

The use of wildflower plantings to conserve beneficial insects in tree fruit

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What are beneficial insects?

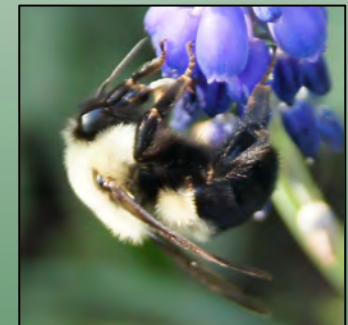
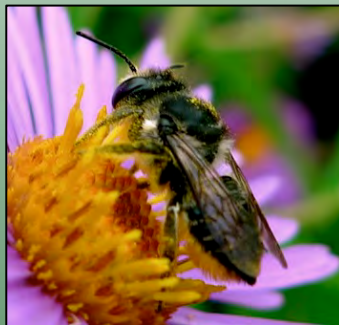
- Insect natural enemies

- Biocontrol agents
- Feed on pests



- Insect pollinators

- Provide pollination
- Often nest in ground or soft wood



Why conserve beneficial insects?

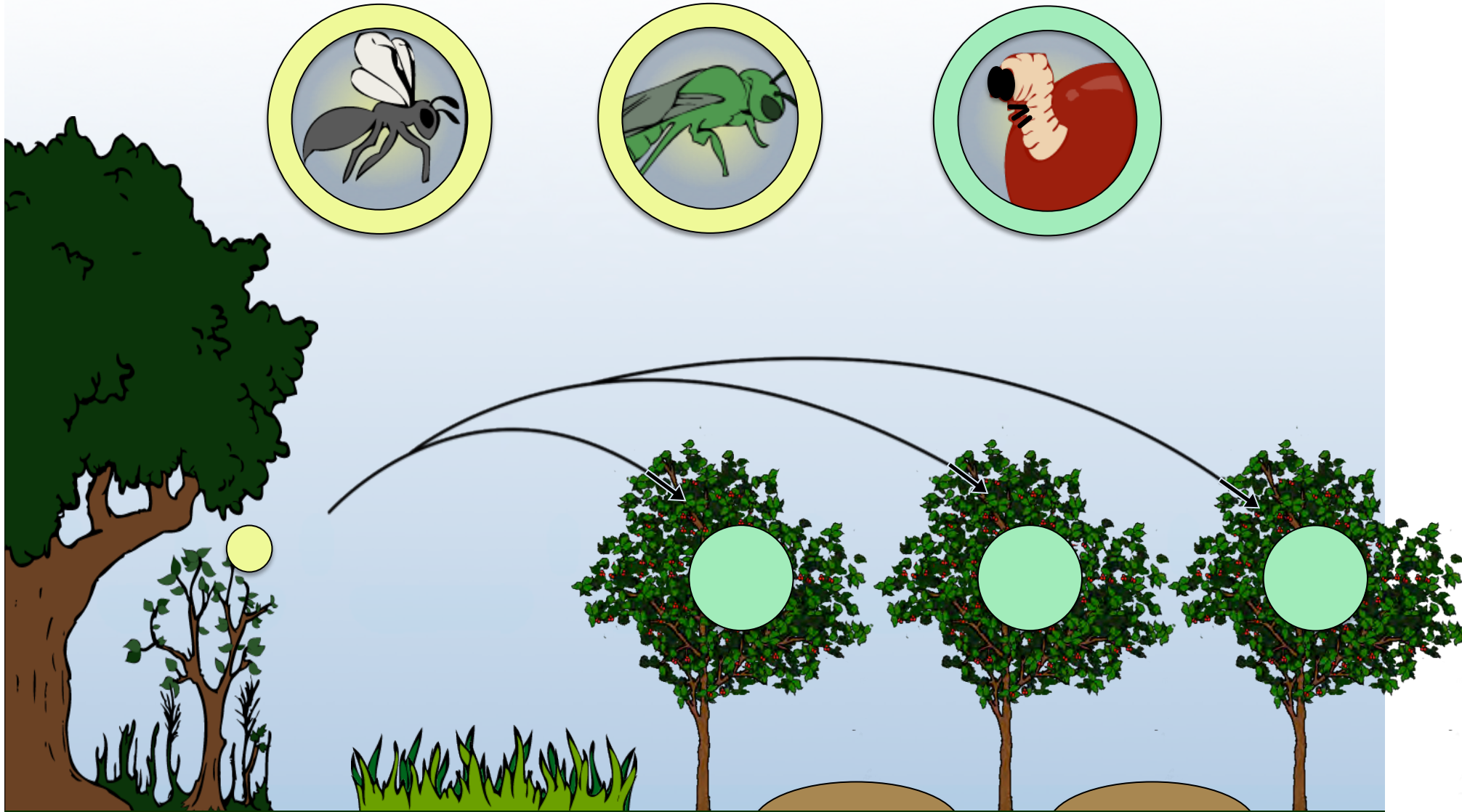
- Declines in beneficial insect diversity and abundance (Biesmeijer et al. 2006)
- Risk a loss in valuable ecosystem services
 - Natural pest control: \$4.5 billion annually
 - Pollination: \$3 billion annually (Losey and Vaughn)
- Can increase beneficial insects by adding resource-rich habitat



