Habitat for Pollinators:

Current Efforts in Conservation and Restoration

Logan Rowe,
Department of Entomology
Michigan State University

SARE
Sustainable Agriculture Research & Education

Project GREEEN

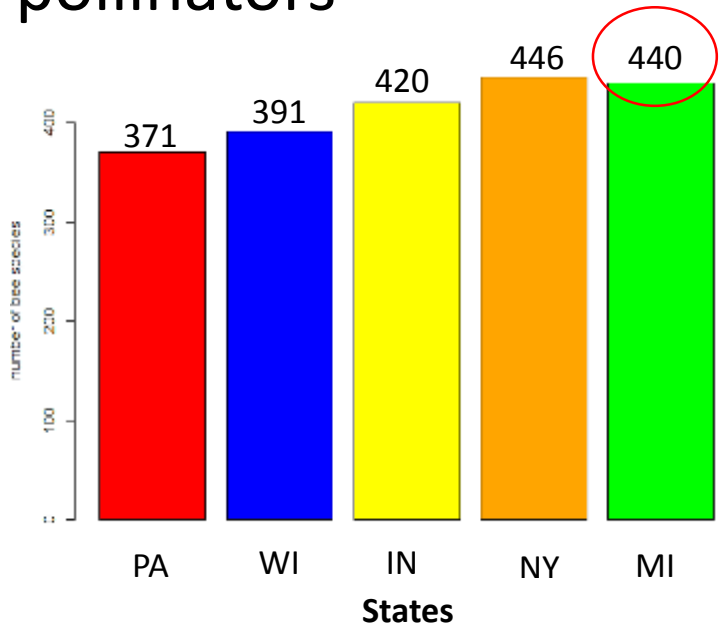
MICHIGAN STATE UNIVERSITY
ENTOMOLOGY

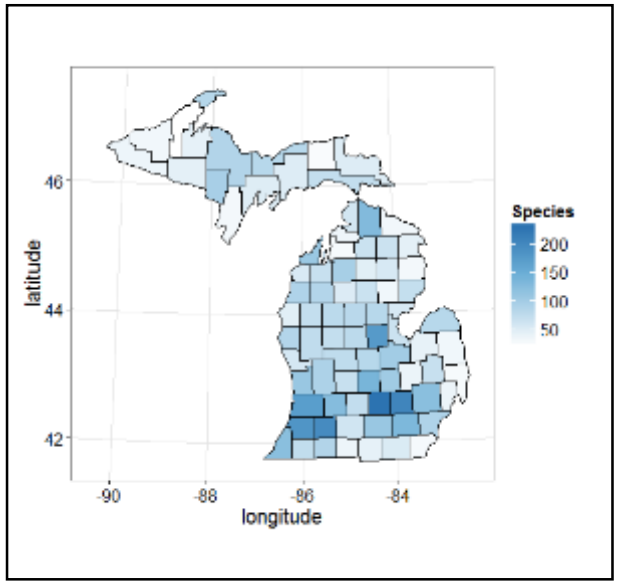
Overview

- Bee diversity
- What do we know about how habitats influence pollinators?
  - Long Leaf Pine Project
  - On Farm habitat for Pollinators
- Plant selection to support pollinators
- Questions?

Bee Diversity

- Bees represent a large and diverse group of pollinators





Jason Gibbs (unpublished data)

Bee Diversity

Miner Bees *Andrena*

Cellophane Bees *Colletes*

Mason Bees *Osmia*

Leafcutter Bees *Magachile*

Long-Horned Bees *Melissodes*

Wool Carder Bees *Anthidium*

Sweat Bees *Halicidae*

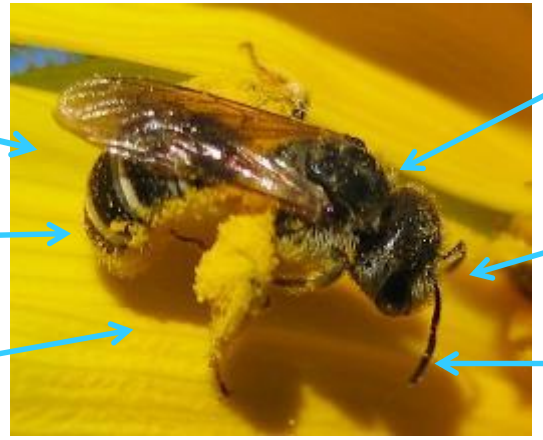
Carpenter Bees *Xylocopa*

Bumble bees *Bombus*

Social Bees

Honey bees *Apis*

Characteristics of bees



Pollinator Importance

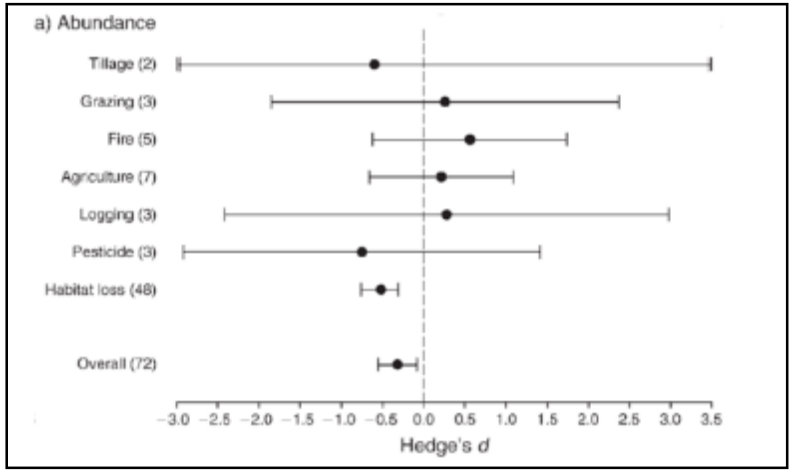
- Bees play a vital role in the stability of both managed and unmanaged ecosystems.
  - depend almost entirely on accessible plant resources such as pollen and nectar
  - 84% of flowering plant species rely on pollination services provided by insect pollinators
  - In agricultural systems, bees are valued at about 7.6 billion dollars/ year (Losey and Vaughan 2006).

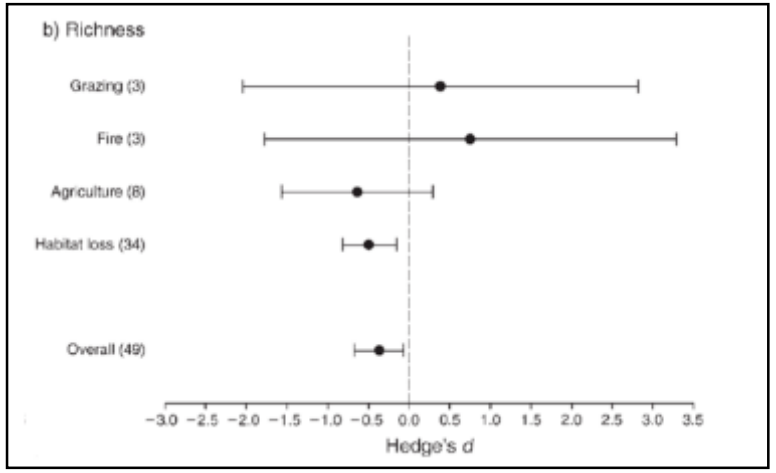
Pollinator Habitats

- Habitat loss is primary driver of wild bee declines (Kearns et al. 1998)

