias incarnata</i>	Pink	4	M/H	Excellent monarch caterpillar host plant and nectar plant. A great option for shorelines, rain gardens, and riparian buffers.
	5 Black-eyed Susan	<i>Rudbeckia hirta</i>	Yellow	2	L	Biennial but can self-seed. Butterfly attractant. Also visited by longhorn bees, green sweat bees, and other pollinators.
	6 Common boneset	<i>Eupatorium perfoliatum</i>	White	6	M/H	Tolerates sandy or clay soils but needs constant moisture. Also attracts bees and an amazing assortment of beneficial wasps.
	7 Eastern purple coneflower	<i>Echinacea purpurea</i>	Pink/purple	5	L/M	Attracts a number of butterflies, native bees, and hummingbirds. Native range includes most of the region apart from MN.
Summer to Fall	8 Field thistle	<i>Cirsium discolor</i>	Pink/purple	7	L	Not to be confused with exotic thistles, this non-aggressive native thistle is exceptional for pollinators and songbirds. Biennial.
	9 Marsh blazing star	<i>Liatris spicata</i>	Purple	5	M/H	Highly adaptable and easy to grow. Attracts many butterflies, bees, and hummingbirds. A great <i>Liatris</i> for wet soils.
	10 Meadow blazing star	<i>Liatris ligulistylis</i>	Purple	5	M	The ultimate monarch magnet, even compared to other <i>Liatris</i> . Native range stretches east only as far as WI. Medium soils.
	11 Ontario blazing star	<i>Liatris cylindracea</i>	Purple	2	L	Shorter than other <i>Liatris</i> species and tends to bloom later in the year. Requires dry soils.
	12 Rough blazing star	<i>Liatris aspera</i>	Purple	4	L	Another incredibly attractive <i>Liatris</i> for monarchs as well as many other insects. Drought tolerant.
	13 Sawtooth sunflower	<i>Helianthus grosseserratus</i>	Yellow	10	M	Tolerates many soil types. Can be quite large in the garden. Continues blooming late into the fall. Rhizomatous.
	14 Showy goldenrod	<i>Solidago speciosa</i>	Yellow	5	L	An excellent monarch nectar plant; also visited by beneficial solitary wasps, pollen-eating soldier beetles, and more.
	15 Smooth oxeye	<i>Helopsis helianthoides</i>	Yellow	5	L/M	Also known as early sunflower, this plant has a long bloom period from July to October. Tolerates clay and moist soils.
	16 Spotted bee-balm	<i>Monarda punctata</i>	White/pink/yellow	3	L	Prolific blooms are highly attractive to beneficial wasps and bees. Prefers dry, sandy soils. A beautiful, unique flower.
	17 Spotted joe-pye weed	<i>Eutrochium maculatum</i>	Pink	6	H	Prefers moist soils. Attracts numerous butterflies and bees, including the very rare rusty patched bumble bee.
Fall	18 Stiff goldenrod	<i>Oligoneuron rigidum</i>	Yellow	5	L/M	This plant offers abundant and accessible pollen and nectar—a utopia for insects! Flat-top flower is unusual for a goldenrod.
	19 Swamp thistle	<i>Cirsium matrican</i>	Pink/purple	7	H	This lovely native thistle attracts numerous butterflies and bees. Host plant for the swamp metalmark butterfly. Wet soils. Biennial.
	20 Whorled milkweed	<i>Asclepias verticillata</i>	White	3	L	Monarch caterpillar host plant and exceptional nectar plant. This small milkweed plant is great for landscaping. Dry soils.
	21 Wild bergamot	<i>Monarda fistulosa</i>	Purple	5	L/M	A superb bumble bee plant, also known as bee balm. Also attracts hawk moths and hummingbirds. Aromatic foliage.
	22 Aromatic aster	<i>Symphoricarum oblongifolium</i>	Purple	2	L	Very late blooming aster with fragrant foliage. Stiff stems branch out to create a bush-like appearance. Full sun and dry soils.
	23 Maximilian sunflower	<i>Helianthus maximiliani</i>	Yellow	8	L	Very showy and vigorous plant. Caterpillar host plant for the silvery checkerspot and bordered patch butterflies.
	24 New England aster	<i>Symphoricarum nove-angliae</i>	Pink/purple	6	M	One of the latest fall-blooming plants. Butterfly magnet and important food resource for pre-hibernation bumble bee queens.



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What does urban pollinator habitat look like??



Photos: Alina Harris, Stefanie Steele, Laura Rost, Kelly Gill

Examples from MI + WI Habitat Kit Programs



In-row Pollinator Strip



High Tunnel Insectary



Farm Outbuilding Planting



Prairie Pocket Planting

Need: FOOD all growing season



Photos: Sarah Foltz Jordan, Stefanie Steele, Matthew Shepherd, Kathryn Prince, Nancy Adamson, Justin Wheeler Jim Eckberg, Jennifer Hopwood

Need: SHELTER/NESTING - always



Photos: Stefanie Steele, Micah Kloppenburg, Laura Rost, Sara Morris, Mace Vaughan / Xerces;



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Need: PROTECTION - always



PROTECTING POLLINATORS FROM PESTICIDES

Buying Bee-Safe Plants

Plants grown for sale in retail nurseries, even those marketed as "pollinator-friendly," are commonly treated with pesticides. Learning more about your local nursery's pest management practices and ensuring the flowering plants you purchase are free from harmful pesticides are important steps in protecting pollinators.



Pollinator gardening has skyrocketed in popularity. Increasingly, garden centers and nurseries are labeling plants as "pollinator-friendly," or adding bee or butterfly images to plant tags to denote their ability to attract these wonderful insects to the landscape.

Consumers may make the assumption that these images and phrases mean that these plants are safe for bees and that pesticides harmful to bees and butterflies were not applied during production. While this may be the case for some growers, don't assume it's so. Currently there is no legal or nursery industry standard definition or set of practices mandated for the use of terms such as "pollinator-friendly" or "bee-friendly."

Plants that attract pollinators should be free from harmful pesticide residues

surprise that researchers are finding toxic levels of insecticides in nursery plants. So, remember that the bee and butterfly pictures on the plant tags only tell half the story—whether a plant is attractive to pollinators. You will still need to figure out whether a plant is free of harmful pesticides, a task that takes some time and effort.

In this factsheet, we provide tips on why and how to talk with nurseries about pollinator-friendly practices.

Consumer Requests Are Powerful and Can Transform Practices

While it may feel awkward to start the conversation with your retailer or nursery, consumer requests can transform nursery production practices and the purchasing behavior of retail plant buyers. By respectfully asking the questions outlined here, you will signal that customers are informed and care



Tools: Communicate Intention – “cues to care”



Photos: Marilyn Griffin, Stefanie Steele, Kailee Slusser, Laura Rost, Kelly Gill / Xerces, Pat Mclamore

Who are the pollinators

and beneficial insects



Who are the pollinators? Insects primarily...



POLLEN—KEY CHARACTERISTICS:

- ⇒ Does the bee have **pollen** on its body?
- ⇒ If so, **where?**
- ⇒ Does the pollen look **moist and packed**, or **dry and loose**?

BEES = Most important and efficient group of pollinators:

1. Actively collect and transport pollen
2. Exhibit flower constancy
3. Forage near nest



Packed on the outside of the bee's hind leg

Photograph courtesy of Tom Koerner.



On the underside of its abdomen

Photograph by Sara Morris.



Photograph courtesy of Debbie Roos.



All over its legs and at the base of its thorax

Photograph by Mace Vaughan.



All around its hind legs

Photograph by Sara Morris.



All over

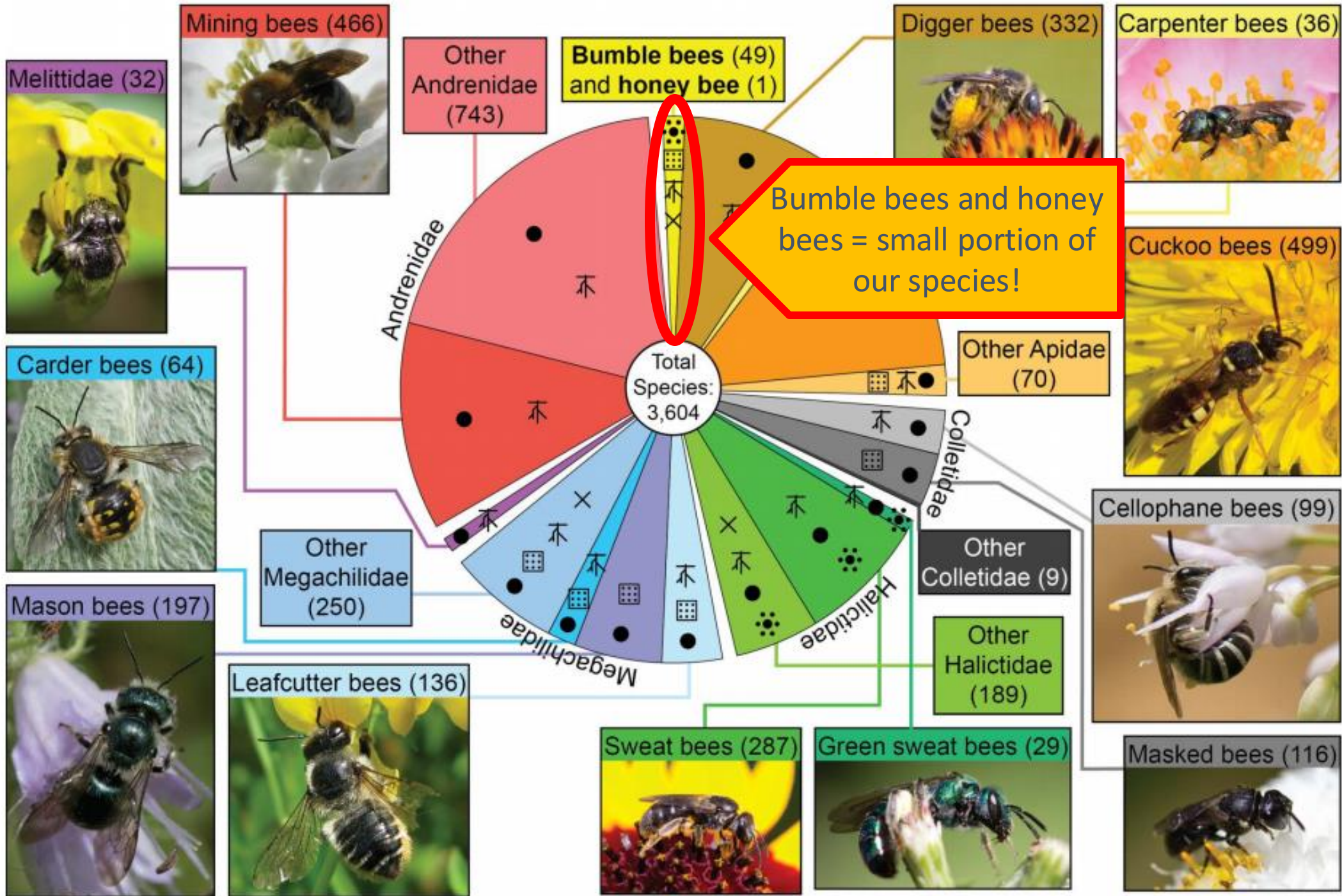
Photograph courtesy of Anne Reeves.

Reminder:
Male bees do not have pollen carrying structures!

WHAT SIZE IS THE BEE?



Many bees = size
of a **grain of rice**



Bumble bees and honey bees = small portion of our species!

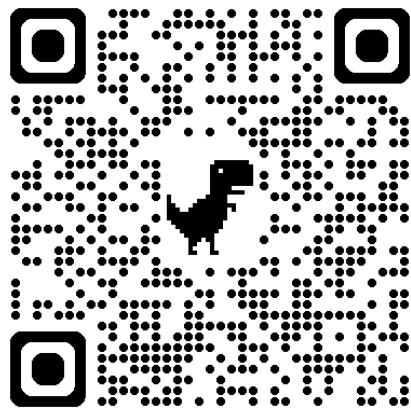
- Social ● Solitary
- ⌘ Ground-nesting
- ▣ Cavity-nesting
- ✕ Nest parasites

Some bees need certain flowers



Photo: Nancy Lee Adamson

Learn more
about specialist
bees!



