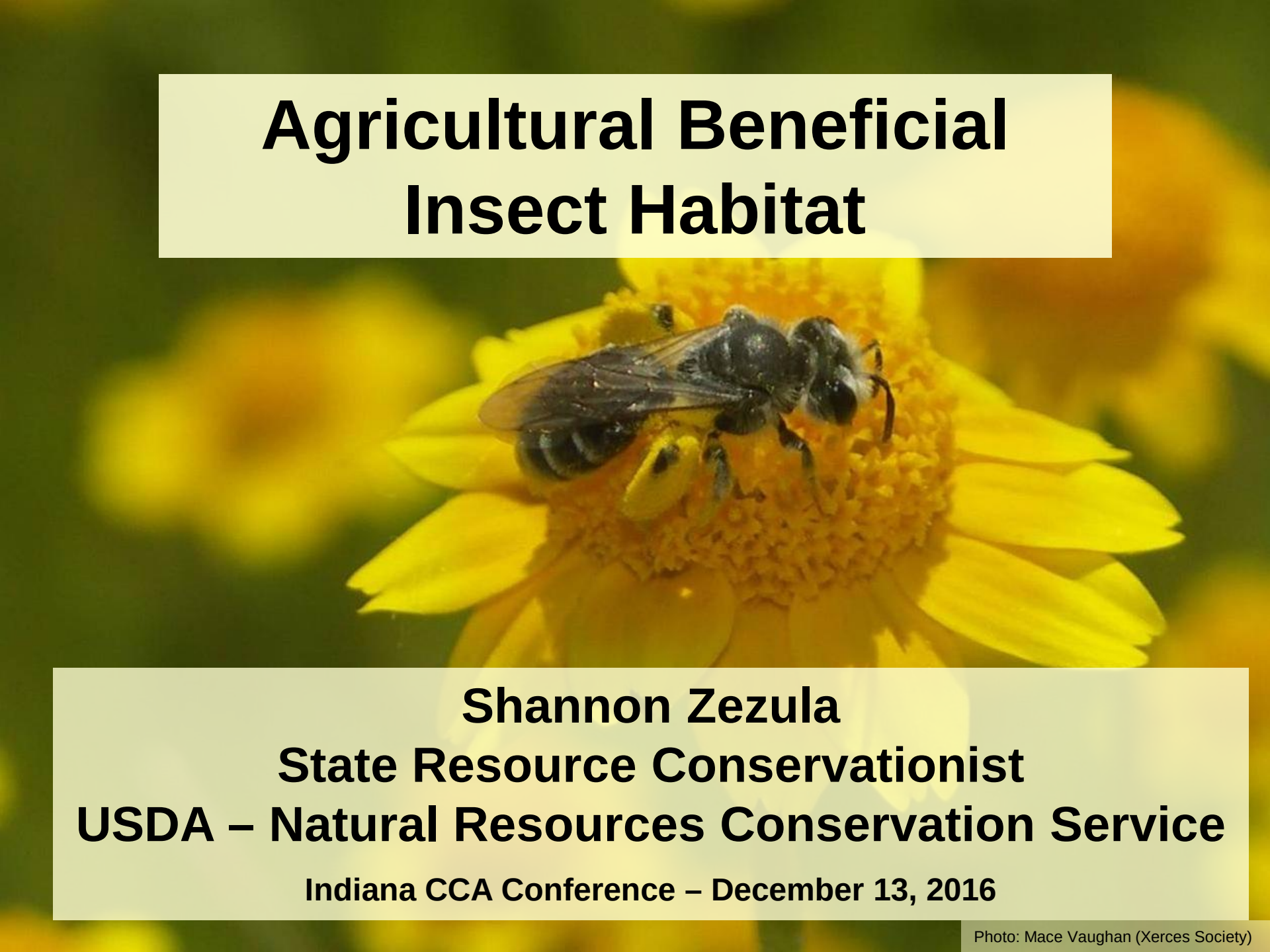
Agricultural Beneficial Insect Habitat



Shannon Zezula
State Resource Conservationist
USDA – Natural Resources Conservation Service

Indiana CCA Conference – December 13, 2016

Photo: Mace Vaughan (Xerces Society)

TOPICS

- Who are the beneficial insects?
- Why are insects important to agriculture?
- Current issues
- What do they need?

- Available Programs and Resources

Who Are the Beneficial Insects?

Photo: Hannah Gaines (University of Wisconsin)

Insect Diversity on Earth

Insects are the most diverse animals on the planet!

For every pest species, there are 1,700 species that are either beneficial or that we simply don't understand

Jonathan Lundgren
USDA-ARS
Brookings, SD

Who Are the Pollinators?

- Birds
- Bats
- Insects

Dean E. Biggins, USFWS

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A quick clarification…

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Who are the (Insect) Pollinators?

- Honey Bees are the No. 1 pollinator
  (about 75% of crops)

Native Pollinators: Native Bees

NATIVE BEES

- ≈ 4,000 Species in N.A.
- +95% are Solitary - unlike the honey bee
- By The Way...Most Are Unwilling to Sting!