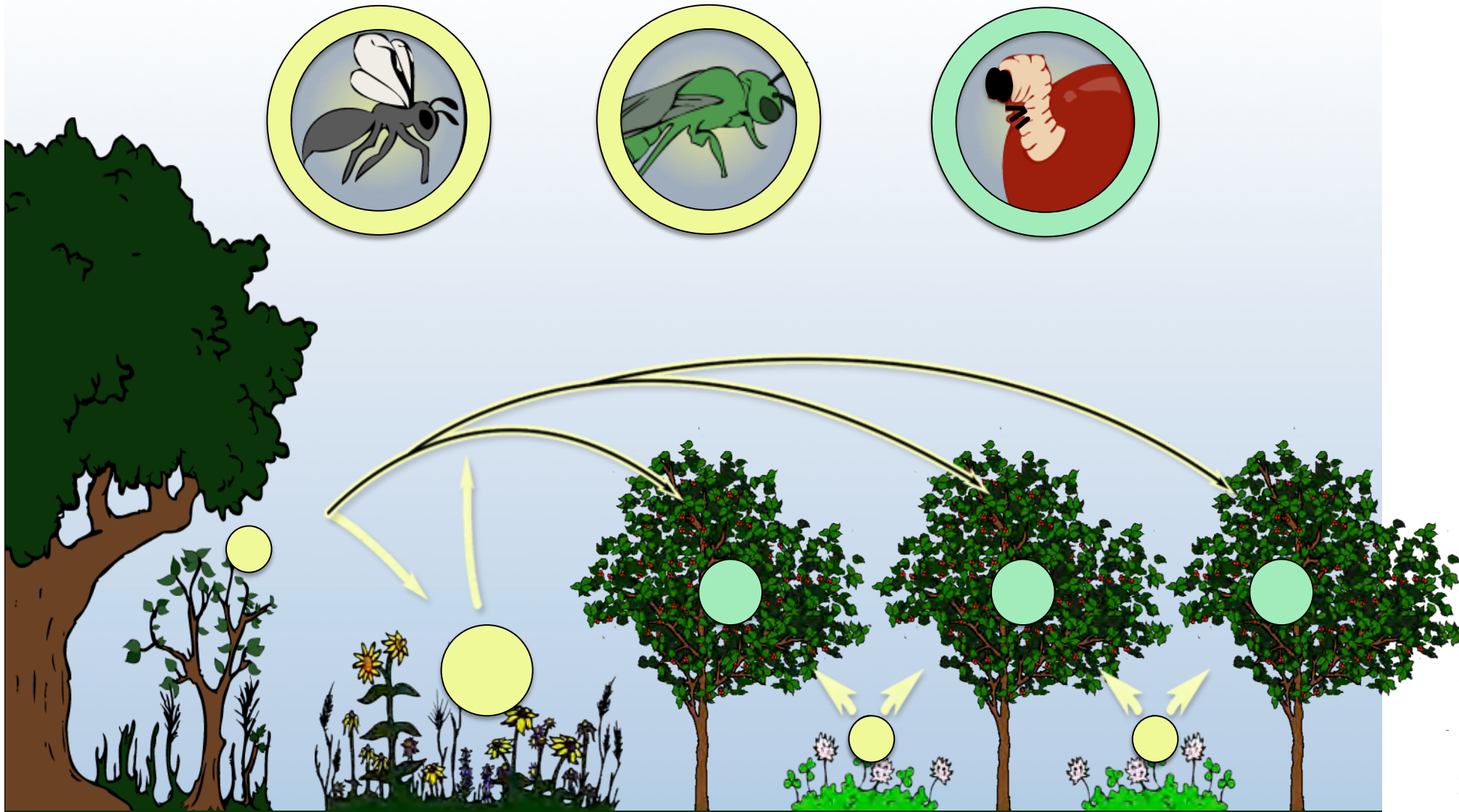
Habitat for beneficial insects

- Beneficial insects need floral resources
 - Crop flowers only provide resources for a short period
- Planting flowers on farms can increase beneficial insect populations
- Flowers/conservation strips can be planted where there is space
 - Field margins / un-cropped areas
 - Drainage ditches
 - Hedgerows
 - Between or within crop rows





Typical resource-poor environment surrounding an orchard.



Adding flowers can provide resources in and around the orchard.

Types of flowering plants

- Herbaceous annuals
 - Buckwheat
- Herbaceous perennials
 - Black-eyed Susans
- Flowering shrubs
 - Viburnum
- Flowering trees
 - Willow



Perennial flowering plants

- Advantages
 - Natives are adapted to local environments
 - Less likely to become invasive
 - No need for annual sowing
 - Increase beneficial insects in farms
- Drawbacks
 - Expensive seed (funding sources to help)
 - May take years to establish and bloom
 - Requires plot maintenance during first year
- Examples: **boneset, blue lobelia, and cup plant**

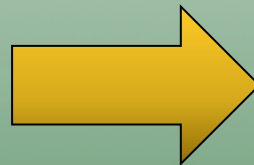
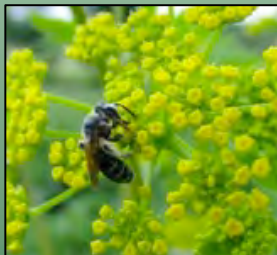
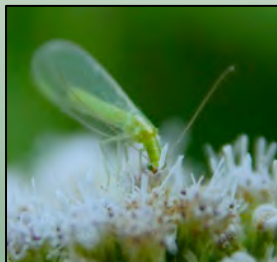


Current research at MSU

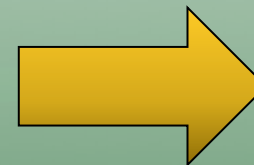


- **Objective:** Determine if adding habitat for beneficial insects improves biological control and pollination
- **Methods:** Established wildflower plantings in farms to provide necessary resources for beneficial insects
 - **Hypothesis:** Increased floral resources, increased beneficial insects, better crop yield