Flowers that host pollen specialist bees include:

- Sunflowers (*Helianthus*)
- False goldenaster (*Heterotheca*)
- Ironweed (*Vernonia*)
- Native thistles (*Cirsium*)
- Asters (*Symphyotrichum*)
- Willows (*Salix*)
- Primroses (*Oenothera*)
- Globemallow (*Sphaeralcea*)
- Squash (*Cucurbita*)
- And many more



Photo: Lacewing larva consuming aphid by Alex Wild

Common Beneficial Insect Groups

- Insect Predators
- Insect Parasitoids
- Some are also pollinators:
 - Flies, wasps, beetles
- Some also play a role in soil health

- Non-insects:
 - Spiders, harvestmen, centipedes, mites, pseudoscorpions

Predators: Flower Flies/Hover Flies

- Predaceous larvae, adults feed on pollen and nectar
- Overwinter in leaf litter or soil



Photos: Mace Vaughan, Xerces Society; Mario Ambrosino



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Predators: Soldier Beetles

- Predatory as larvae, some as adults
- Adults will feed on nectar and pollen
- Overwinter in leaf litter or loose soil



Photos: Adult soldier beetles mating, by Debbie Roos; larva by Karen Loughrey Richard

Predators: Predatory Wasps

- Larvae consume prey, adults feed on flower nectar
- Nest underground or in tunnel cavities
- Many are solitary species, but social paper wasps also beneficial



Parasitoid Wasps

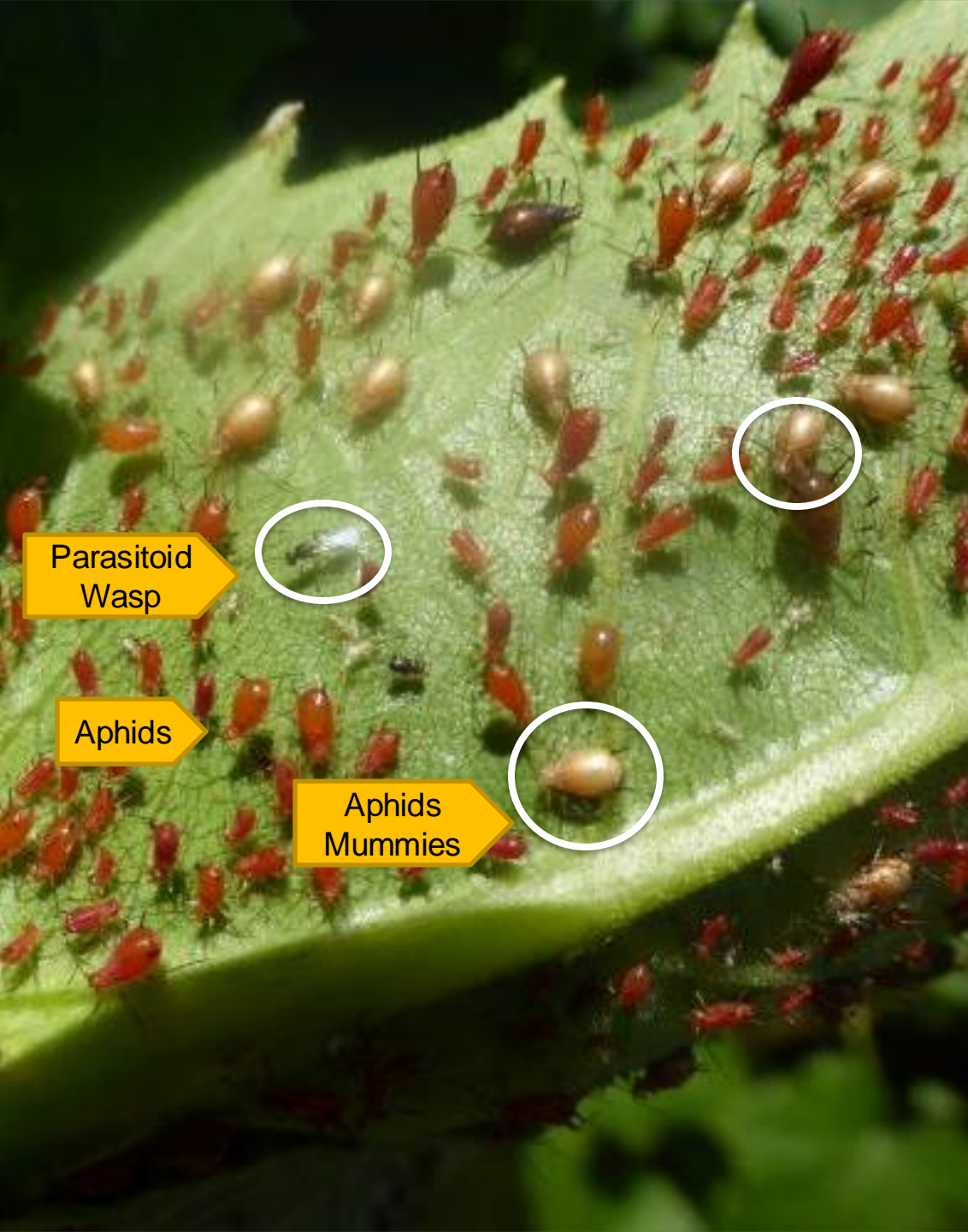


Photo: Sarah Foltz Jordan

- Most parasitoids are specialists
- Persist in environments with low-levels of prey
- Overwinter within host
- Adults are nectar-feeding
- Recognizing their activity may be easier than seeing the wasp itself
 - Aphid mummies
 - Emergence holes in eggs
 - Pupae on caterpillars

Resources to Learn More: Beneficial Insects Scouting Tools



FIGURE 1: Floral monitoring outside a high-tunnel greenhouse (left), sweep-netting meadow habitat (center), and a parasitized colony of aphids (right).

BENEFICIAL INSECTS FOR NATURAL PEST CONTROL:

Flower Scouting

PURPOSE

Beneficial insects like flower flies, soldier beetles and predatory wasps can provide important natural pest control in a farm or garden setting. This guide and worksheet is designed to help you assess the presence of beneficial insects visiting flowers in a farmscape. Many predatory and parasitoid insects use flowers for food. With this guide, you will be able to count these flower-visiting beneficial insects in habitat adjacent to crops. Use this guide along with our foliage and soil scouting guides to gain a better understanding of the beneficial insect community on your farm.

WHAT YOU NEED	<ul style="list-style-type: none"> • Clipboard, worksheet copy, and pen/pencil • Timer • Measuring tape (100-ft. preferred, shorter ok) • Thermometer (or means to collect weather info) • Flags or stakes (to mark transect lines) • Hand lens (optional)
WHERE TO USE	Flowering habitats adjacent to crops (e.g. field borders, hedgerows) or within crops (e.g. cover crops, beetle banks, insectary strips). Scouted habitat areas should be located in full sun and protected from pesticide applications.
WHEN TO USE	Twice per year, May – August <ul style="list-style-type: none"> • Visits separated by at least 2 to 3 weeks • Visits between 10:00 AM and 3:00 PM Warm, sunny, and calm conditions <ul style="list-style-type: none"> • Temperatures >60 °F (15.5 °C) • Skies sunny to partly cloudy or bright but overcast



HOW TO SCOUT

You will be conducting visual observations of insects on flowers along two 100 ft.-length transect lines (scouting paths) for 7.5 minutes per transect line. A transect line may be divided into shorter lengths for small habitat areas (see worksheet for more info). Before scouting, assess habitat area(s) to ensure that flowers are present to scout.

- Lay out measuring tape to define your transect lines. Use flags to mark them if needed.
- Set your timer for 7.5 minutes and ready your clipboard and worksheet.
- Begin your timer and slowly walk the designated transect line, observing and recording foraging flower visitors. Focus on beneficial insects listed (see photos to right). Record only those beneficial insects observed within a 3 ft. distance from the transect line.
- Walk slowly while scouting for insects. Avoid sudden movements and visual interference from your shadow that may scare off insects.
- Pace all transect walks to end simultaneous with the timer. If timer ends before you complete the entire transect distance, quickly assess the remaining length.
- *Consistency is key for good scouting!* When scouting between transects and scouting dates, try to use the same methods as much as possible.

Acknowledgments: Guide created by Thelma Heidel-Baker, Sarah Foltz Jordan, Jarrod Fowler, and Eric Lee-Mader of The Xerces Society. Photos by Sarah Foltz Jordan (1, 2, 4) and Thelma Heidel-Baker (3, 5).

Adapted from Ward, K., D. Cariveau, E. May, M. Roswell, M. Vaughan, N. Williams, R. Winfree, R. Isaacs, and K. Gill. 2014. Streamlined bee monitoring protocol for assessing pollinator habitat. 16 pp. Portland, OR: The Xerces Society.



BENEFICIAL INSECTS FOR NATURAL PEST CONTROL:

Foliage Scouting

PURPOSE

Beneficial insects like lady beetles, damsel bugs, and lacewing larvae can provide important natural pest control in a farm or garden setting. This guide and worksheet is designed to help you assess the beneficial insects present - though not always readily visible - in plant vegetation. Many beneficial insects hunt and rest in plant vegetation. Using a simple tool called a beat sheet, you will be able to count the foliage-dwelling predatory insects in habitat adjacent to crops. Use this guide along with our flower and soil scouting guides to gain a better understanding of the beneficial insect community on your farm.

WHAT YOU NEED	<ul style="list-style-type: none"> • Beat sheet (blank sheet of paper) • Clipboard (for beat sheet and worksheet) and pen/pencil • Timer • Measuring tape (100-ft. preferred, shorter ok) • Flags or stakes (to mark transect lines) • Thermometer (or means to collect weather info) • Hand lens (optional)
WHERE TO USE	Undisturbed habitats adjacent to crops (e.g. field borders, hedgerows, woodland edges) or within crops (e.g. cover crops, beetle banks, insectary strips). Scouted habitat areas should be located in full sun and protected from pesticide applications.
WHEN TO USE	Twice per year, June-September <ul style="list-style-type: none"> • Visits separated by at least 2 to 3 weeks • Visits between 10:00 AM and 3:00 PM Warm and calm conditions <ul style="list-style-type: none"> • Temperatures >60 °F (15.5 °C) • Skies sunny to partly cloudy or bright but overcast

HOW TO SCOUT

You will use an insect beat sheet (see image, right) to observe beneficial insects on plant foliage along two 100 ft.-length transect lines (scouting paths). Observations will occur for 7.5 minutes along each 100 ft. transect. Smaller habitat areas may require a transect line to be divided into shorter lengths.

- Select the habitat area(s) you want to monitor, and lay out the measuring tape to define your transect lines. Use flags to mark the transects if needed.
- Set your timer for 7.5 minutes and ready your beat sheet and worksheet. Begin your timer and slowly move along the transect line, using the beat sheet as you go.
- To use the beat sheet, choose a handful of stems near the top of herbaceous plants or ends of branches on woody plants then carefully bend the plant material over the insect beat sheet. Smartly tap the plant material onto the beat sheet several times to shake insects out of the vegetation.
- Quickly and briefly observe insects on the sheet. Record observations of beneficial insects onto the worksheet. Use images to the right as a starting point for common beneficial insects you may observe.
- Only plants within 3 ft. of the transect line should be sampled.
- Try to pace all transect walks to end simultaneous with the timer. If timer ends before you complete a transect, quickly assess the remaining transect left.



Acknowledgments: Guide created by Thelma Heidel-Baker, Sarah Foltz Jordan, Jarrod Fowler, and Eric Lee-Mader of The Xerces Society. All photos taken by Thelma Heidel-Baker.

BENEFICIAL INSECTS FOR NATURAL PEST CONTROL:

Soil Scouting

PURPOSE

Beneficial insects like predatory ground beetles and spiders can provide important natural pest control in a farm or garden setting. This guide and worksheet is designed to help you assess the presence of predatory organisms that hunt and rest on soils. Using catch-and-release pitfall traps, you will be able to easily detect and count these soil-surface predators. Use this guide along with our flower and foliage scouting guides to gain a better understanding of the beneficial insect community on your farm.