Photo: Nancy Adamson (Xerces Society)

Native Bee Efficiency

NATIVE BEES

- Forage in colder and wetter weather
- European Honeybees forage up to 1,000 ft.
- Native Bees will forage 1,500 - 3,000 ft.

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Photo: Mace Vaughan

More Efficient Pollinators

250 female orchard mason bees **=**

1.5 - 2 European Honeybee hives
(15,000 - 20,000 bees)

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Photo: Rufus Isaacs,
Michigan State University

Native Pollinators: Other Insects

- Flower Flies
- Butterflies and Moths
- Flower-visiting Beetles

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Other Beneficials

Biological Control:

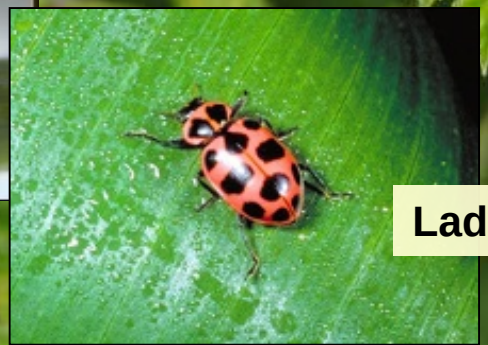
Many of the flowering plants that support pollinators…also support predatory and parasitic insects

(B. Newton, 2004)

Soldier beetle

Syrphid fly drinking raspberry nectar

Parasitoid wasp



Ladybug beetle

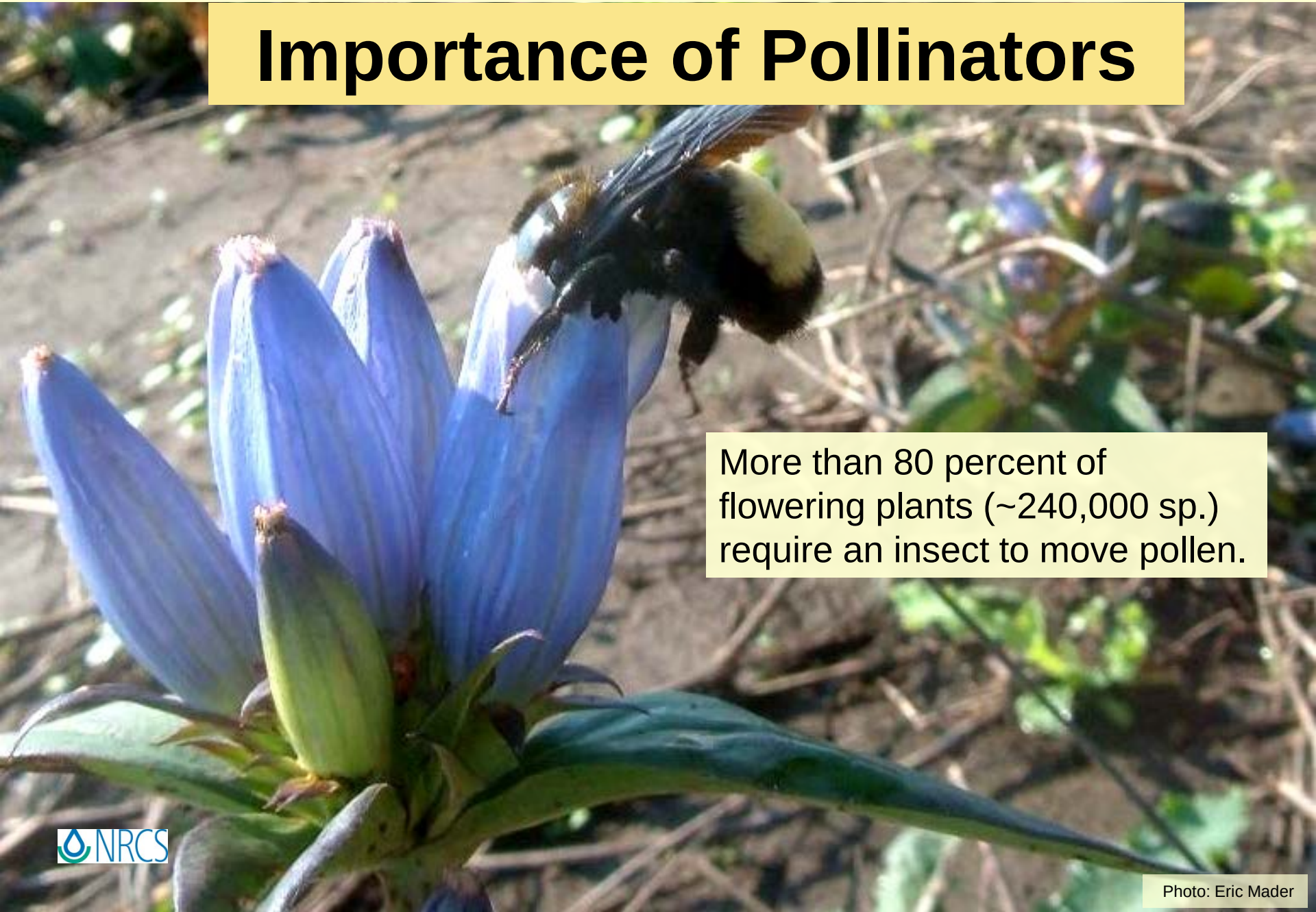
Photo: Alex Wild

Background Photo: Mace Vaughan (Xerces)

Why are Insects Important?