Flower planting



Orchard

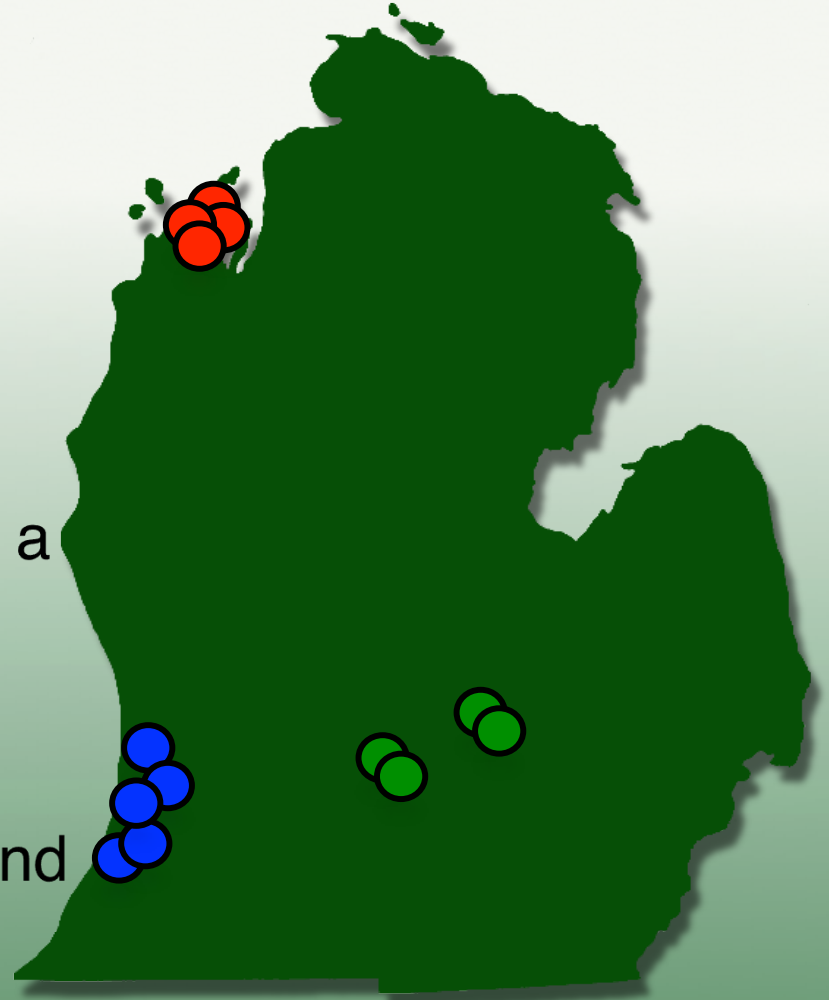


Fruit Production



Location of wildflower plantings

- Established 13 replicated wildflower plantings in 2009
- Compared plantings to mowed grass border
- Wildflowers were planted along a separate border of crop
- Measured beneficial and pest insect abundance, biocontrol, and pollination



Native perennial wildflowers



COMMON NAME	SCIENTIFIC NAME	BLOOM PERIOD						
		April	May	June	July	August	September	October
Golden Alexanders	<i>Zizia aurea</i>							
Foxglove	<i>Penstemon digitalis</i>							
Sand Coreopsis	<i>Coreopsis lanceolata</i>							
Black-eyed Susan	<i>Rudbeckia hirta</i>							
Swamp milkweed	<i>Asclepias incarnata</i>							
Butterfly milkweed	<i>Asclepias tuberosa</i>							
Beebalm	<i>Monarda fistulosa</i>							
Yellow Coneflower	<i>Ratibida pinnata</i>							
Joe Pye-weed	<i>Eupatorium maculatum</i>							
Blue Lobelia	<i>Lobelia siphilitica</i>							
Boneset	<i>Eupatorium perfoliatum</i>							
Cup Plant	<i>Silphium perfoliatum</i>							
Stiff Goldenrod	<i>Solidago rigida</i>							
New England Aster	<i>Aster novae-angliae</i>							
Smooth Aster	<i>Aster laevis</i>							