WHAT YOU NEED	<ul style="list-style-type: none"> • Clipboard, worksheet copy, and pen/pencil • Small spade or trowel • Containers for pitfall traps (e.g., plastic drinking cups or large yogurt containers, ideally with lids) • Flags or stakes (to mark trap locations)
WHERE TO USE	Undisturbed habitats adjacent to crops (e.g. field borders, hedgerows, woodland edges) or within crops (e.g. cover crops, beetle banks, insectary strips). Scouted habitat areas should be located in full sun and protected from pesticide applications.
WHEN TO USE	Twice per year, July-September <ul style="list-style-type: none"> • Visits separated by at least 1 month • Deploy pitfall traps in early evening • Empty traps as soon as possible the next morning Warm conditions with daytime temperatures >60 °F (15.5 °C) Avoid sampling in rainy conditions that may flood traps

HOW TO SCOUT

You will be setting out catch-and-release pitfall traps (see photo, right) to observe and record soil-surface predators. The number of traps you will set out is dependent on the number of habitat areas you are interested in monitoring. We recommend one or two pitfall traps per habitat feature of interest, placed at least 50 ft. apart (further apart in larger habitat areas).

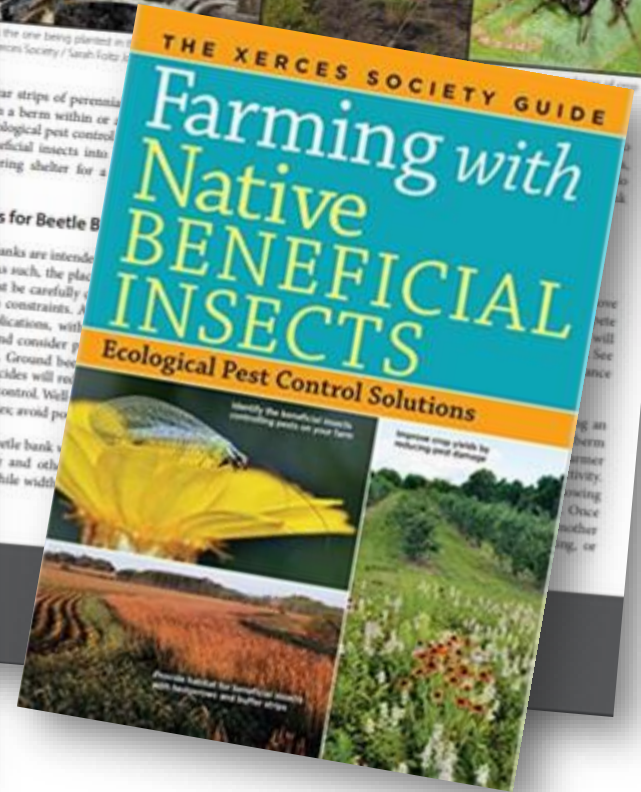
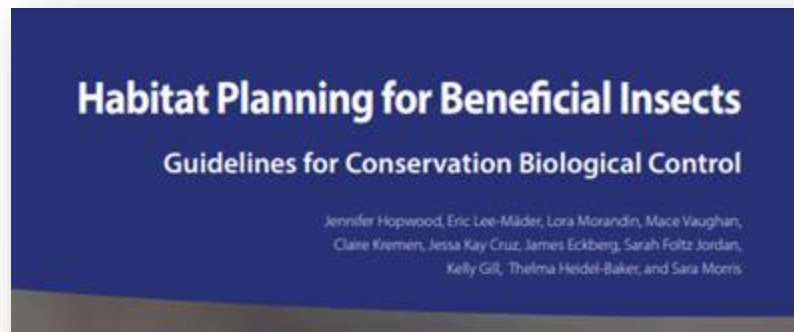
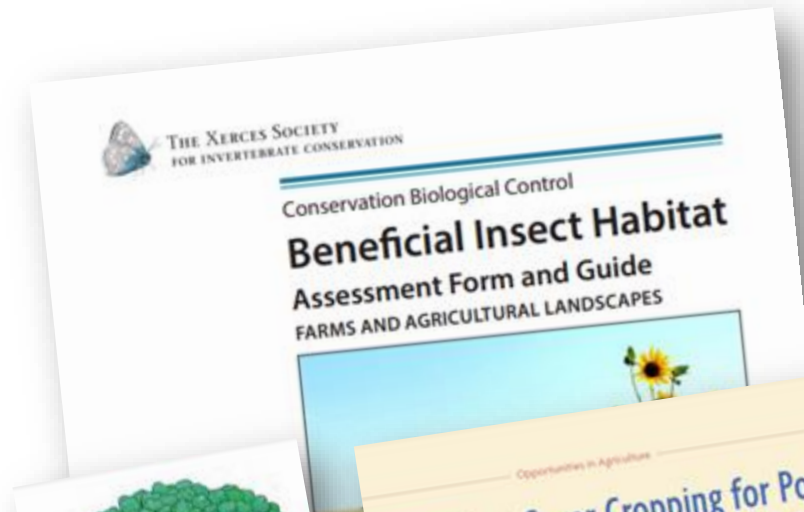
- **Select habitat area(s) you want to monitor.**
- **Deploy traps in late afternoon or early evening.** Dig an appropriate-sized hole in each location you wish to survey. Place container (lidded if possible) inside the hole so that its rim is level with the soil surface. (Using lid prevents dirt from spilling into bottom of the trap, and a dirt-free container makes trap evaluation easier the next morning.) Once the container is well-positioned, fill dirt in around the container and carefully remove the lid.
- **Use flags or stakes to mark trap locations.** Mark trap locations to ensure you can find traps again the next morning.
- **Revisit traps the following morning.** Use provided worksheet to record any predators in traps. Use photos at right for guidance on commonly caught predators.
- **Remove trap, or place lid on the trap (if reusing).** The stake/lagging should be left in place for the next survey date. Traps can be left in place, but must be covered to prevent further captures during the interim period. If farm practices (like mowing) prevent use of physical markers in some habitat areas, then a detailed description of trap locations is needed.



Acknowledgments: Guide created by Thelma Heidel-Baker, Sarah Foltz Jordan, Jarrod Fowler, and Eric Lee-Mader of The Xerces Society. All photos taken by Sarah Foltz Jordan.



Downloadable resources at xerces.org: Beneficial Insects



Downloadable resources at xerces.org: Monarch and Pollinator Habitat

Nesting & Overwintering Habitat

FOR POLLINATORS & OTHER BENEFICIAL INSECTS

STEPS TO CREATE NESTING & OVERWINTERING HABITAT:

- ✓ Save the debris
- ✓ Leave the leaves
- ✓ Restore the "perfect" lawn
- ✓ Remove snow you use much
- ✓ Save a small area "place" a log
- ✓ Build a brush pile
- ✓ Build a rock pile or rock wall
- ✓ Provide a safe water source
- ✓ Install a habitat sign

MILKWEEDS OF THE GREAT LAKES

MICHIGAN, OHIO, ILLINOIS, INDIANA & WISCONSIN

ROADSIDE HABITAT FOR MONARCHS

Milkweeds (*Asclepias* spp.) are herbaceous perennial plants named for their milky sap. These plants occur in a wide range of habitats, including intact natural communities on roadsides and highly disturbed roadsides. As required host plants for monarch (*Danaus plexippus*) caterpillars, milkweeds play an essential role in the butterfly's life cycle (see reverse). Vegetation management that allows milkweeds to persist can support monarchs. This guide can help you recognize the most common native species found on roadsides.

KEY

- MAX HEIGHT
- MONOTAXIC (SINGLE SPECIES)

Milkweeds in the Great Lakes Region (in alphabetical order):

- Asclepias incarnata*

Collecting and Using Your Own Wildflower Seed

To Expand Pollinator Habitat on Farms

James Eckberg, Jennifer Hopwood, and Eric Lee-Mäder

FARMING FOR BEES

Guidelines for Providing Native Bee Habitat on Farms

Mark Vaughan, Jennifer Hopwood, Eric Lee-Mäder, Matthew Shepherd, Claire Kremen, Anne Stone, and Scott Hoffman Black

MONARCH NECTAR PLANTS

Great Lakes

The Great Lakes region encompasses Wisconsin, Michigan, Ohio, north of western and central New York tallgrass prairies, sprawling wetlands. These communities are hotbeds of butterflies, including the monarch.

100 Plants to FEED THE MONARCH

Create a Healthy Habitat to Sustain North America's Most Beloved Butterfly

THE XERCES SOCIETY

THE XERCES SOCIETY GUIDE

Attracting NATIVE POLLINATORS

Protecting North America's Bees and Butterflies

Encourage pollination in your garden, orchard, or farm.

Identify the flower-visiting insects of your region.

Provide host plants and nesting sites for bees and butterflies.

Create a landscape that is beautiful, diverse, and pollinator-friendly.

FOREWORD BY DR. MARLA SPIVAK

NATIVE PLANTS FOR POLLINATORS & BENEFICIAL INSECTS

Great Lakes

LEFT—Monarch butterfly (*Danaus plexippus*) nectaring on *Liatris ligularis*. RIGHT—Pine green sweat bee (*Agrochloa purpur*) on a flower.

Plant Selection

These plants are attractive to a diversity of pollinators, providing pollen and nectar to bees, butterflies, flies, beetles, wasps, and moths. Some plants provide additional resources as caterpillar host plants or nesting sites and nesting materials for above-ground nesting bees. Many support specialist bees that require pollen from specific plants to survive and supplement beneficial insects that can help control pests of ornamental and crop plants. These plants are native to this region—determine if a species is native in your area at plants.usda.gov—and can be used to create or enhance pollinator habitat across rural and urban landscapes.

When purchasing plants, let your local garden center or nursery know you want plant material free of pesticides that may harm pollinators.

Resources

- Pollinator Conservation Resource: xerces.org/pollinator-resource-center
- Bring Back The Pollinators: BringBackthePollinators.org
- Reducing Pesticide Use & Impacts: xerces.org/pesticides

SCIENTIFIC NAME	COMMON NAME	BLOOM	LIFE	FORM	SUN	SOIL	ADDITIONAL DE
<i>Agastache scrophulariifolia</i>	Purple giant hyssop	Jul-Sep	P	☎	☀	D-M	☎
<i>Amelanchier laevis</i> *	Allegheny serviceberry	May-May	P	☎	☀	D-M	☎
<i>Asclepias incarnata</i>	Swamp milkweed	Jun-Aug	P	☎	☀	M-W	☎
<i>Asclepias syriaca</i>	Common milkweed	Jun-Aug	P	☎	☀	D-M	☎
<i>Asclepias tuberosa</i> *	Butterfly milkweed	Jun-Aug	P	☎	☀	D	☎
<i>Carex bebbii</i>	Bebb's sedge	Mar-Jun	P	☎	☀	W	☎
<i>Carex cristatella</i>	Crested sedge	Mar-Jun	P	☎	☀	M-W	☎

FARMING FOR POLLINATORS

Native Bees and Your Crops

Native bees are valuable crop pollinators. These wild bees help increase crop yields, and may serve as important insurance when honey bees are hard to come by.

There are simple and inexpensive things you can do to increase the number of native bees living on your land. Any work you do on behalf of pollinators will support other beneficial insects and wildlife. In addition, improvements to pollinator habitat may be eligible for financial support from government programs.

Inside you'll find more information, along with a visual guide to identifying and enhancing habitat for native bees on your farm.

MONARCH CONSERVATION

MONARCH CONSERVATION

Guide to Saving America's Butterfly

Monarch, the beloved butterfly, is disappearing from communities across North America, suffering from habitat loss, loss of pesticide use. Changing the conservation action from gardeners, farmers, policy-makers.

Reverse the monarch's decline by planting milkweed, the caterpillars' host plant, and other native flowers for nectar, habitat for monarchs, and forested groves in wild.

If you find more information about how to protect the monarch, visit www.monarchbutterfly.org for a printable migration.

CULTIVANDO PARA LOS POLINIZADORES

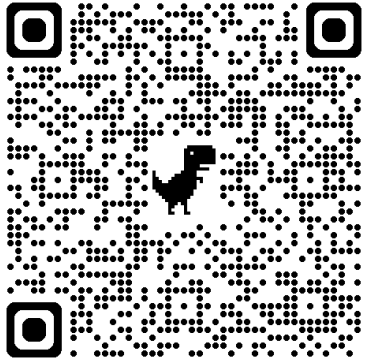
Las Abejas Nativas y Sus Cosechas

Las abejas nativas son polinizadoras muy valiosas de los cultivos. Estas abejas silvestres ayudan a aumentar el rendimiento de los cultivos, y pueden llegar a ser sumamente importantes en la ausencia de abejas domesticadas.