High Complexity ⟷ Low Complexity

Pollinator Habitats

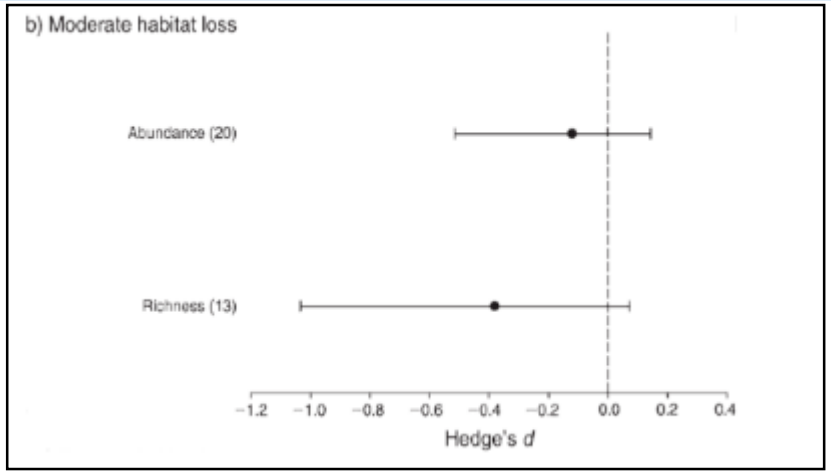


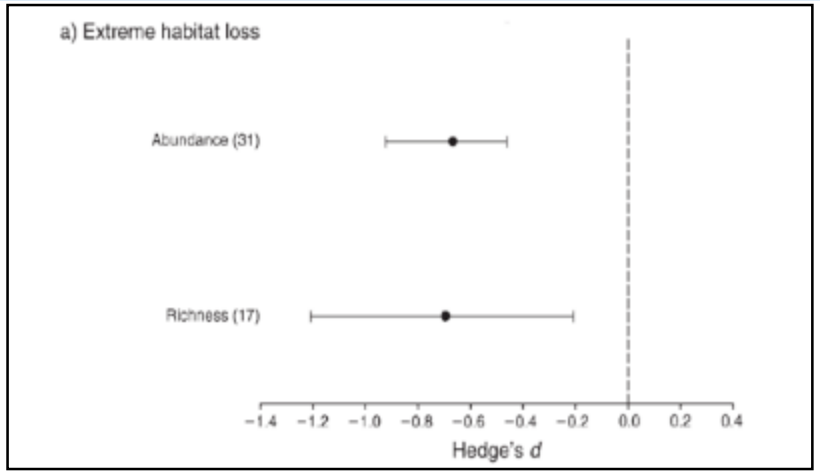


Winfree et al. 2009

- In general, pollinator abundance and richness are decreasing across different types of landscape disturbance
- Some forms of disturbance are worse than others

Pollinator Habitats





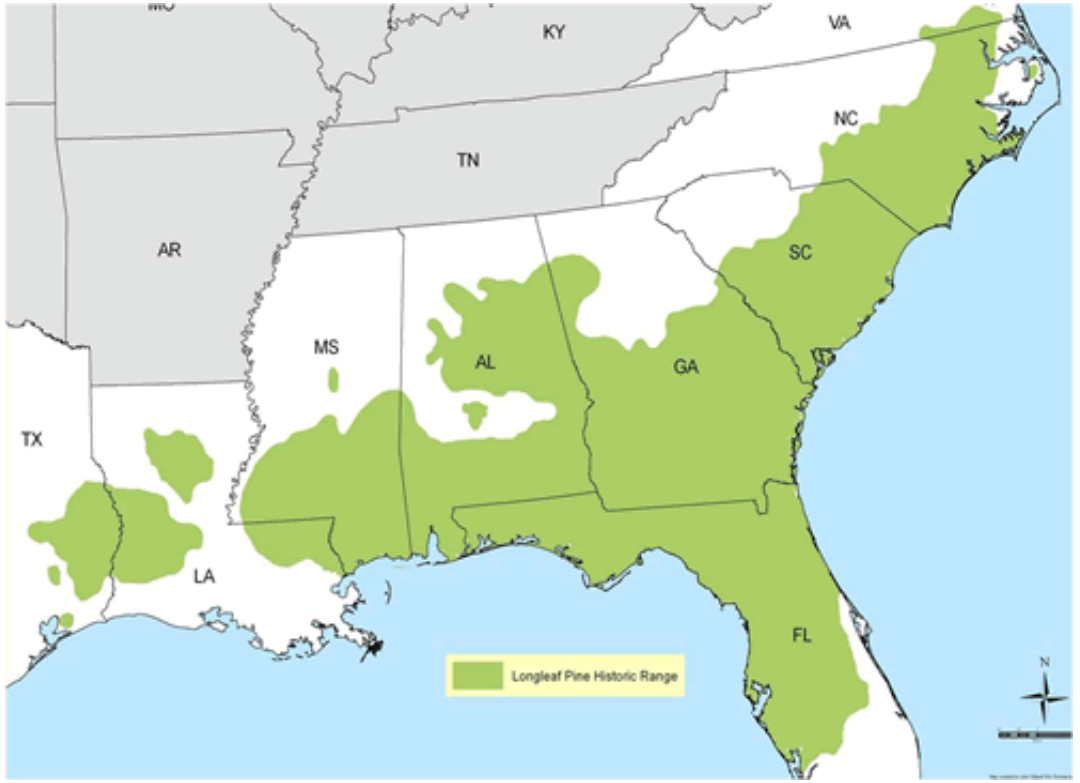
Winfree et al. 2009

- Worse in areas with extreme habitat loss

- An increase need to conserve and restore diverse habitats that support pollinators!

Longleaf Pine Savanna

- Highly threatened, fire maintained ecosystem unique to the southeastern U.S.
- Dominated by *Pinus palustris*
- >4% of original pine forests remain
- Degradation caused by many factors including:
  - Fire suppression
  - Logging and naval industry