Cherry bloom



May – Year 1

After planting seed



June – Year 1

Mow down to 4-6 inches once a month during first year



May – Year 2

If weeds are present in second year, mow again



June – Year 2



May – Year 3

Do not mow during third year



June – Year 3



August – Year 3

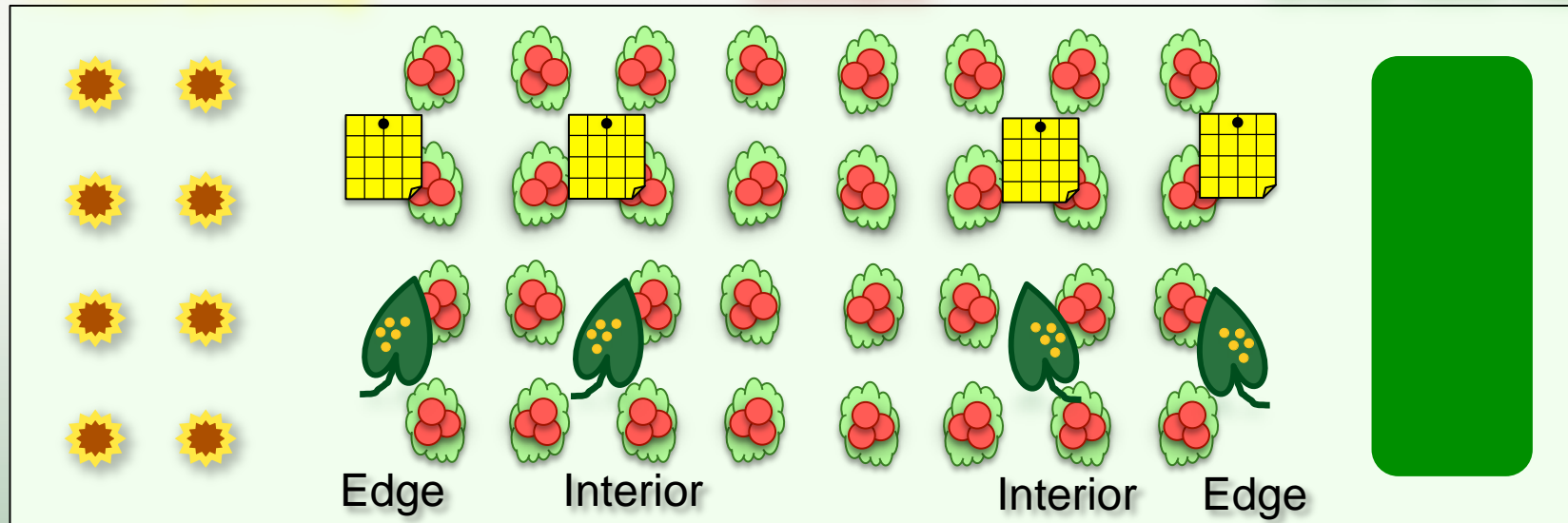


Natural enemies in orchards

Flower planting

Orchard

Grass field margin



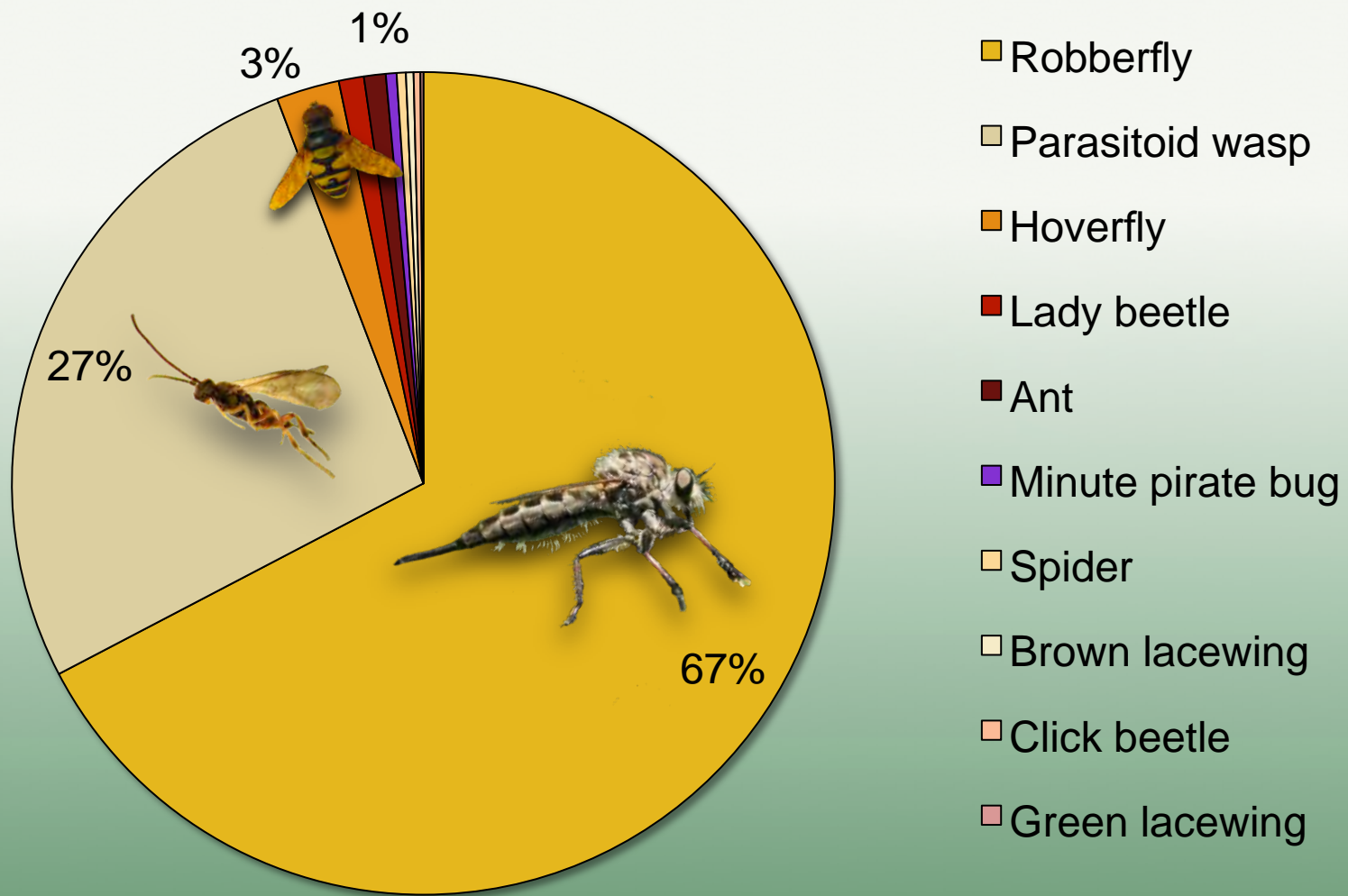
Insect sampling

- Yellow sticky cards
- Along the edge and interior
- Arthropods identified to major taxonomic groups

Biocontrol services

- Collected spotted tentiform leafminer infested leaves
- Along edge and interior
- Measured parasitism