Hay cosas sencillas y baratas que usted puede hacer para aumentar el número de abejas nativas en su terreno. Cualquier trabajo que usted haga para ayudar a los polinizadores apoyará a otros insectos beneficiosos y a los animales silvestres. Además, las mejoras al ambiente de los polinizadores pueden ayudarle a calificar para apoyo financiero de programas del gobierno.

Dentro de este folleto, hay más información junto con una guía visual, para identificar y mejorar el ambiente de las abejas nativas en su finca.

New-ish Regional Pollinator and Beneficial Insect Plant Lists!



SCIENTIFIC NAME	COMMON NAME	BLOOM	LIFE	FORM	SUN	SOIL	ADDITIONAL DETAILS ⓘ
<i>Agastache scrophulariifolia</i>	Purple giant hyssop	JUL-SEP	P			D-M	
<i>Amelanchier laevis</i>★	Allegheny serviceberry	MAR-MAY	P			D-M	
<i>Asclepias incarnata</i>	Swamp milkweed	JUN-AUG	P			M-W	
<i>Asclepias syriaca</i>	Common milkweed	JUN-AUG	P			D-M	
<i>Asclepias tuberosa</i>★	Butterfly milkweed	JUN-AUG	P			D	
<i>Carex bebbii</i>	Bebb's sedge	MAY-JUN	P			W	
<i>Carex cristatella</i>	Crested sedge	MAY-JUN	P			M-W	
<i>Carex scoparia</i>	Broom sedge	MAY-JUN	P			M-W	
<i>Carex vulpinoidea</i>	Fox sedge	APR-MAY	P			M-W	
<i>Ceanothus americanus</i>	New Jersey tea	JUN-JUL	P			D-M	
<i>Cirsium discolor</i>	Field thistle	AUG-OCT	B / P			M	
<i>Coreopsis lanceolata</i>	Lanceleaf tickseed	APR-JUN	P			D-M	

KEY	LIFE: <u>A</u> nnual	SOIL: <u>D</u> ry	★ Staff favorite	FORM: Forb	Sedge	Vine	SUN: Full sun	ADD'L. DETAILS: Larval host (butterfly, moth)	Bumblebee plant	Nest materials
	<u>B</u> iennial	<u>M</u> oist		Cactus	Shrub		Partial sun	Supports specialist bee	Nest thatch	Deer resistant
	<u>P</u> erennial	<u>W</u> et		Grass	Tree		Full shade	Attracts beneficial insects	Nest site	

Downloadable resources at xerces.org: Pesticide Guidance

Making Decisions About Neonicotinoid Seed Treatment Use in Iowa
Scouting & Field History Reports for Early Season Corn and Soybean IPM

XERCES SOCIETY for Invertebrate Conservation
USDA United States Department of Agriculture
Natural Resources Conservation Service

How Neonicotinoids Can Kill Bees
The Science Behind the Role These Insecticides Play in Harming Bees
2nd Edition, Revised & Expanded

XERCES SOCIETY for Invertebrate Conservation

PROTECTING AQUATIC ECOSYSTEMS
Insecticide Seed Treatments Threaten Midwestern Waterways

XERCES SOCIETY for Invertebrate Conservation

How Common are Insecticide Seed Treatments in the Midwest?

XERCES SOCIETY for Invertebrate Conservation

Organic Pesticides
MINIMIZING RISKS TO POLLINATORS AND BENEFICIAL INSECTS

XERCES SOCIETY for Invertebrate Conservation

CREATING AND MAINTAINING HEALTHY POLLINATOR HABITAT
Guidance to Protect Habitat from Pesticide Contamination

This guidance document was designed to help growers, land managers, and others safeguard pollinator habitat from harmful pesticide contamination. It includes information on selecting habitat sites, as well as ways to maintain clean pollinator habitat.

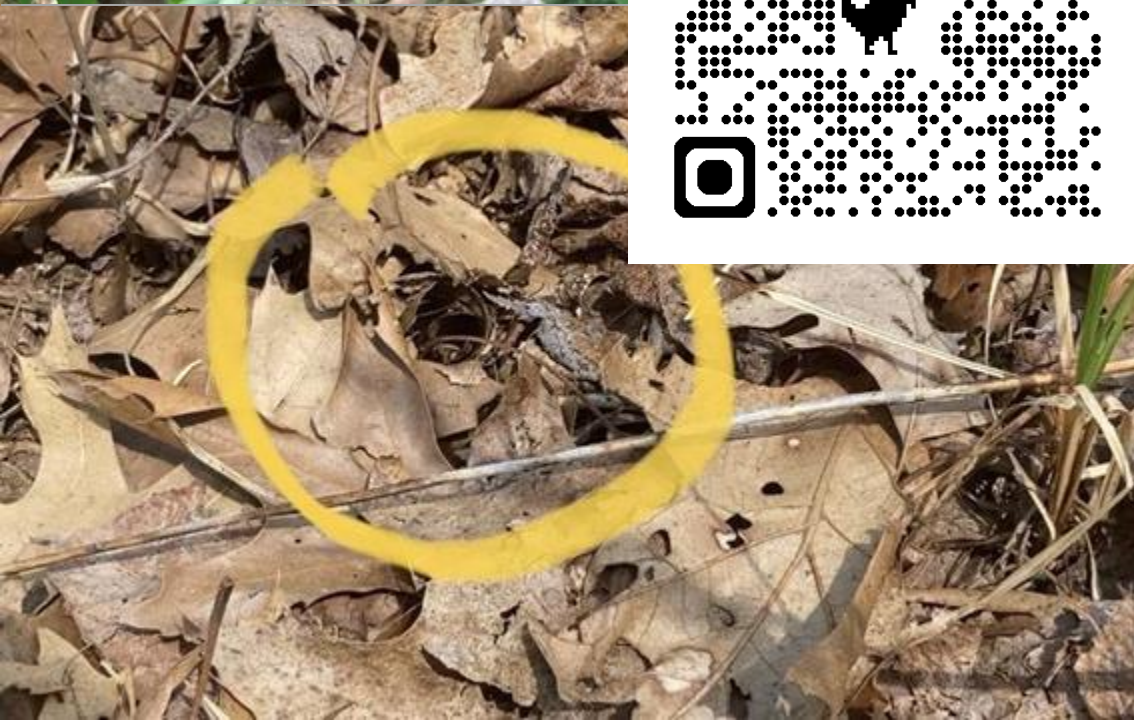
With growing interest in installing pollinator habitat, it is very important to manage the habitat and surrounding areas to reduce pesticide contamination. This can be achieved by instituting a combination of measures such as incorporating non-chemical options into pest management plans, eliminating prophylactic and other pesticide uses, and increasing risk mitigation efforts that limit movement of pesticides into habitat. If pesticide risks cannot be managed, habitat should not be installed.

Priority Pesticide Concerns for Pollinators

While a wide range of pesticides could pose risk to pollinators, priority pesticide concerns include:

- **Insecticides.** In general, insecticides are more acutely toxic to insect pollinators than other pesticides. Insecticides...

Written by Kaitie Cuda, Hillary Sandifer, Thelma Heston Baker, Anna Kay Choi, Scott Hoffman-Buck, Eric Lee Miller, Kara Vaughan, and Jennifer Hopwood
www.xerces.org



Get Involved: Community Science

1. iNaturalist:
 - *Megachile* bee leaf cuts (leafcutter bees)
 - Project GNBees (ground nesting bees)
2. Monarch Butterflies:
 - Xerces Monarch Nectar Plant Database
 - Journey North: Monarch Nectar & Plant Watch
 - International Monarch Blitz
3. Xerces Atlas Programs:
 - Firefly Atlas
 - Bumble Bee Atlas & Watch
4. Xerces Insect Scouting & Monitoring Guides
 - Beneficial Insect
 - Native Bee
 - Soil Inverts

Photos: Xerces / Stefanie Steele

Thank You



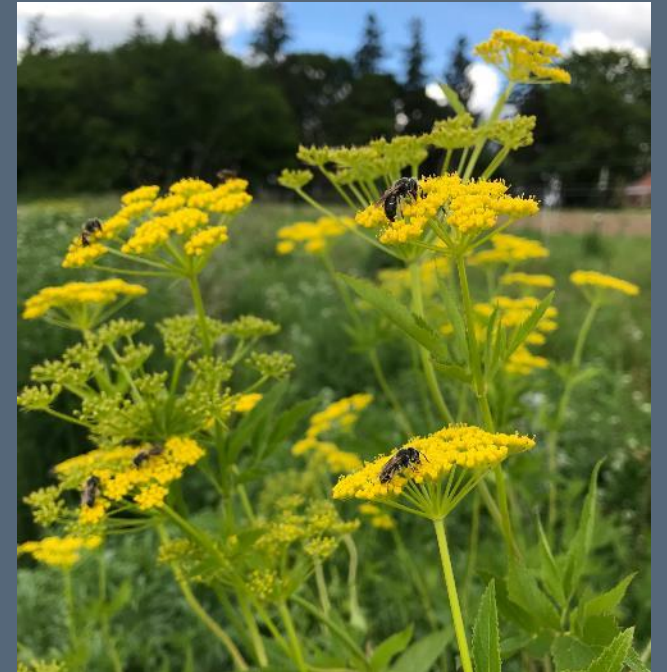
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Feel free to follow up with us!

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Thank You



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ADDITIONAL SLIDES

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Bee (“vegetarian wasps”) vs. Wasp

Bees: hairier; pollen carrying structure, thicker body



Wasps: few hairs; no pollen carrying structure – spiny legs; wings may fold lengthways; thin waist



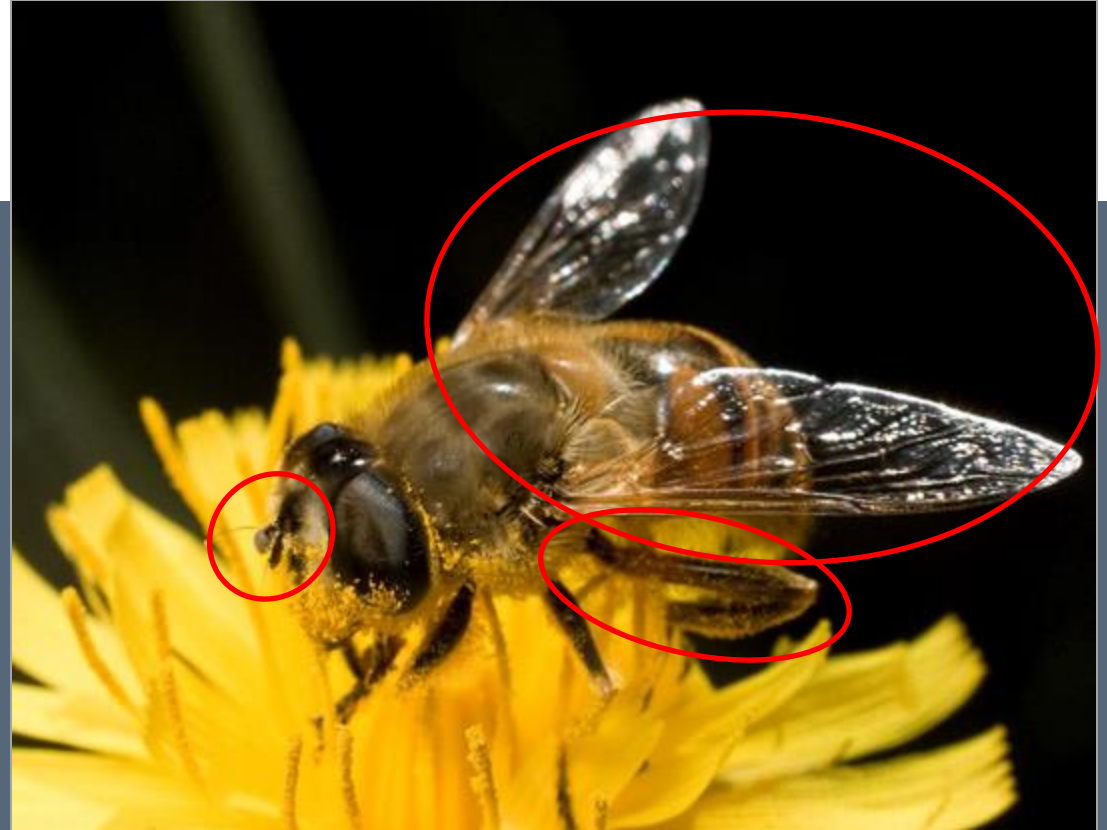
Photos: Cole Cheng, Flickr; Jason King, Flickr; Whitney Cranshaw, CSU, Bugwood.org

Bee vs. Fly

Bee: long, elbowed antennae; eyes on side of head; pollen carrying structure; two pairs of wings, hairy



Fly: tiny antenna; large eyes; no pollen carrying structure; one pair of wings, slender legs



Photos: Bryan E. Reynolds; Sean McCann

Bee Nests: Plants used by leaf cutter bees (*Megachile*) for cell partitioning

- Ash (*Fraxinus* spp.)
- Juneberry (*Amelanchier* spp.)
- Native honeysuckle (*Lonicera canadensis*)
- Basswood (*Tilia americana*)
- Maples (*Acer* spp.)
- Canada ticktrefoil (*Desmodium canadense*)
- Evening primrose (*Oenothera biennis*)
- Dogwood (*Cornus* spp.)
- Roses (*Rosa* spp.)
- Brambles (*Rubus* spp.)
- Wild Strawberry (*Fragaria*)
- Sumac (*Rhus* spp.)