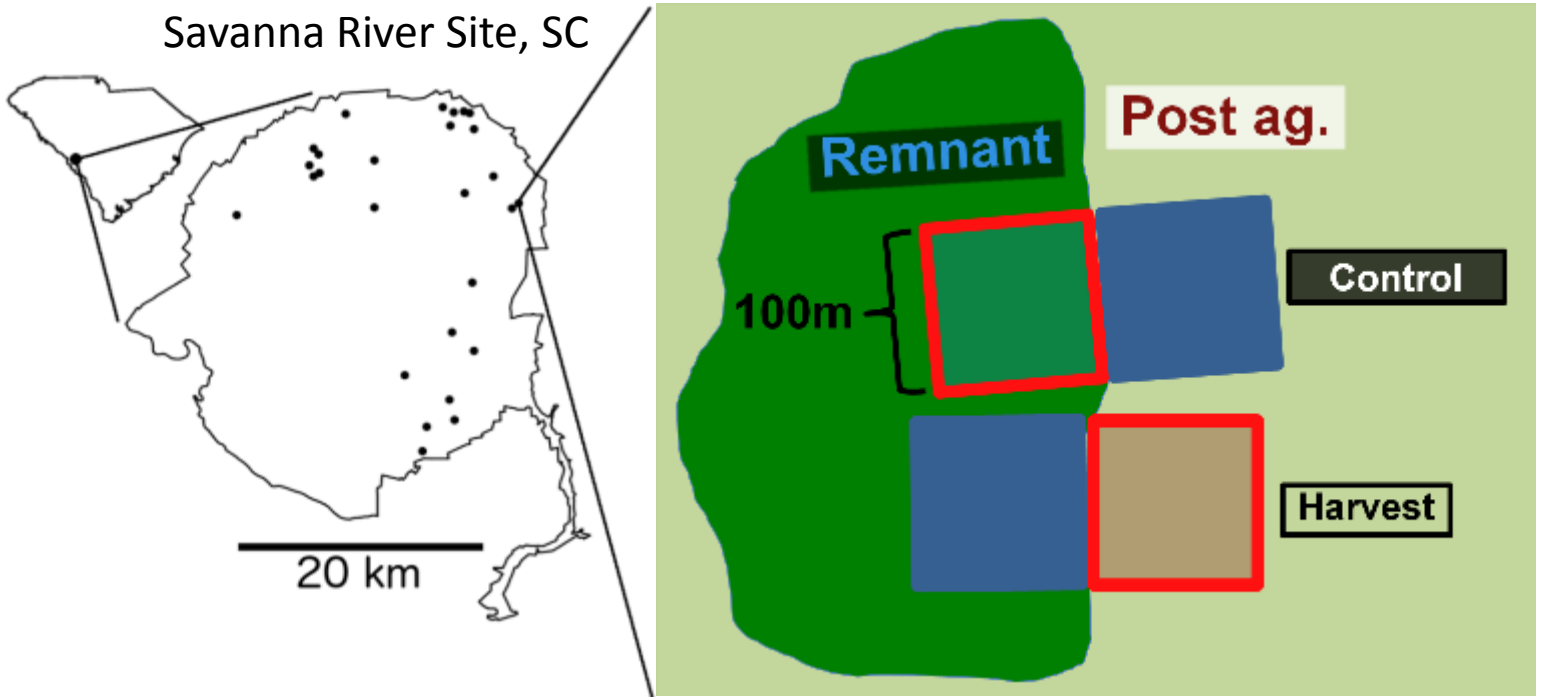
Longleaf Pine Savanna

What is being done to restore the savanna?

- Controlled burning
- Harvesting trees

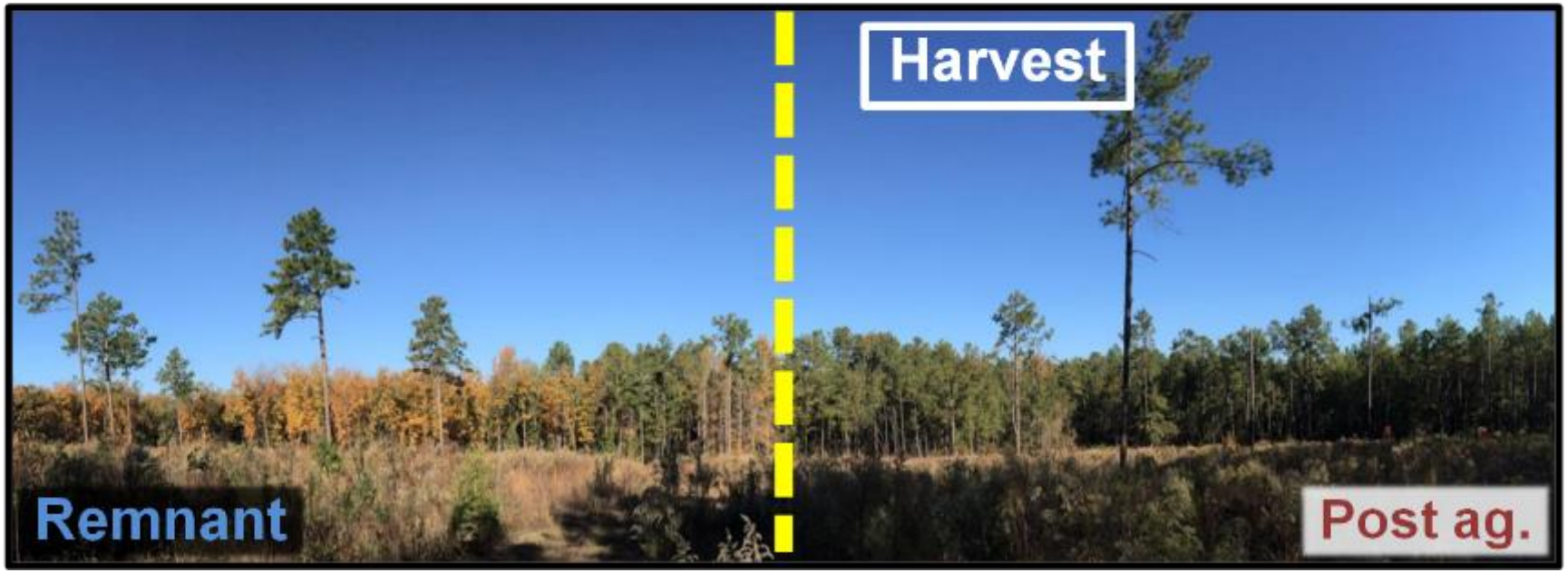
How do these efforts affect native bees?

Sites

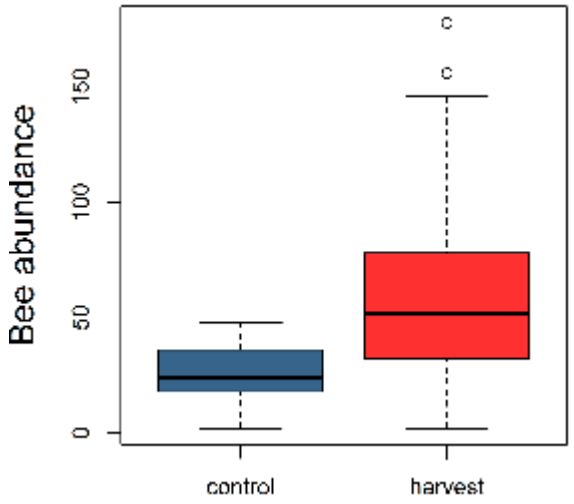


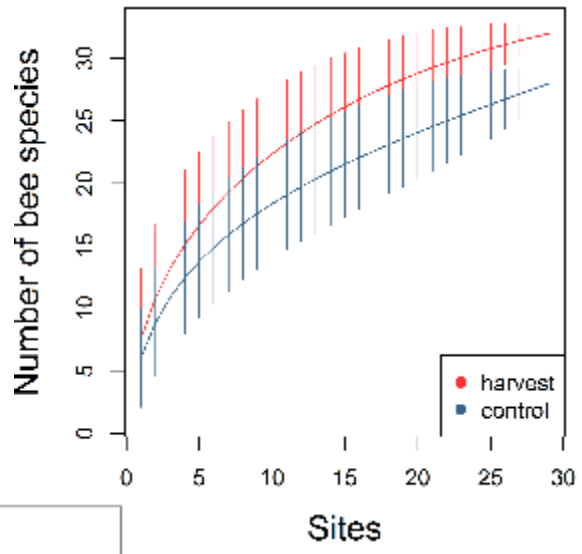
- **Remnant** = Undisturbed longleaf pine stands
  - Control = no restoration treatments
  - Harvest = trees removed to restore savanna
- **Post ag.** = Former agricultural lands, planted with longleaf pines
  - Control = no restoration treatments
  - Harvest = trees removed to restore savanna