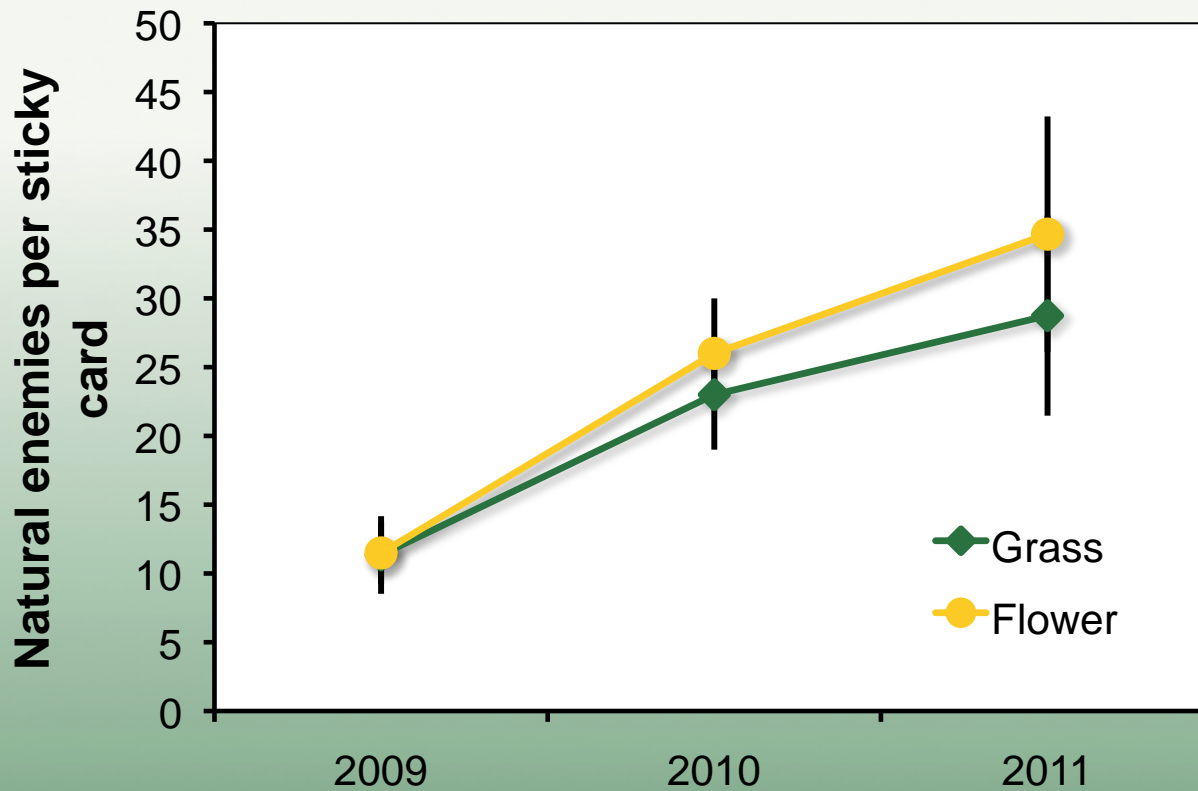
Top 10 observed natural enemies



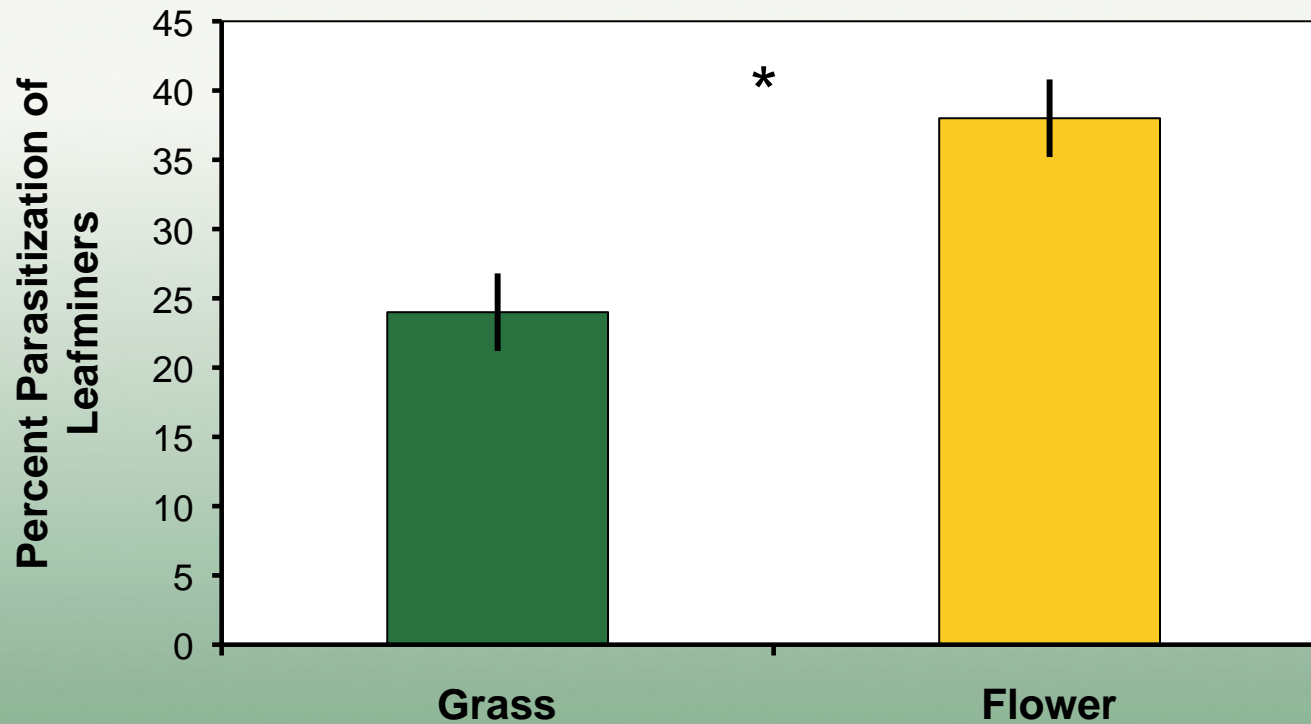