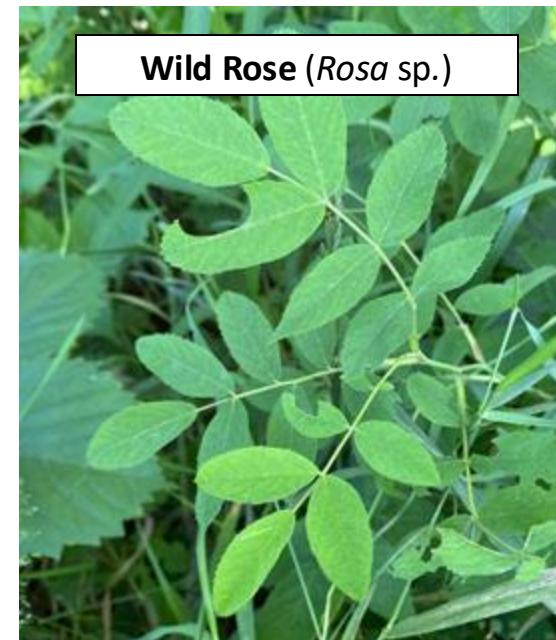
Dwarf raspberry (*Rubus pubescens*)



Black Ash (*Fraxinus nigra*)



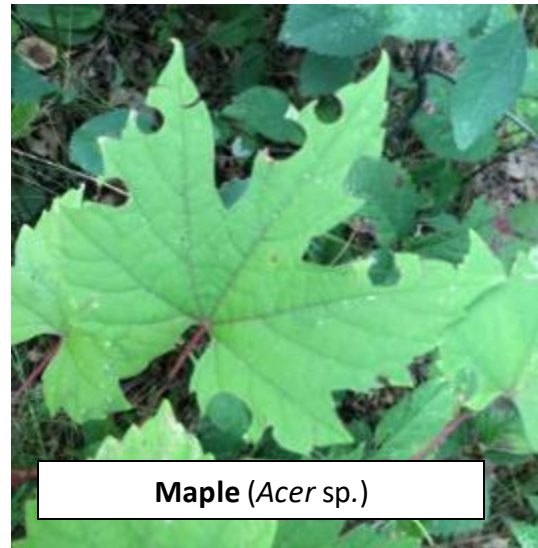
Juneberry (*Amelanchier* sp.)



Wild Rose (*Rosa* sp.)

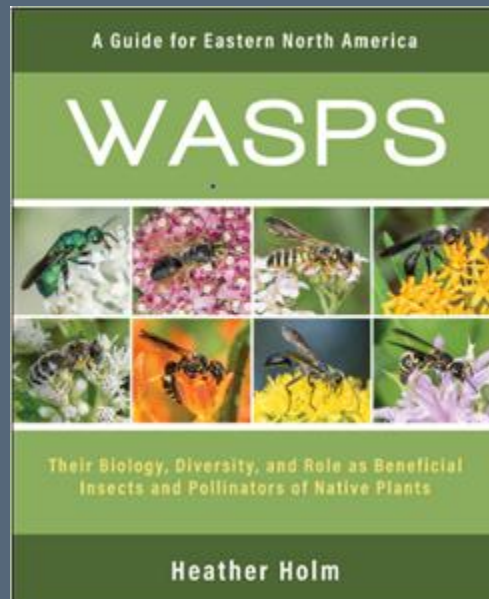
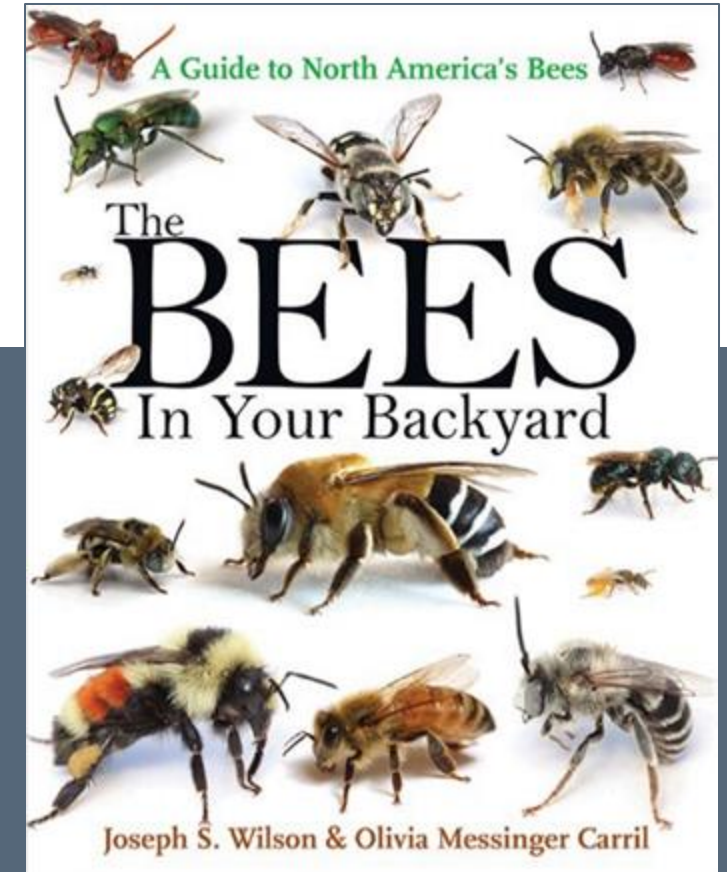
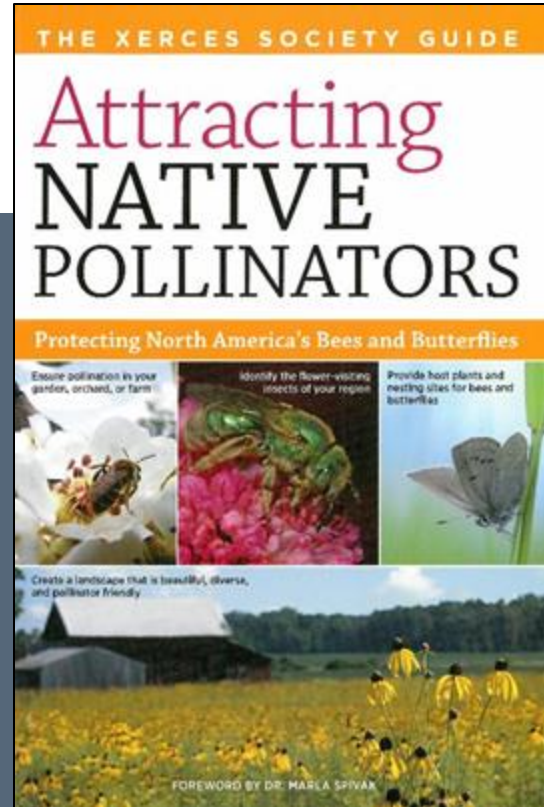
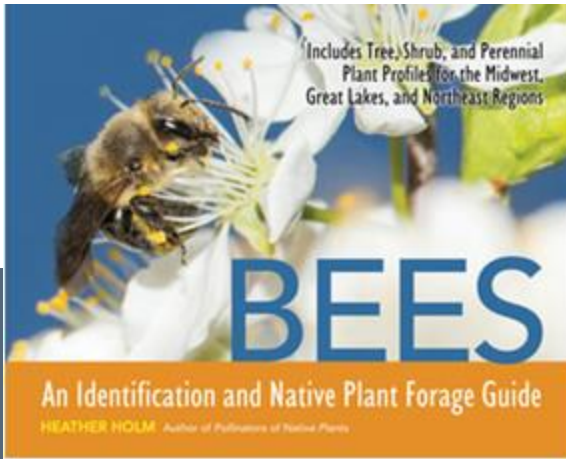


Native honeysuckle
(*Lonicera canadensis*)



Maple (*Acer* sp.)

Books to Help You Understand Bees



Other Resources to Help ID Bees

Michigan Pollinator Initiative: Native Bee Habitat

<https://pollinators.msu.edu/resources/pollinator-planting/native-bee-habitat/>

Bumble Bee Watch

<https://www.bumblebeewatch.org/>

iNaturalist

<https://www.inaturalist.org/>

Discover Life

<https://www.discoverlife.org/mp/20q?search=Apoidea>

BugGuide

<https://bugguide.net/node/view/59>

Exotic Bee ID

<http://idtools.org/id/bees/exotic/>

Discussion Questions

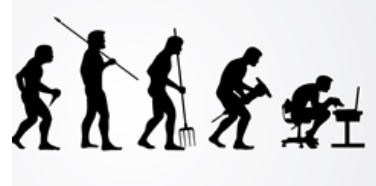
1. What challenges/roadblocks do you face establishing habitat?
2. For those who have established habitat, what did you wish you knew at the beginning or would have done differently?
3. What resources do you use to create pollinator habitat? How could resources improve to better help you?
4. How has your community responded to your pollinator habitats? How do you educate them about the habitat?
5. What about your habitat brings you the most joy or benefits to your farm/garden/community?