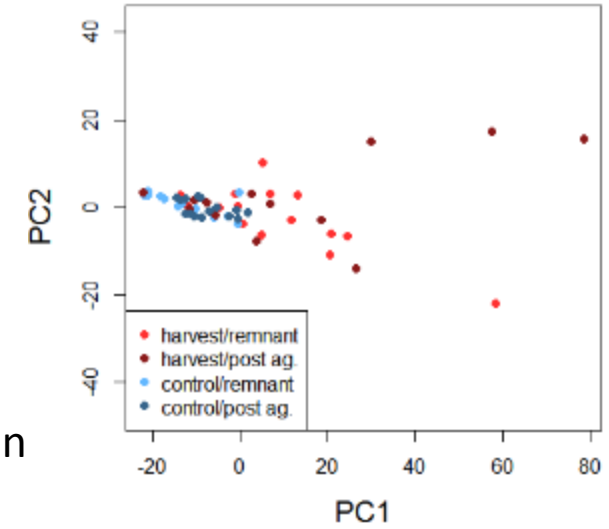
Sites



Restoration Treatment



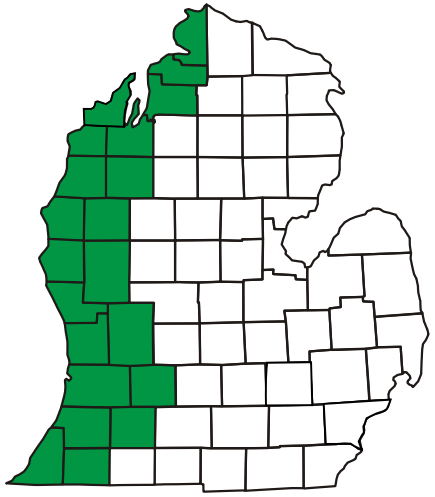


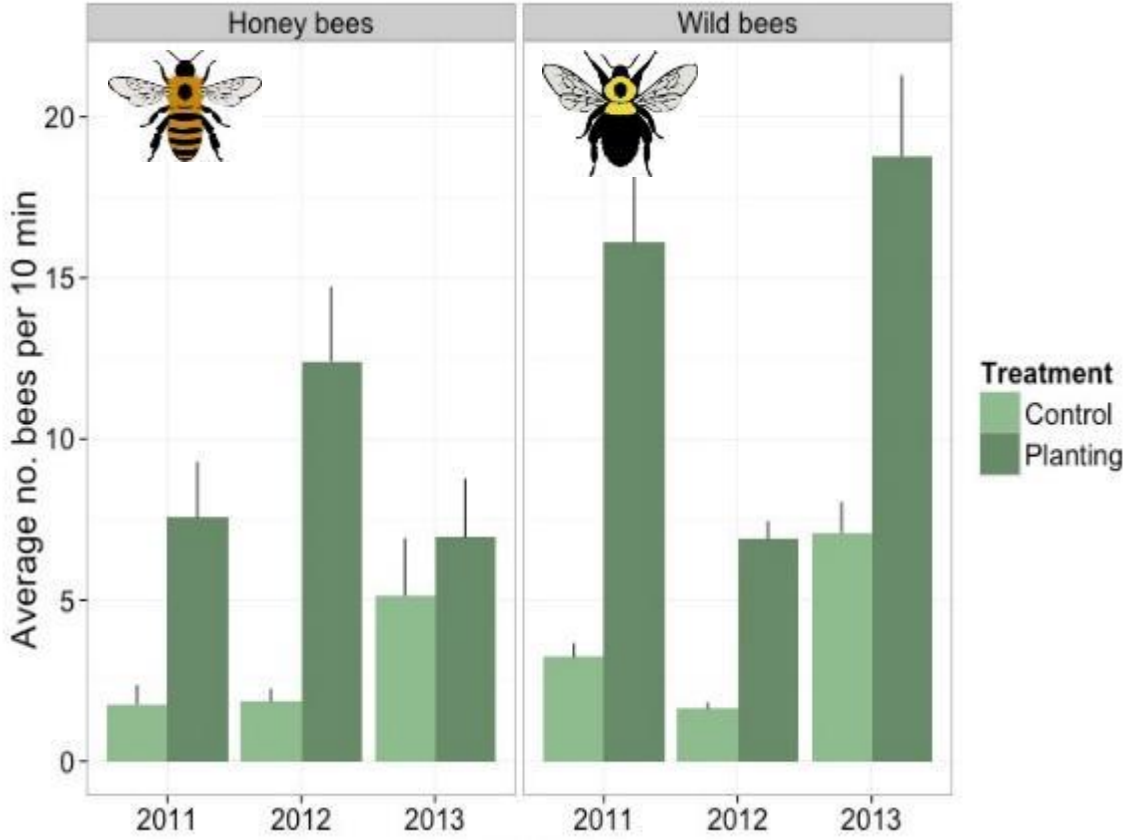


Community Composition

Bee response to habitat enhancements

Michigan SAFE Program





The Xerces Society for Invertebrate Conservation

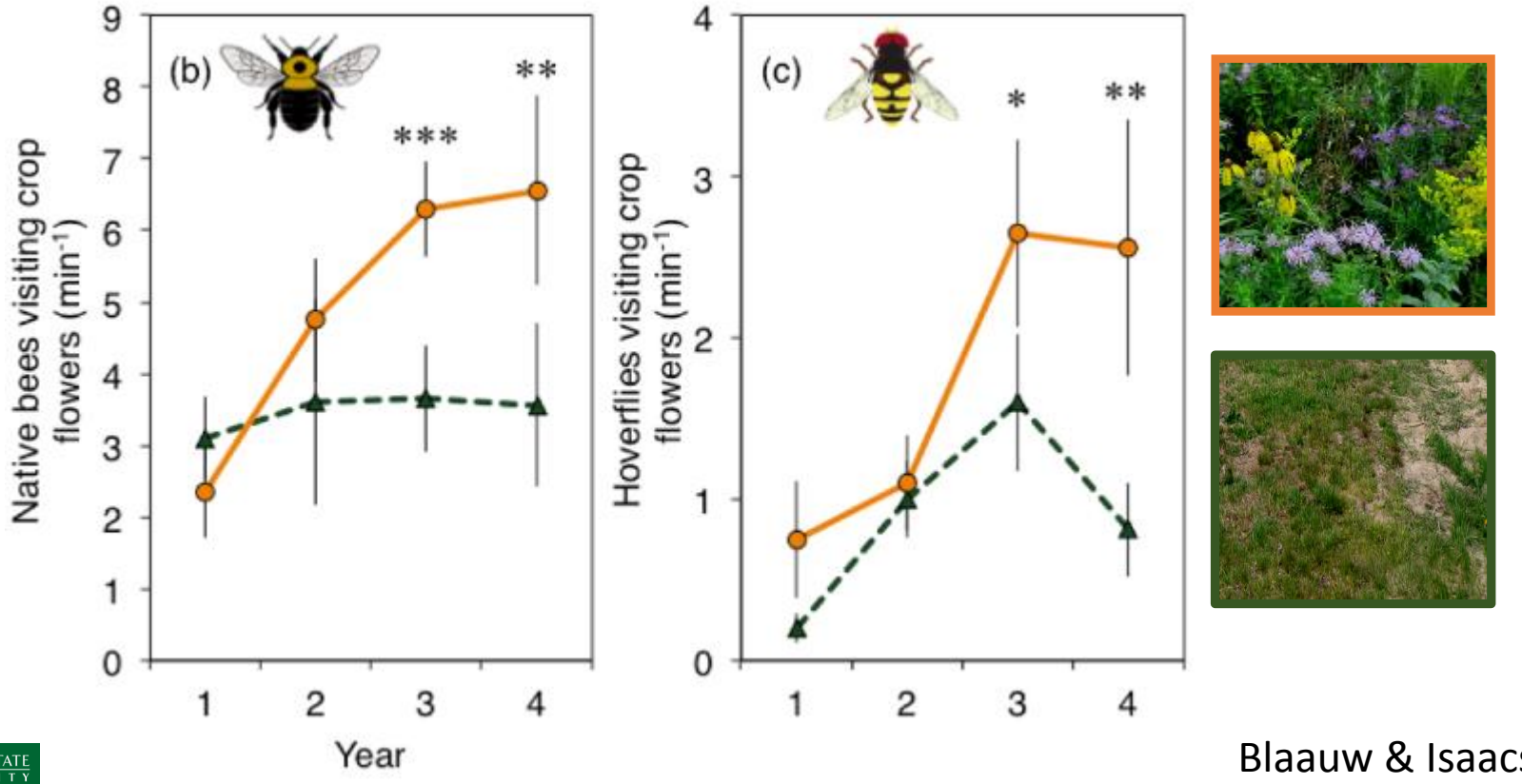
USDA NRCS United States Department of Agriculture Natural Resources Conservation Service