Total number of insects = 9708



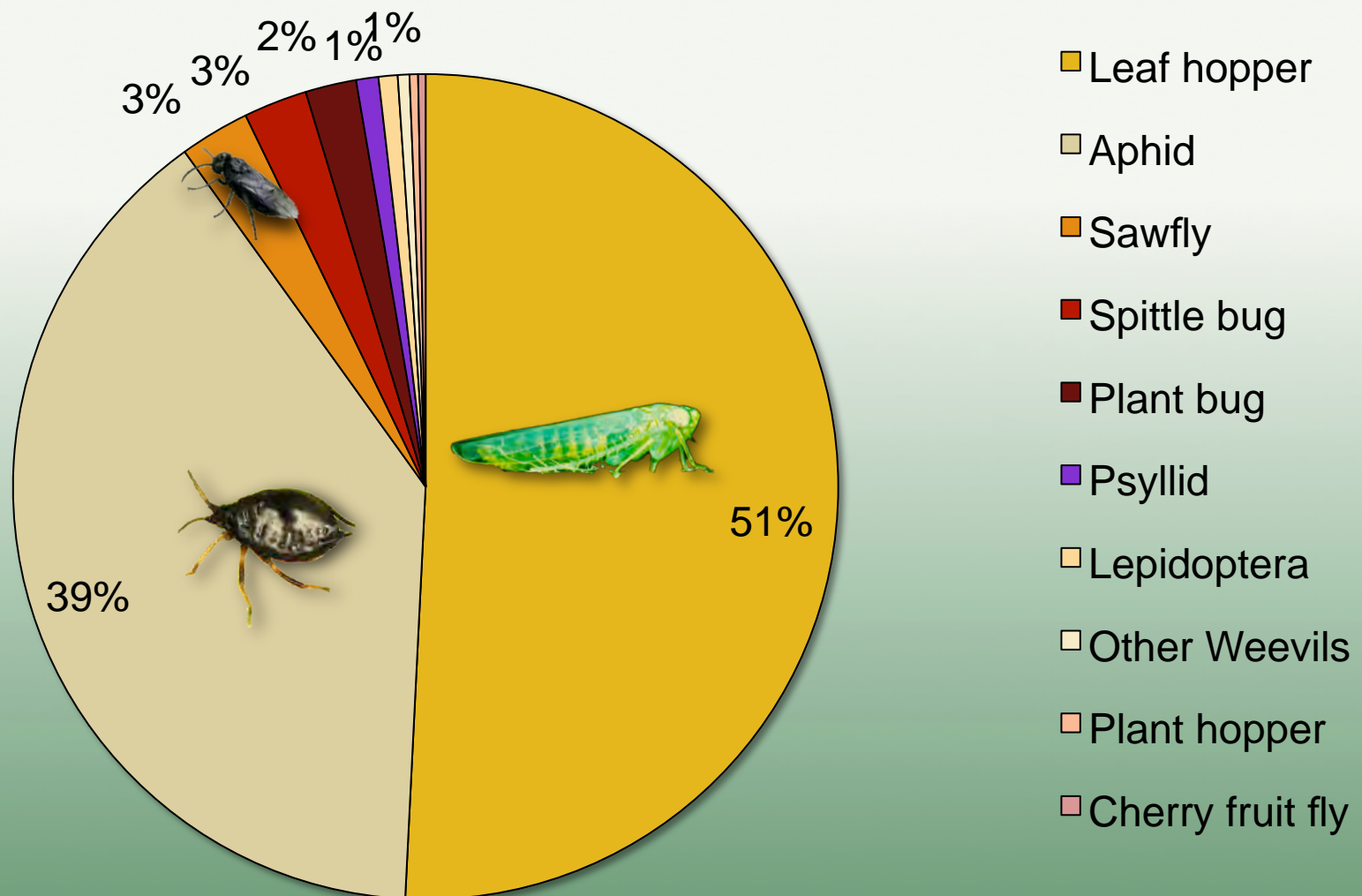
Natural enemies in orchards increased over time