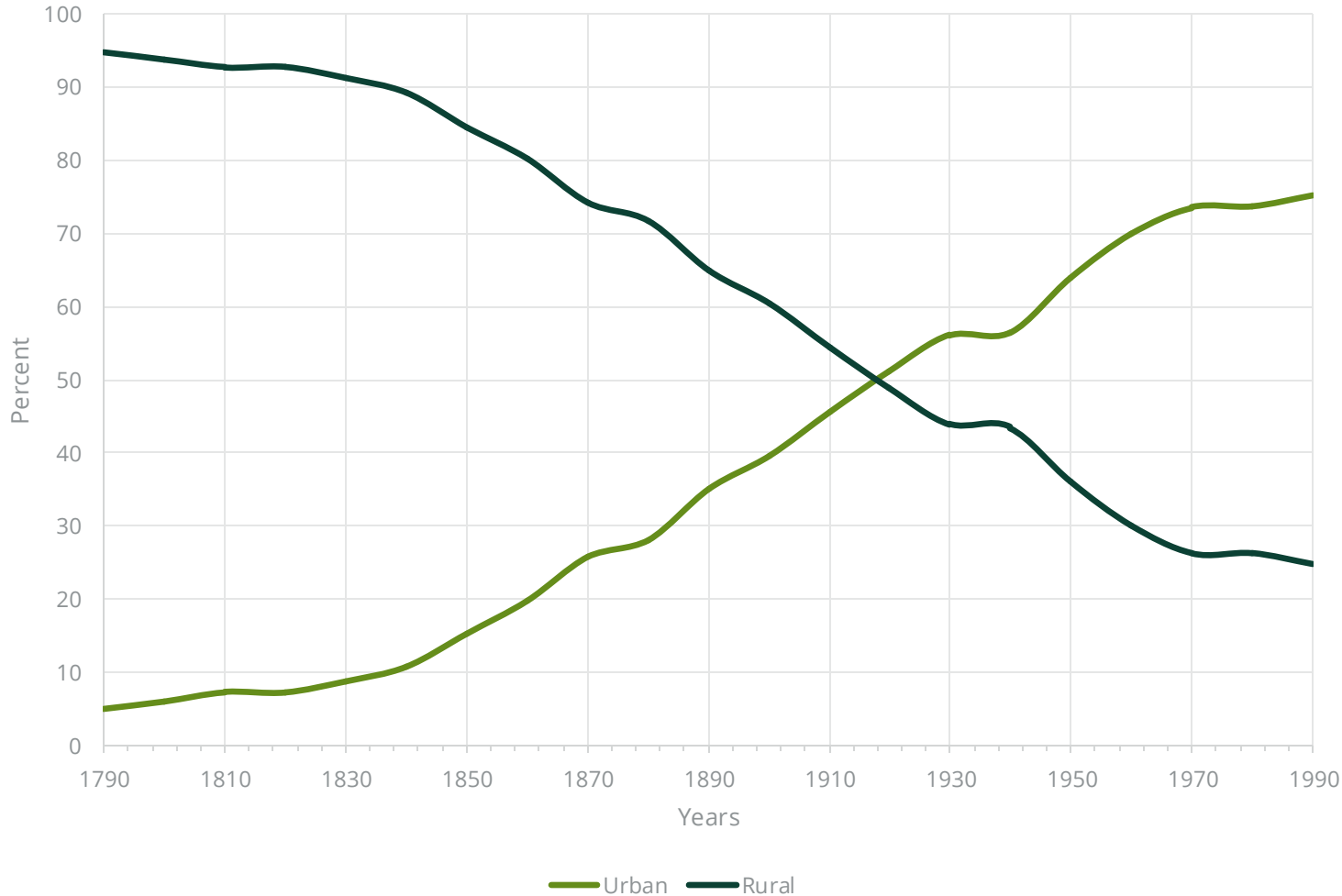
Urban Soil Management

Edwin Muñiz – Soil Scientist

Transformation United States Rural to Urban Population



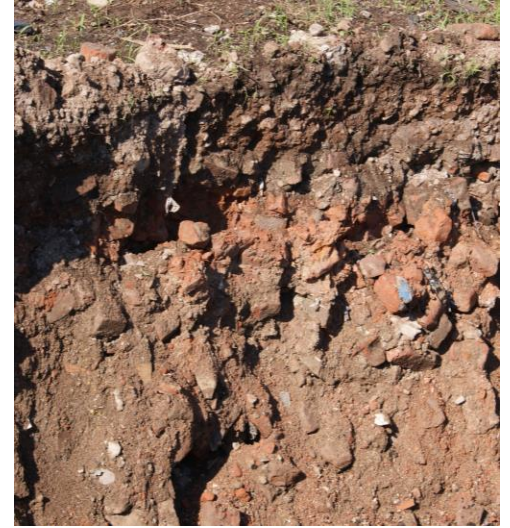
Years	Percent	
	Urban	Rural
1990	75.2	24.8
1980	73.7	26.3
1970	73.6	26.3
1960	69.9	30.1
1950	64.0	36.0
1940	56.5	43.5
1930	56.1	43.9
1920	51.2	48.8
1910	45.6	54.4
1900	39.6	60.4
1890	35.1	64.9
1880	28.2	71.8
1870	25.7	74.3
1860	19.8	80.2
1850	15.4	84.6
1840	10.8	89.2
1830	8.8	91.2
1820	7.2	92.8
1810	7.3	92.7
1800	6.1	93.9
1790	5.1	94.9



About, 84 % of the population of the U.S.A. lives in urban areas (University of Michigan, 2019)

What are Urban Soils?

- Soil material formed from human-altered or human-transported material
- Contain
 - Natural coarse fragments
 - Construction debris
 - Metal
 - Glass
 - Other
- Activities not associated with agriculture



Type Soil Material - Artifictic



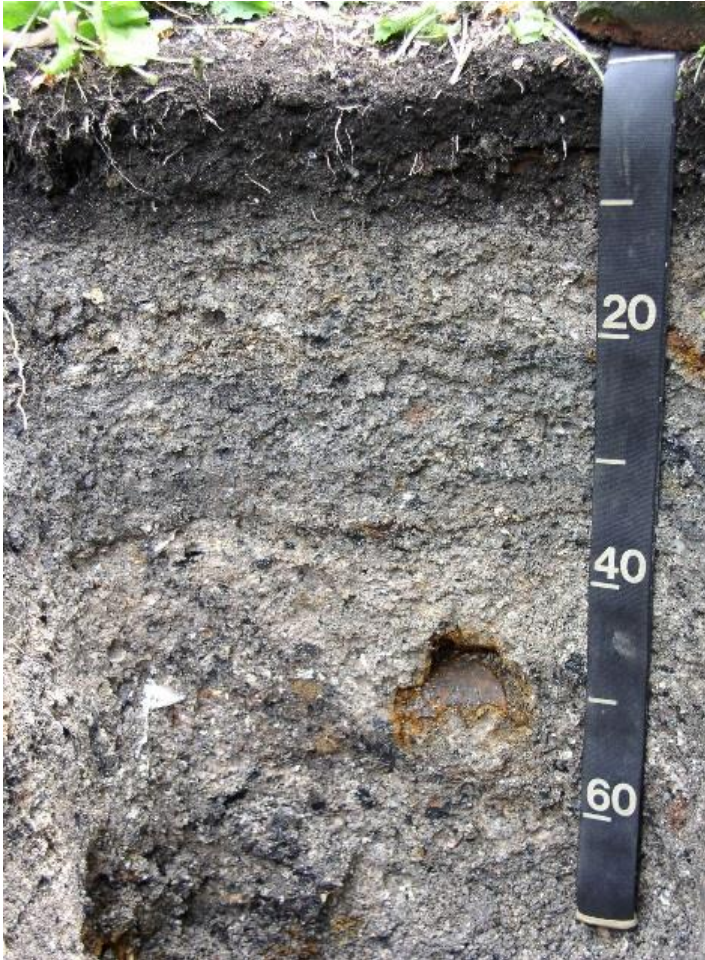
Laguardia



Secaucus

- Soil material consisting of
 - Natural coarse fragment
 - Concrete
 - Bricks
 - Metal
 - Glass
 - Asphalt

Type Soil Material - Combustic



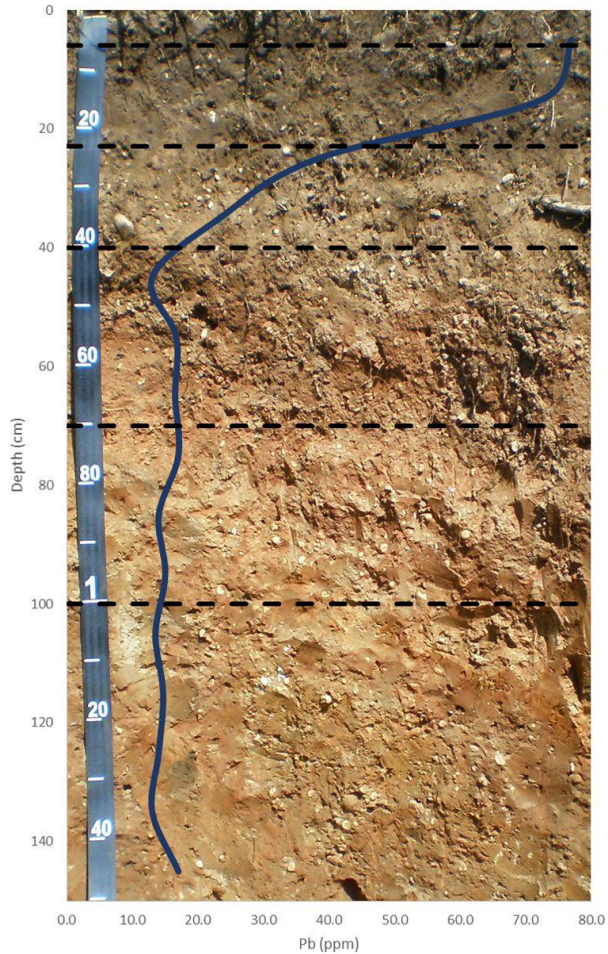
Mosholu



Rikers

- Soil material consisting of
 - Coal slag
 - Coal ash
 - Fly ash

Atmospheric deposition and Dredgic



Bigapple

Sediment material from dredging are used as fill in low-lying urban areas. Depending on the dredge material salt may be moved onto a site. Other problem with dredge material may include compaction of a subsurface layer.

Scheyer, J.M., and K.W. Hipple. 2005. Urban Soil Primer. United States Department of Agriculture, Natural Resources Conservation Service, National Soil Survey Center, Lincoln, Nebraska (<http://soils.usda.gov/use>).



Resources Concern with Urban Soils



Urban Soils Resources Concern

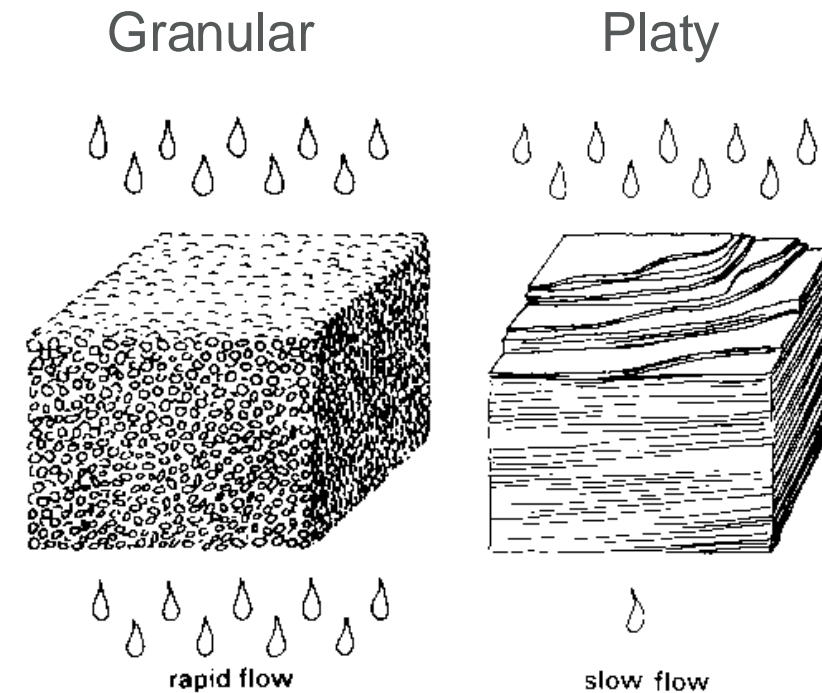
- Soil erosion
 - Soil transport by rainfall, melting snow, irrigation and wind.
- Subsidence
 - Loss of volume and depth of organic soils due to oxidation caused by above normal microbial.
- Organic matter depletion
 - Management-induced depletion of any or all pools of soil organic matter resulting in limited soil function and processes that support plant productivity, biological activity and water and nutrient cycling.

Urban Soils Resources Concern

- Soil organism habitat loss or degradation
 - Quantity, quality, diversity or connectivity of food, cover, space, shelter and/or water is inadequate to meet requirements of beneficial soil organisms.
- Compaction
 - Management-induced soil compaction at any level throughout the soil profile resulting in reduced plant productivity, biological activity, infiltration and aeration.

Urban Soils Resources Concern

- Aggregate instability
 - Management-induced degradation of water stable soil aggregates resulting in destabilized soil carbon; surface crusting; reduced water infiltration, water holding capacity, and aeration; depressed resilience to extreme weather; increased ponding and flooding; increased soil erosion and plant stress; and reduced habitat and soil biological activity.