FSA

MICHIGAN STATE UNIVERSITY

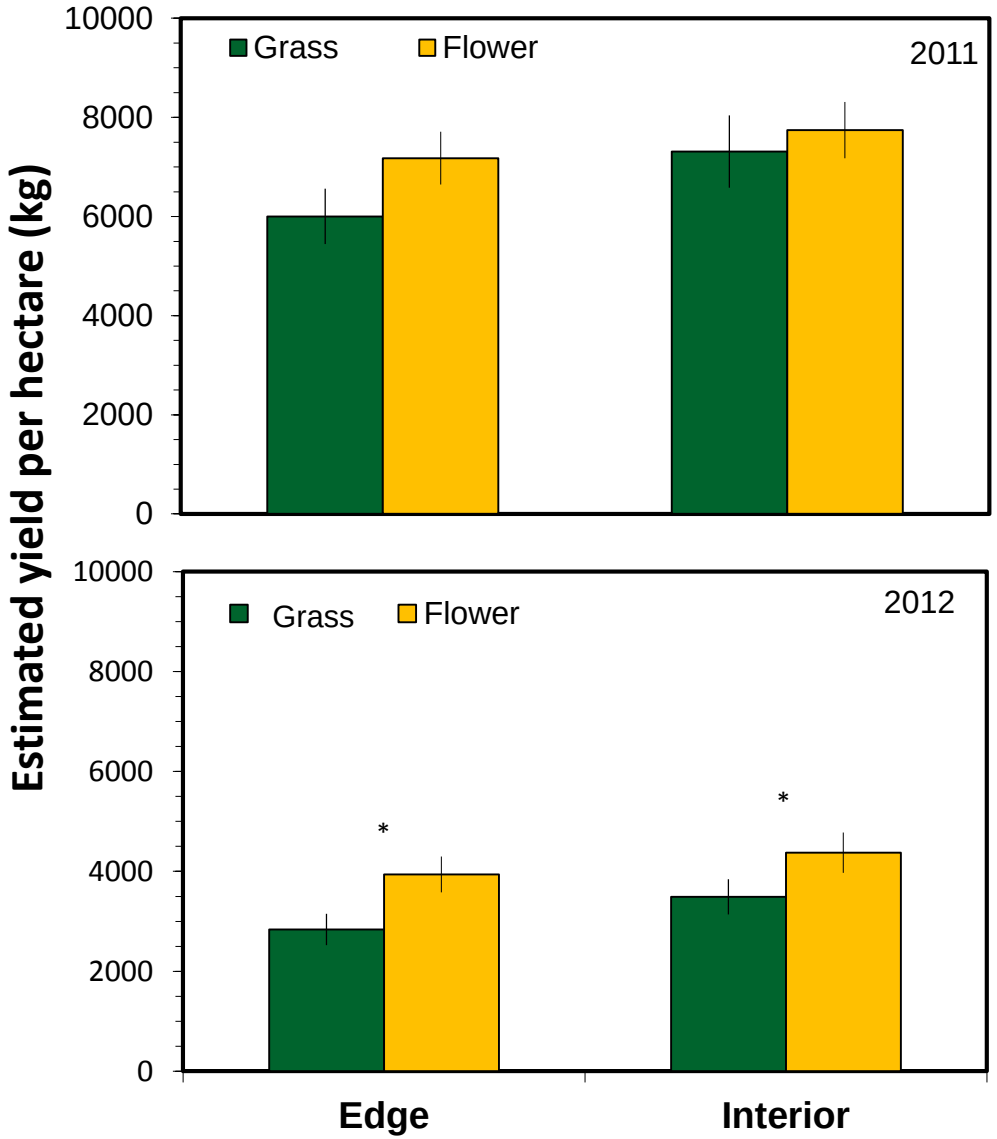
Habitat on farms for beneficial insects

Wild bees and natural enemies increase over time



Blaauw & Isaacs, 2014

Habitat can support increased yield



Costs of habitat establishment paid off within 4 years due to higher blueberry yields

Insectary Plants for Beneficial Insects

Objectives

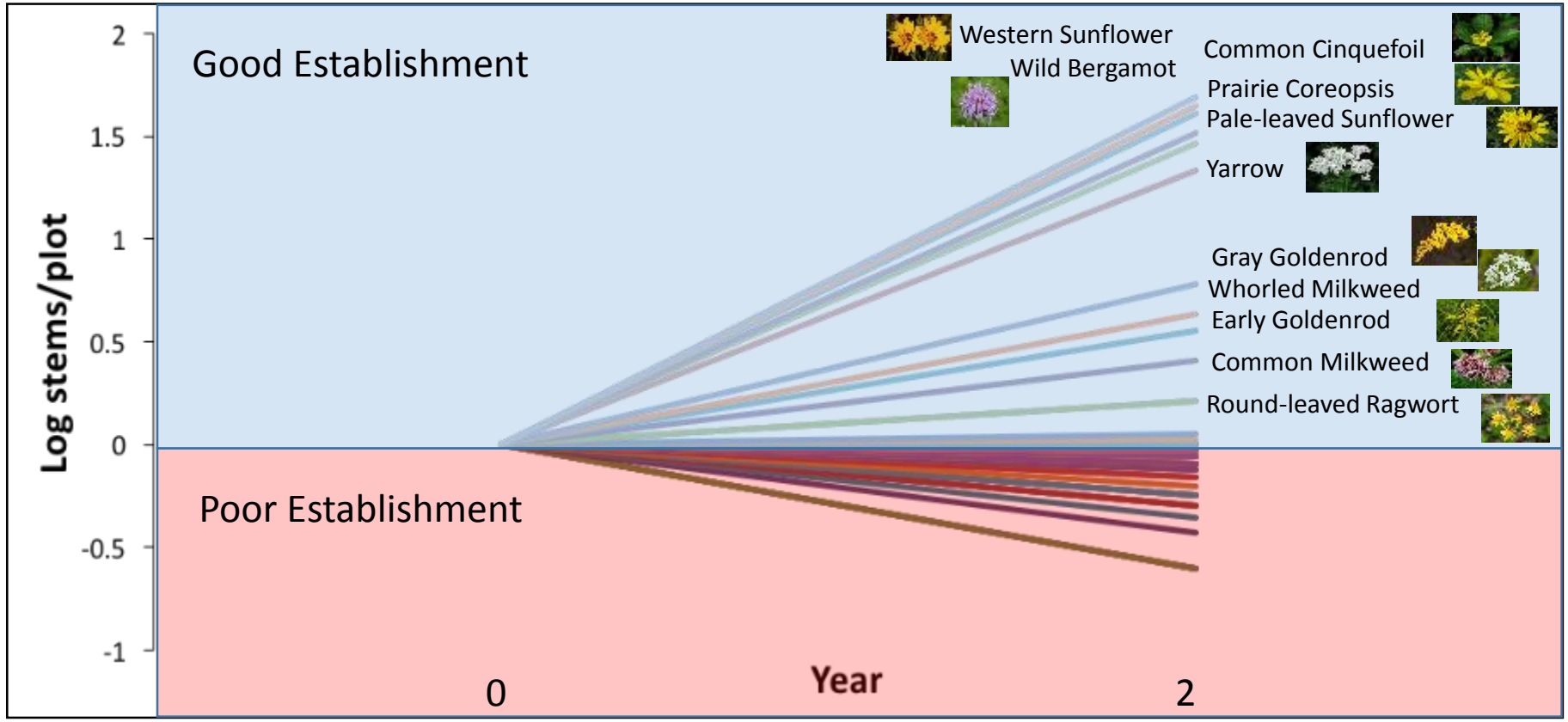
- 1. Identify plants adapted for dry soils that best support managed and native pollinators.
- 2. Identify the plant traits that are best predictors of pollinator attraction
- 3. Develop a tool as part of the MSU Native Plants website to select insectary plants for desired needs.