Parasitism of leafminer larvae higher in trees adjacent to wildflower plantings



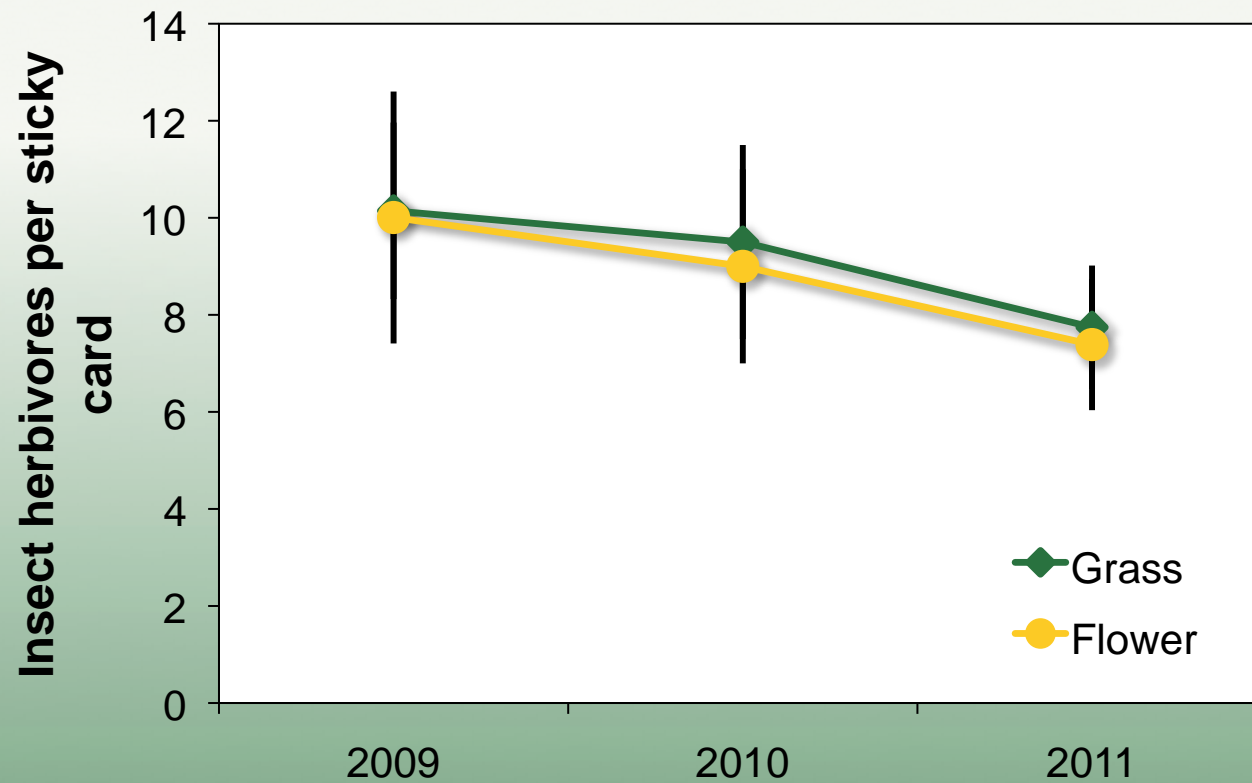
Top 10 observed plant feeders



Total number of insects = 2408



Plant feeders did not increase in fields adjacent to flower plantings



Do plantings increase bees in crops?

Insect sampling

- 15 minute observations
- Sampled adjacent to flower and control fields
- Identified bees to family