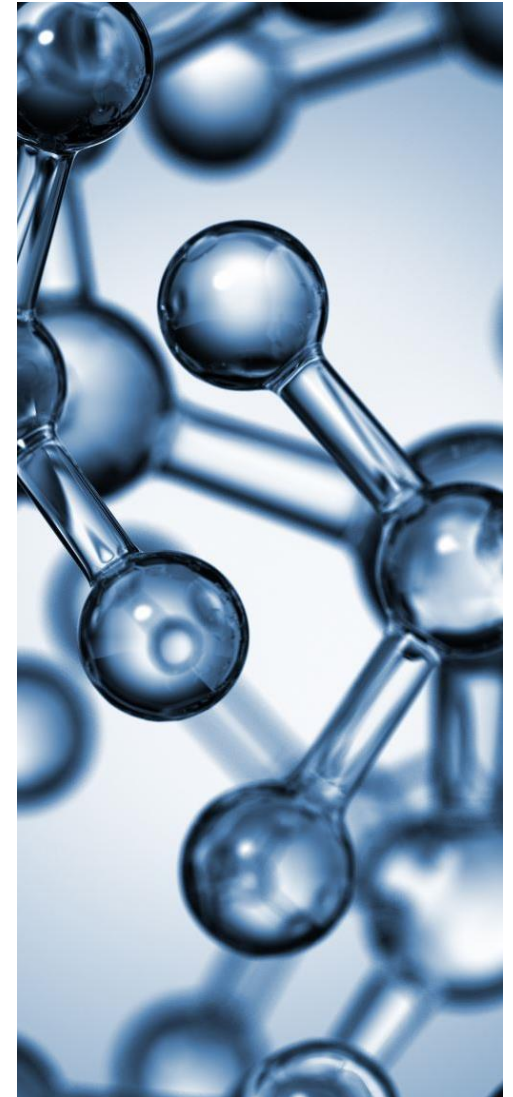


Urban Soils Resources Concern

- Seasonal high-water table
 - Water table levels can change depending on a number of factors including precipitation rates, soil permeability, drainage patterns, and more.
- Plant productivity and health
 - Improper fertility, management or plants not adapted to site negatively impact plant productivity, vigor and/or quality
- Concentrated salts or other chemicals
 - Concentration of salts or concentrations of other chemicals impacting productivity, populations of beneficial organisms or limiting desired use.

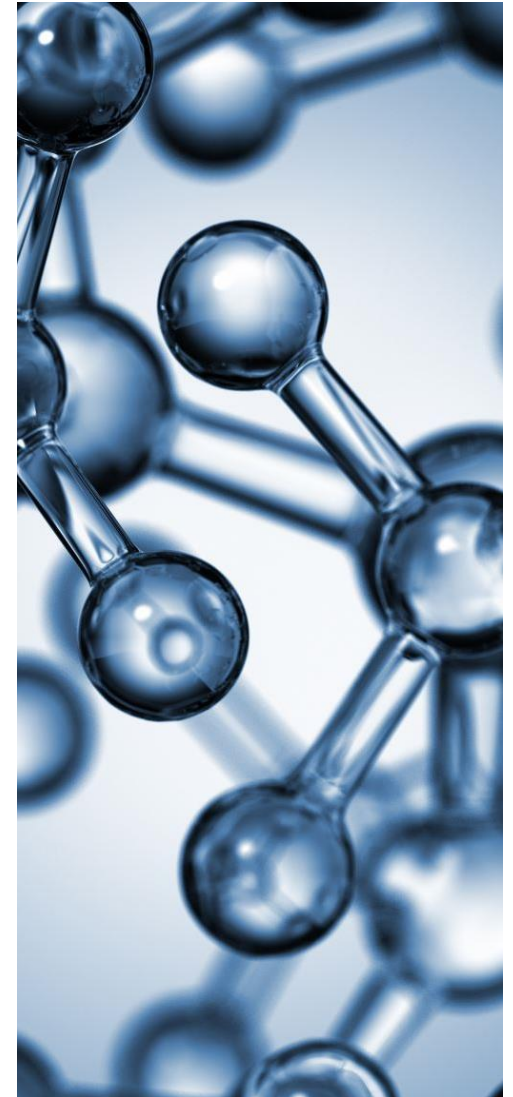
Sources of trace elements in soil

- Natural source (parent material) – low concentrations most of the times
- Mining
- Manufacturing and synthetic products
 - Pesticides
 - Fertilizers
 - Paints
 - Batteries
 - Industrial waste
 - Leaded gasoline



Sources of trace elements in soil

- Land application
 - Industrial or domestic sludge
 - Animal manure
- Coal combustion
- Atmospheric deposition



Resource concerns example

- Organic matter depletion
- Concentration of salts or other chemicals
- Soil organism habitat or degradation
- Aggregate instability
- Moisture management
- Surface water depletion
- Emission of particulate matter
- Plant productivity and health





Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Soil Management and Best Management Practices in Urban Agriculture



Urban Soil Management

- Increasing the soil pH to 6.5 or higher.
 - Raising pH reduce lead (cation, positive charge) availability but at the same time increases arsenic (anion, negative charge) availability.
- Reduce soil saturation
 - Improves soil aeration and will allow metals to oxidize, making them less soluble.

Urban Soil Management

- Applying phosphate
 - Heavy phosphate applications reduce the availability of cationic elements like lead but have the opposite effect on anionic elements like arsenic.
- Plant selection
 - Plants could translocate larger quantities of metals to their leaves than to their fruits or seeds. The greatest risk of food chain contamination is in leafy vegetables like lettuce or spinach.

Best management practices (UCONN Factsheet)

- Gardens should be located away from older, painted structures and heavily traveled roads.
- Give planting preference to fruiting crops like tomatoes, squash and peppers on soils with elevated lead levels.
- Remove outside leaves of green leafy vegetables, peel root crops, and wash all vegetables thoroughly to remove soil particles.

Best management practices (UCONN Factsheet)

- Maintain the soil pH at 6.5 to 7.0 by applying limestone at recommended rates to reduce the availability of lead uptake by plants.
- Maintain soil organic matter levels between 5 and 10 percent. Organic particles will bind with lead making it less available for plant uptake.
- Maintain soil phosphorus levels by applying the recommended amounts of fertilizer to garden plots.

Best management practices (UCONN Factsheet)

- Phosphorus can reduce lead uptake by plants.
- Minimize dust and exposure to bare soil through use of mulches.

Example conservation practices Urban Ag

- Cover crop
- Mulching
- Low tunnel



Example conservation practices Urban Ag

- Solar energy
- Composting facility





Source of Soils Information

Web Soil Survey



Web Soil Survey Urban Areas

The screenshot shows the USDA Web Soil Survey Urban Areas interface. At the top, there is a navigation bar with links: Contact Us, Subscribe, Archived Soil Surveys, Soil Survey Status, Glossary, Preferences, Link, Logout, Help. Below this is a secondary navigation bar with buttons: Area of Interest (AOI), Soil Map, Soil Data Explorer, Download Soils Data, Shopping Cart (Free). The main content area is divided into a sidebar and a main map area. The sidebar contains sections: Search, Area of Interest (with an 'Import AOI' button), and Quick Navigation (with buttons for Address, State and County, Soil Survey Area, Latitude and Longitude or Current Location, PLSS (Section, Township, Range), Bureau of Land Management, Department of Defense, Forest Service, National Park Service, and Hydrologic Unit). The main map area is titled 'Area of Interest Interactive Map' and shows a map of the contiguous United States with state abbreviations. The map includes a legend, a 'View Extent' dropdown set to 'Contiguous U.S.', and a scale indicator.

USDA United States Department of Agriculture
Natural Resources Conservation Service

Web Soil Survey

Contact Us | Subscribe | Archived Soil Surveys | Soil Survey Status | Glossary | Preferences | Link | Logout | Help

Area of Interest (AOI) | **Soil Map** | Soil Data Explorer | Download Soils Data | Shopping Cart (Free)

Printable Version | Add to Shopping Cart

Search

Map Unit Legend

Wayne County, Michigan (MI163)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BntuaB	Blount-Urban land complex, 0 to 4 percent slopes	32.0	1.9%
MidaaA	Midtown gravelly-artifactual sandy loam, 0 to 2 percent slopes	79.2	4.7%
MiduaB	Midtown-Urban land complex, 0 to 4 percent slopes	176.1	10.5%
RvfaaB	Riverfront sandy loam, 0 to 4 percent slopes	5.1	0.3%
RvfubB	Riverfront-	69.6	4.1%

Soil Map

Scale (not to scale)

USDA United States Department of Agriculture
Natural Resources Conservation Service

Contact Us | Subscribe | Archived Soil Surveys

Area of Interest (AOI) | Soil Map

Search

Map Unit Legend

Wayne County, Michigan (MI163)

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RvfubB	Riverfront-	69.6	4.1%

FOIA | Accessibility St

Printable Version

Report – Map Unit Description

Wayne County, Michigan

MidaaA—Midtown gravelly-artifactual sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2tx7g
Elevation: 570 to 680 feet
Mean annual precipitation: 28 to 38 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 135 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Midtown and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midtown Setting

Landform: Wave-worked till plains, water-lain moraines
Down-slope shape: Linear
Across-slope shape: Convex, concave, linear
Parent material: Loamy human-transported material over loamy lodgment till

Typical profile

^Au - 0 to 8 inches: gravelly-artifactual sandy loam
^Cu - 8 to 37 inches: very gravelly-artifactual clay loam
BCgb - 37 to 45 inches: clay loam
C - 45 to 55 inches: clay loam
Cd - 55 to 80 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 38 to 79 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: About 20 to 61 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline (0.1 to 1.5 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Ecological site: F099XY007MI - Lake Plain Flats
Hydric soil rating: No