http://nativeplants.msu.edu/

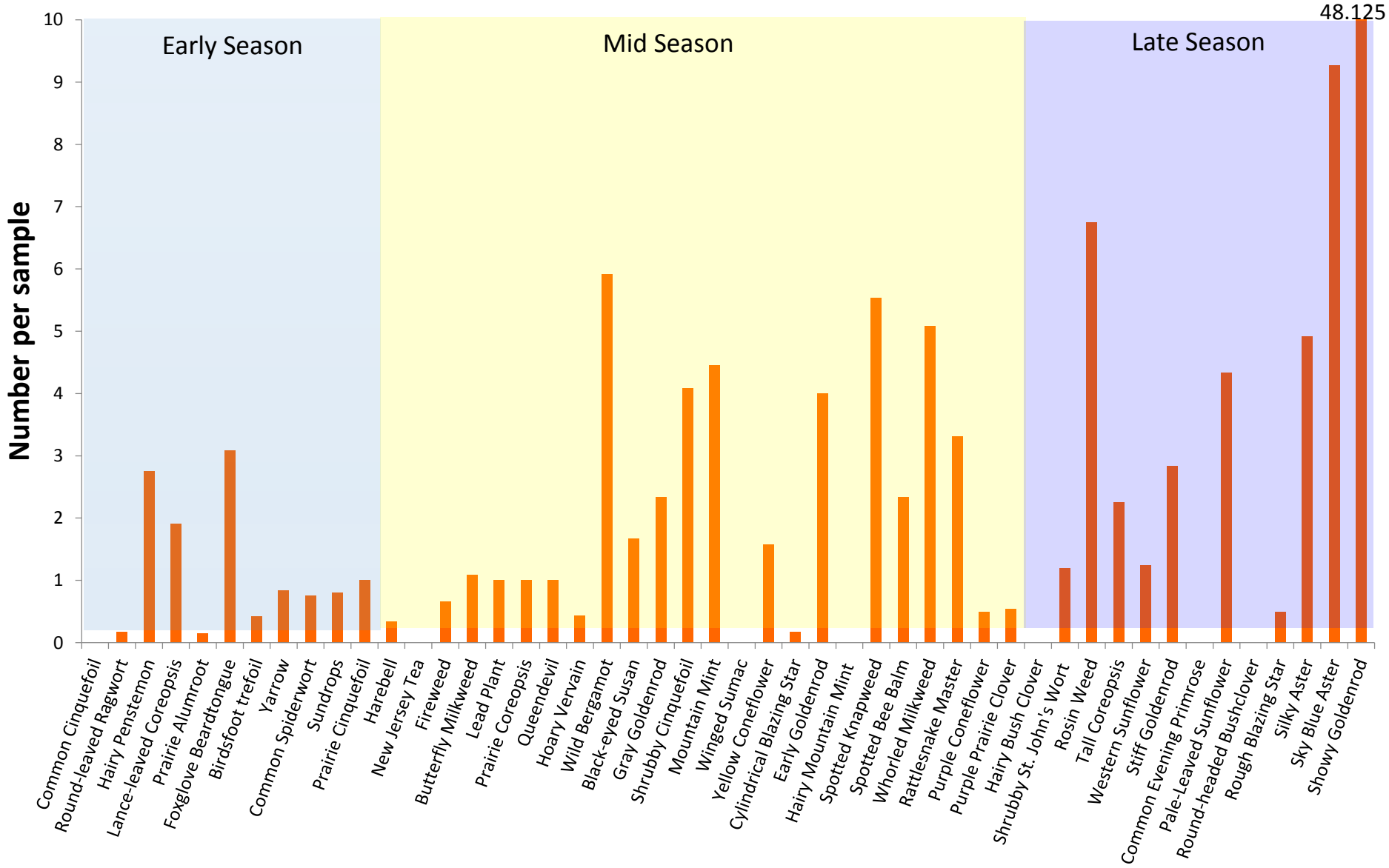
Sampling Pollinators

- weekly observations and collections
  - 2.5 minute samples am/pm
  - Observations for honey bees
  - Wild pollinator collections
    - Identify to species