Measuring pollination of crop flowers

- % fruit set
- Average fruit weight



Grass border

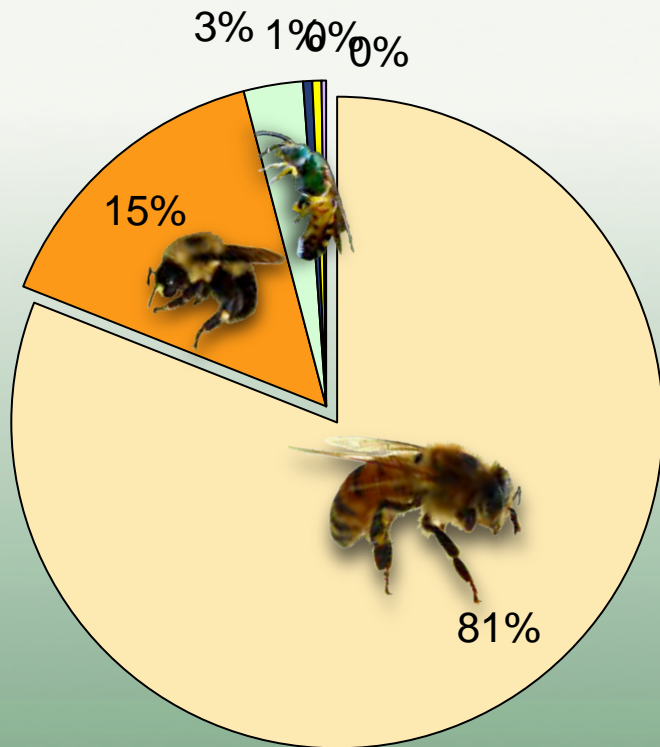


Flower planting

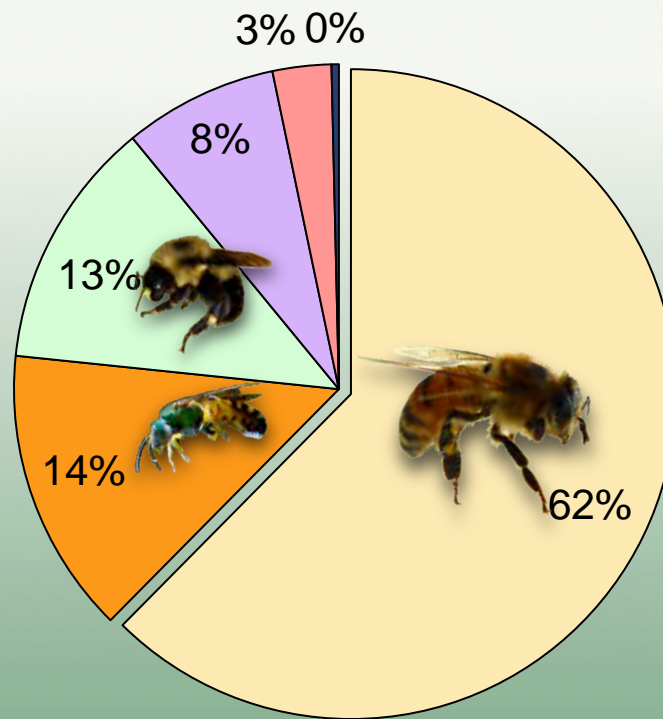


Observed pollinator community

2009



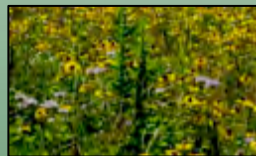
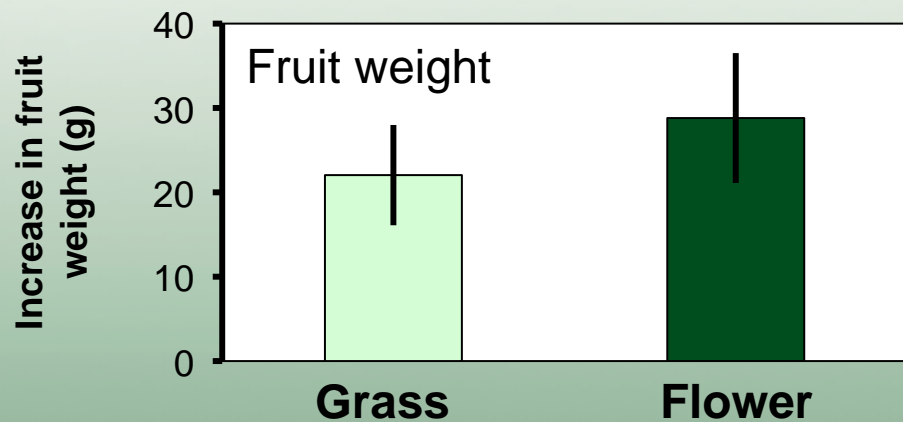
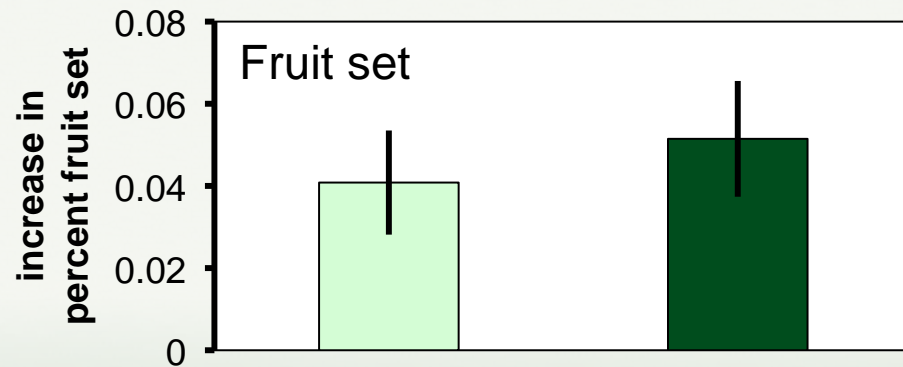
2011



- Honeybee
- Sweat bee
- Bumble bee
- Mining bee
- Hoverfly
- Carpenter bee



Increased pollination in apple orchards adjacent to wildflower plantings (2011)



Summary



- Orchards
 - Increased natural enemies in orchard
 - Higher parasitism in orchards adjacent to flower planting
 - Increased native bees in orchards
 - No change in plant feeders



- Blueberry
 - Increased natural enemies and higher biocontrol
 - Increased native bees and higher pollination

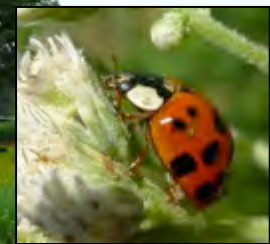
Conclusions

Native wildflower plantings take a few years to establish.

The number of beneficial insects observed in the orchard increased in fields adjacent to wildflower plantings.

Biocontrol of pest insects was shown to be supported by adjacent flower plots.

Pollination and yield increased in blueberry fields adjacent to flower plots after two years of establishment.

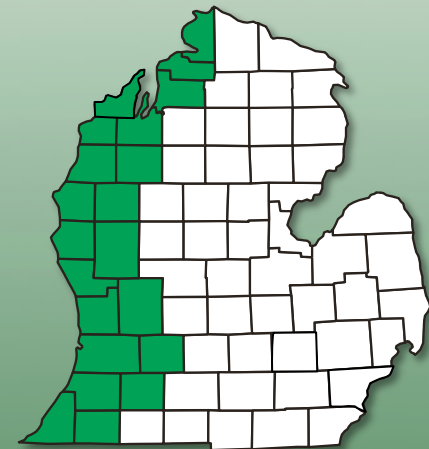


<http://nativeplants.msu.edu>

Establishment and funding support



- Michigan CRP-SAFE Program, CP38E
 - State Acres for Wildlife Enhancement, administered by the Farm Service Agency.
 - NRCS provides technical assistance.
- 2500 acre SAFE pilot project for pollinator habitat
 - *2009-2013*
 - Working lands in west Michigan counties
 - Minimum of 2 acres for wildflowers
 - 90% of establishment costs (~\$600 per acre)
 - Annual land rental payment, 10-15 year contract
 - Mid-contract management cost-share
 - Currently 1700 acres enrolled



Acknowledgements



Collaborators:

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- Kyle Ringwald
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- Jacob Morden

Trevor Nichols Research Complex

Flower sources:

- Michigan Wildflower Farm
- Wildtype Design, Native Plants & Seed

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- Sustainable Agriculture Research and Education (SARE)
- The Department of Entomology at MSU and the Hutson Endowment

Contact Brett Blaauw at blaauwb1@msu.edu



Sustainable Agriculture
Research & Education

Thank you for listening