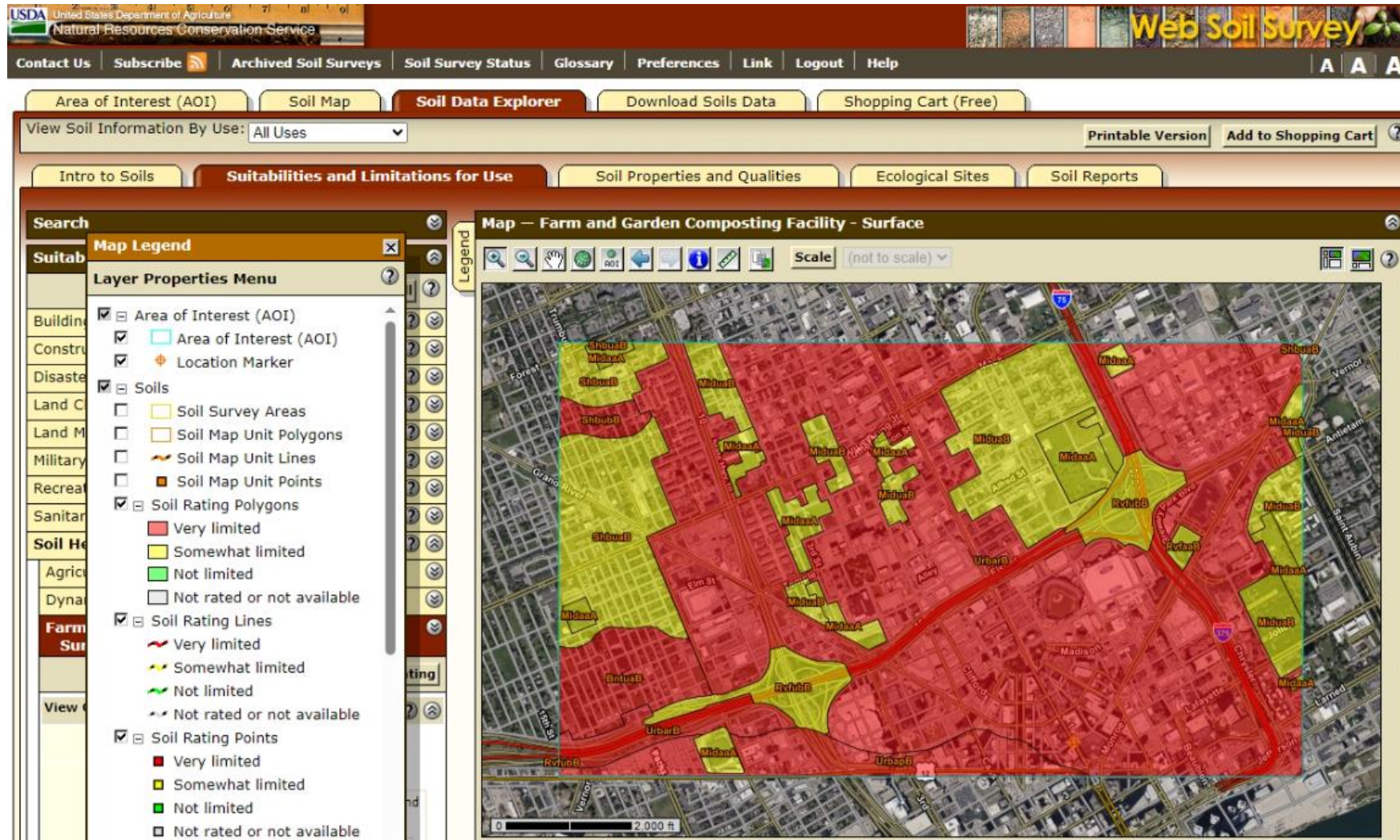
Web Soil Survey

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Ag.gov | White House

Farm and Garden Composting Facility

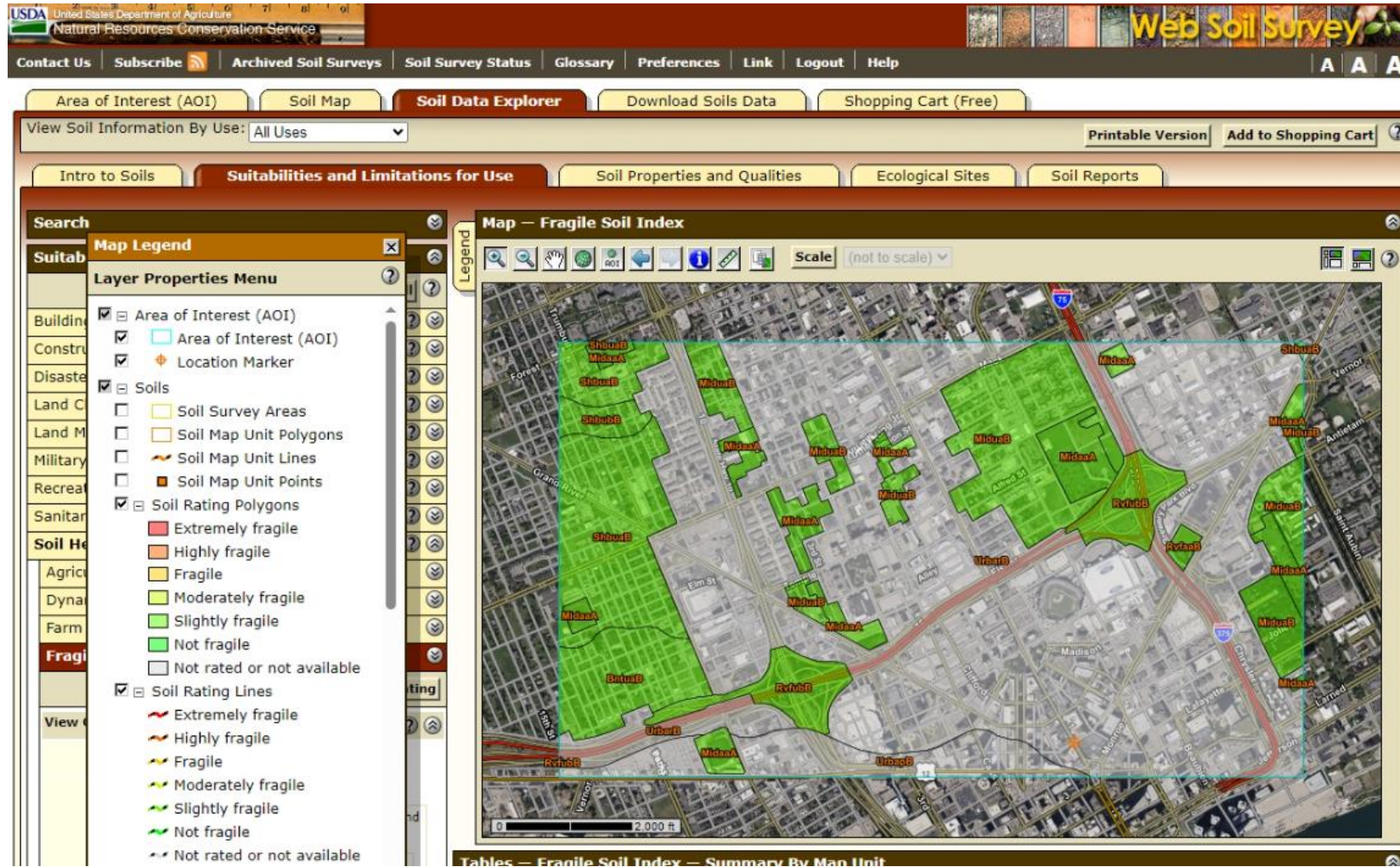
The ratings are based on the soil properties that affect trafficability; decomposition and microorganisms; construction and maintenance of the site; and public health.



Fragile Soil Index

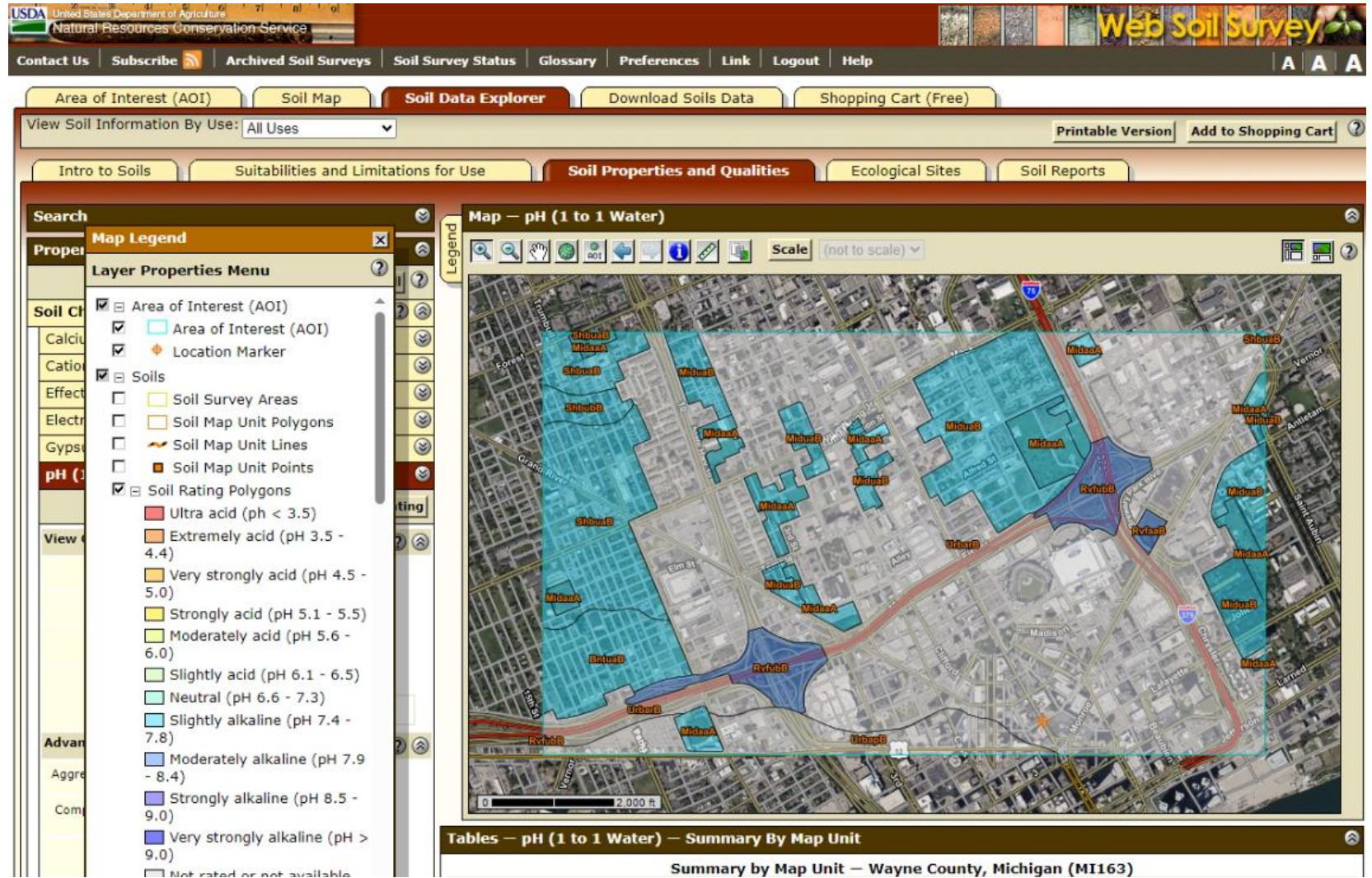
Soils can be rated based on their susceptibility to degradation in the "Fragile Soil Index" interpretation. Fragile soils are those that are most vulnerable to degradation.

Slightly Fragile: These soils have a high potential to resist degradation and be resilient.



Soil Chemistry pH Soil Surface

It is important in selecting crops and other plants, in evaluating soil amendments for fertility.

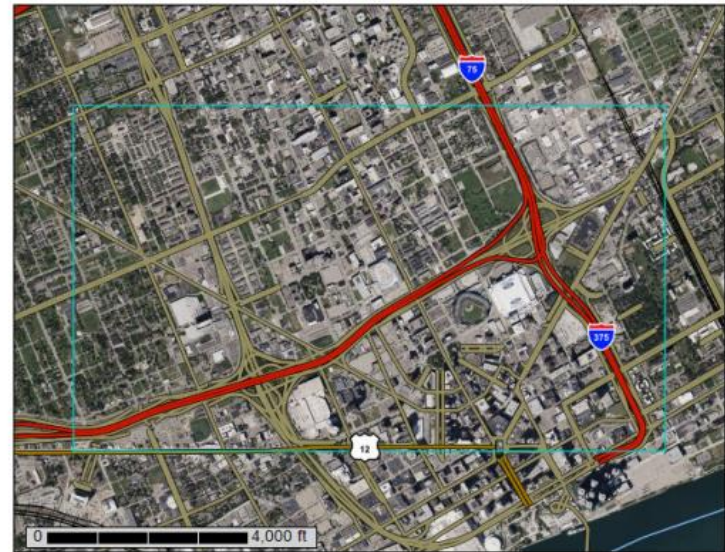


Custom Soil Survey Report



A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Wayne County, Michigan



July 10, 2024

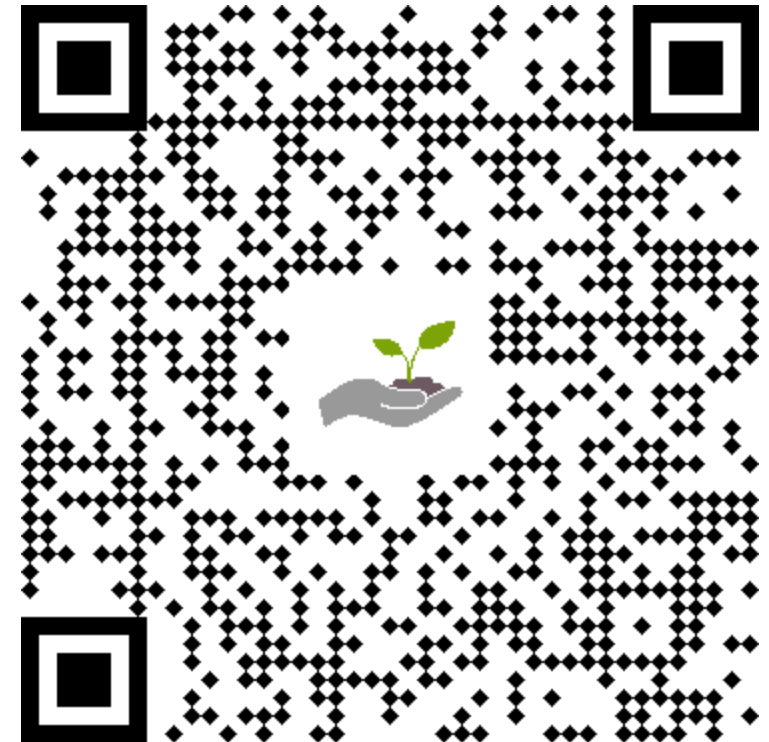
Questions



Connect with us!

- Scan the QR code and visit our website at soils.usda.gov
- Follow us on X, formerly known as Twitter, @USDA_NRCS_SPSD
- Check out our YouTube channel @nrccsoilandplantscience

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