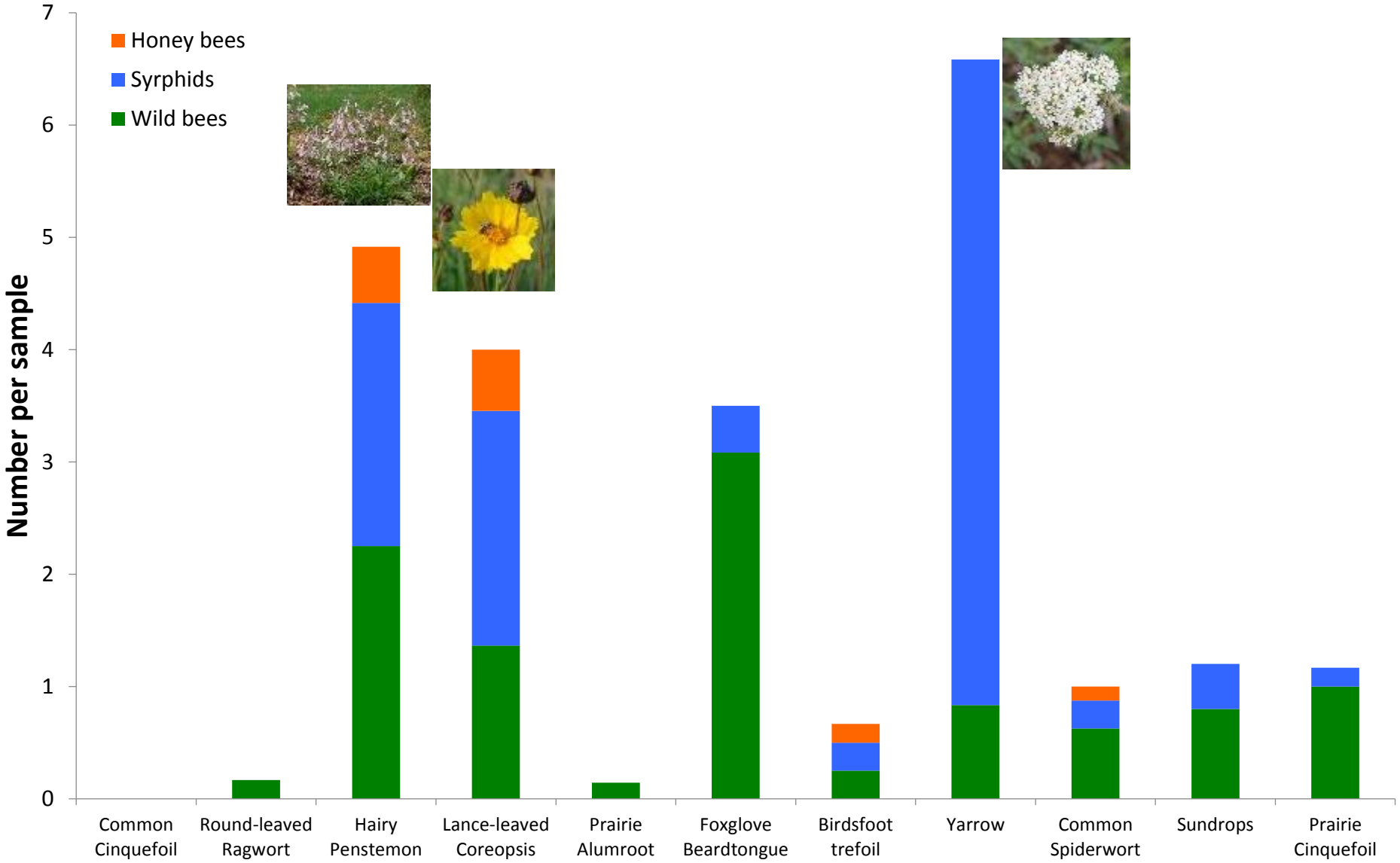
Plant Establishment



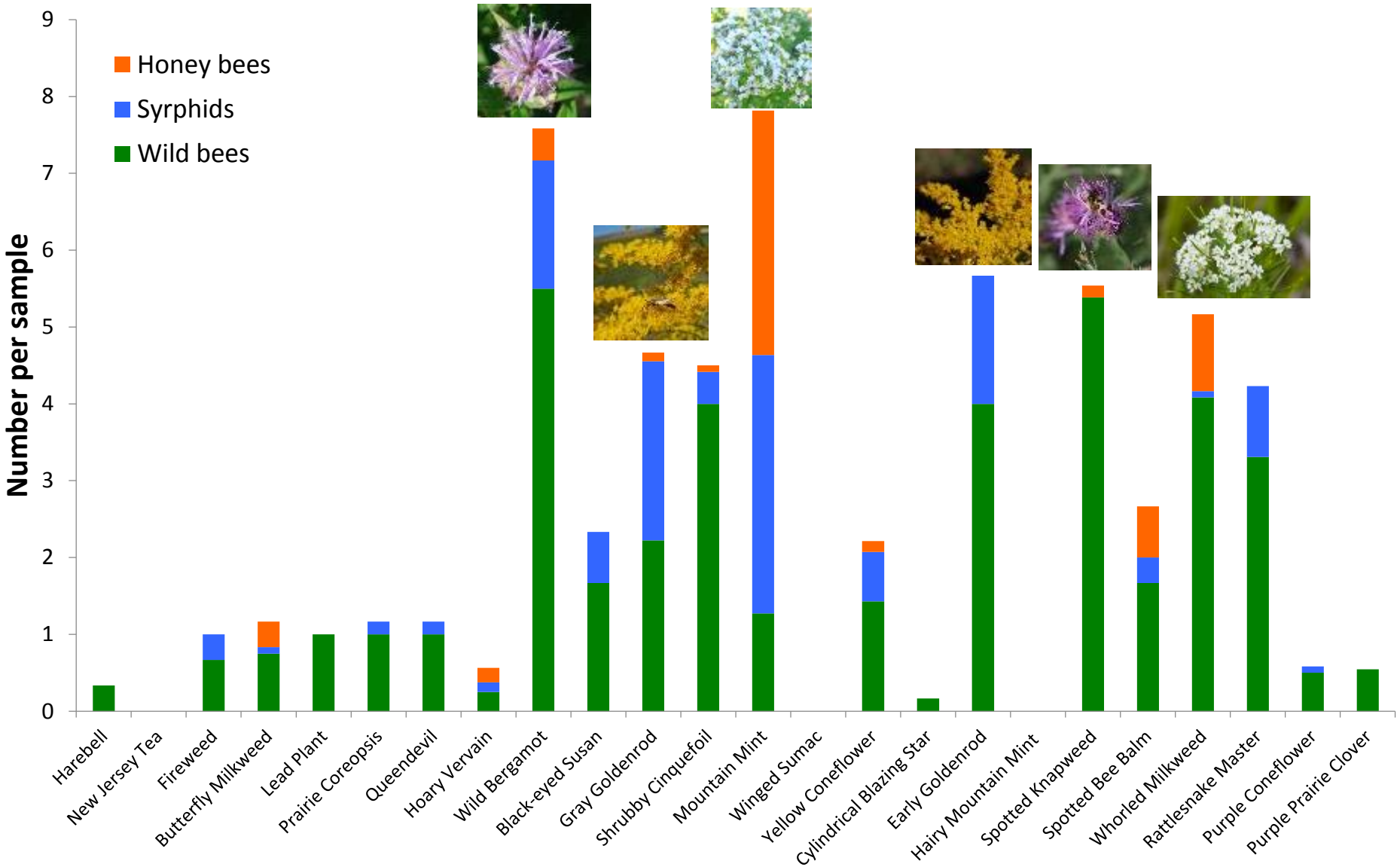
Pollinator Abundance



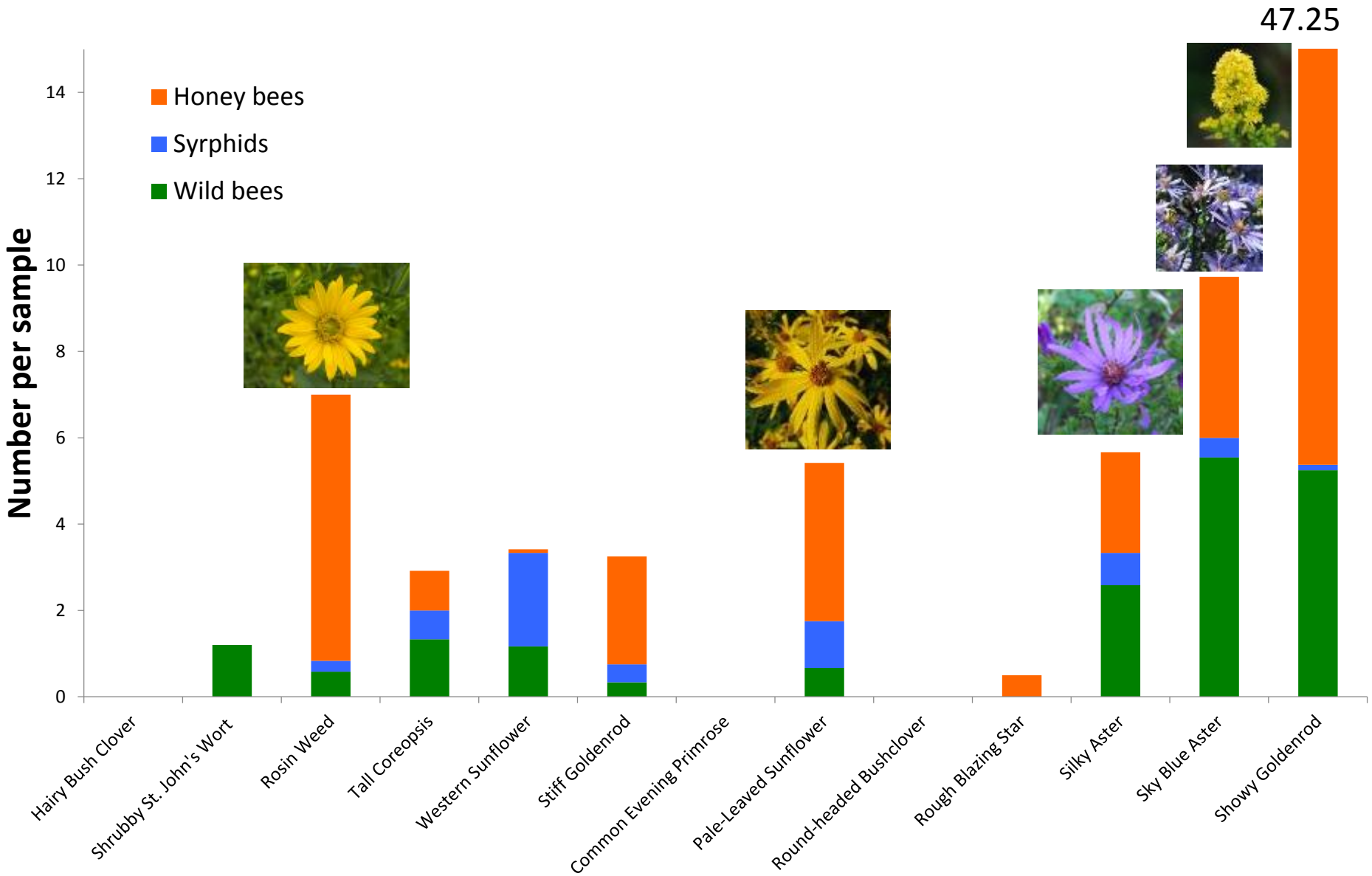
Early Season (May - June)



Mid Season (July - Aug)



Late Season (Aug - Oct)



Factors Affecting Flower Visitation

			Parameter estimate probabilities		
Bee abundance	**Adj. R squared**	**F value**	**area of flower**	**floral area within $1m^2$ plot**	**tallest flower**
All pollinators	0.27	8.25	0.004	0.196	<.001
honey bees only	0.18	5.46	0.749	0.91	<.001
wild bees only	0.23	6.82	0.007	0.053	<.001
bumble bees	0.19	5.62	0.381	0.58	<.001

Results of multiple linear regressions of the abundance of bees observed on study plants during peak bloom against three floral characteristics. Probability values less than 0.05 are highlighted in green.

Common bees and associated plants

Mountain Mint

Rosin Weed

Honey Bees

Pale-leaved Sunflower

Showy Goldenrod

Common bees and associated plants

Wild Bergamot

Foxglove Beardtongue

Bumble Bees

Showy Goldenrod

Sky Blue Aster

Common bees and associated plants

Spotted Knapweed

Whorled Milkweed

Rattlesnake Master

Sweat Bees

Mountain Mint

Common bees and associated plants

Purple Coneflower

Yellow Coneflower

Pale-leaved Sunflower

Leaf Cutter Bees

Black-eyed Susan

Common bees and associated plants

Lance-leaved Coreopsis

Tall coreopsis

Miner Bees

Birdsfoot trefoil

Sky Blue Aster

Anna Fiedler, Julianna (Tuell) Wilson
2004-05

COMMUNITY AND ECOSYSTEM ECOLOGY

Attractiveness of Michigan Native Plants to Arthropod Natural Enemies and Herbivores

A. K. FIEDLER[1] AND D. A. LANDIS

Department of Entomology, 204 Center for Integrated Plant Systems, Michigan State University, East Lansing, MI 48824-1311

COMMUNITY AND ECOSYSTEM ECOLOGY

Visitation by Wild and Managed Bees (Hymenoptera: Apoidea) to Eastern U.S. Native Plants for Use in Conservation Programs

JULIANNA K. TUELL,[1] ANNA K. FIEDLER, DOUGLAS LANDIS, AND RUFUS ISAACS

Department of Entomology, Michigan State University, East Lansing, MI 48824

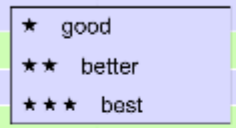
Environ. Entomol. 37(3): 707–718 (2008)

Extension Bulletin E-2973 • New • January 2007

Attracting Beneficial Insects with Native Flowering Plants

Anna Fiedler, Julianna Tuell, Rufus Isaacs, and Doug Landis
Department of Entomology, Michigan State University

Native plant	Natural enemies	Bees
1. *Fragaria virginiana*, wild strawberry	★★	★
2. *Zizia aurea*, golden Alexanders	★★★	★★
3. *Anemone canadensis*, Canada anemone	★★★	★
4. *Penstemon hirsutus*, penstemon	★★	★★
5. *Angelica atropurpurea*, angelica	★★★	★
6. *Heracleum maximum*, cow parsnip	★★★	★
7. *Coreopsis lanceolata*, sand coreopsis	★★★	★
8. *Potentilla fructicosa*, shrubby cinquefoil	★★★	★
9. *Apocynum cannabinum*, Indian hemp	★★★	★
10. *Scrophularia marilandica*, late figwort	★★	★★
11. *Asclepias incarnata*, swamp milkweed	★★	★★
12. *Veronicastrum virginicum*, Culver's root	★★	★★★
13. *Ratibita pinnata*, yellow coneflower	★★★	★★
14. *Allium cernuum*, nodding wild onion	★	★★
15. *Spiraea alba*, meadowsweet	★★★	★★
16. *Agastache nepetoides*, yellow giant hyssop	★★	★★★
17. *Monarda punctata*, horsemint	★★★	★★
18. *Vernonia missurica*, Missouri ironweed	★★	★★
19. *Silphium perfoliatum*, cup plant	★★★	★★★
20. *Cacalia atriplicifolia*, pale Indian plantain	★★	★★
21. *Eupatorum perfoliatum*, boneset	★★★	★★
22. *Lobelia siphilitica*, blue lobelia	★★★	★★★
23. *Helianthus strumosus*, pale-leaved sunflower	★★★	★★
24. *Solidago riddelii*, Riddell's goldenrod	★★★	★★★
25. *Aster novae-angliae*, New England aster	★★★	★★
26. *Aster laevis*, smooth aster	★★	★★



http://nativeplants.msu.edu

Summary


- Habitat is important for bees
- Harvesting can positively influence pollinator comm
- Habitat enhancements can benefit farmers!
- Plants vary in establishment and attractiveness.
- Resources are currently available to get you started





Thanks!

- Acknowledgements:
  - Rufus Isaacs
  - Doug Landis
  - Jason Gibbs
  - Lars Brudvig
  - Funding sources