Photo: Hannah Gaines (University of Wisconsin)

Importance of Pollinators



More than 80 percent of flowering plants (~240,000 sp.) require an insect to move pollen.

Photo: Eric Mader

Importance of Pollinators

Pollinators enable plants to produce fruits and seeds:

- 35% of crop production, worldwide
- One in three mouthfuls of food and drink we consume
- U.S. = $18 to $27 billion value of crops ($217 billion worldwide). $3 billion pollinated from Wild Native Bees

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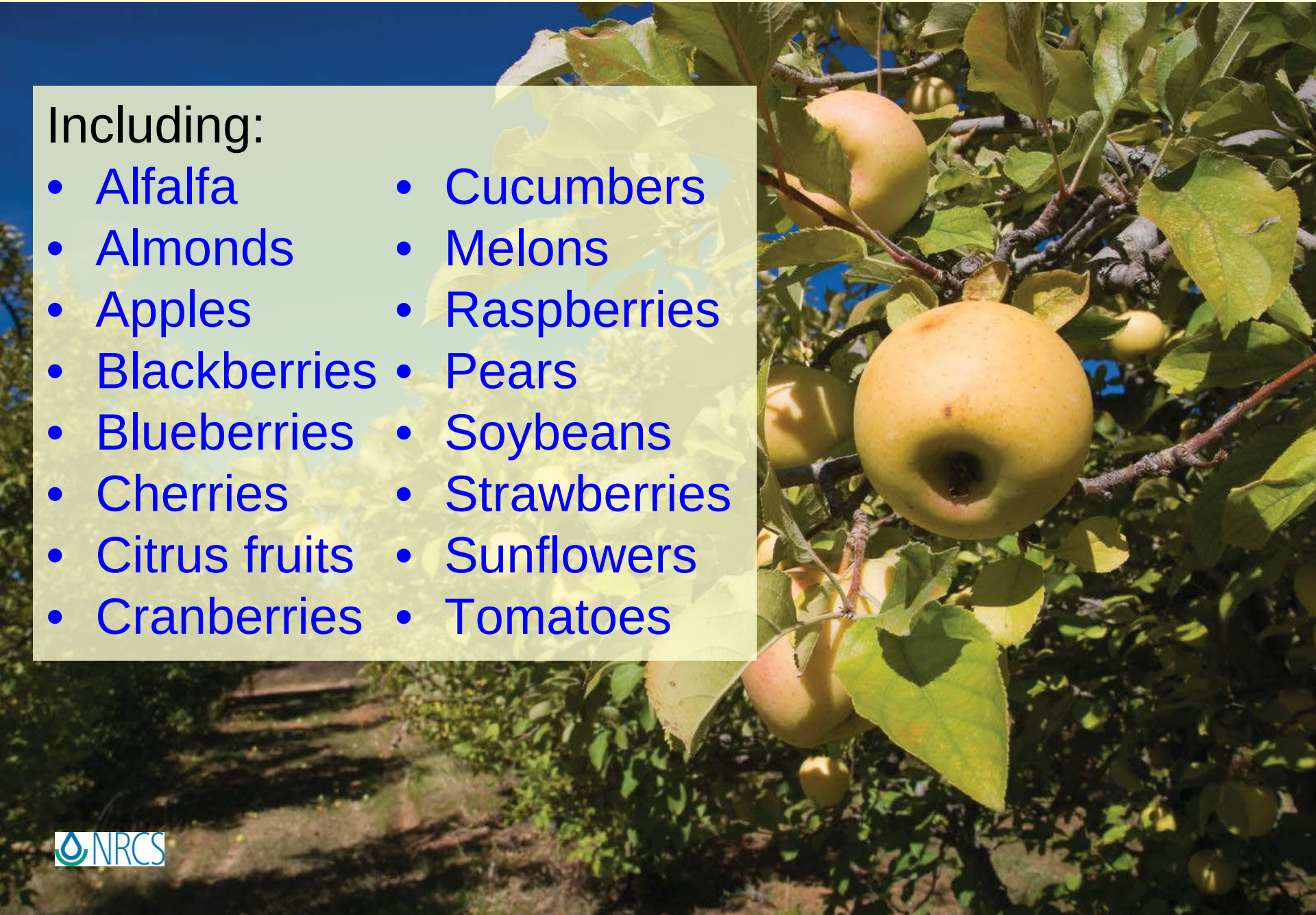
Photo: USDA-ARS/Peggy Greb

Major U.S. Crops



Including:

- Alfalfa
- Almonds
- Apples
- Blackberries
- Blueberries
- Cherries
- Citrus fruits
- Cranberries
- Cucumbers
- Melons
- Raspberries
- Pears
- Soybeans
- Strawberries
- Sunflowers
- Tomatoes

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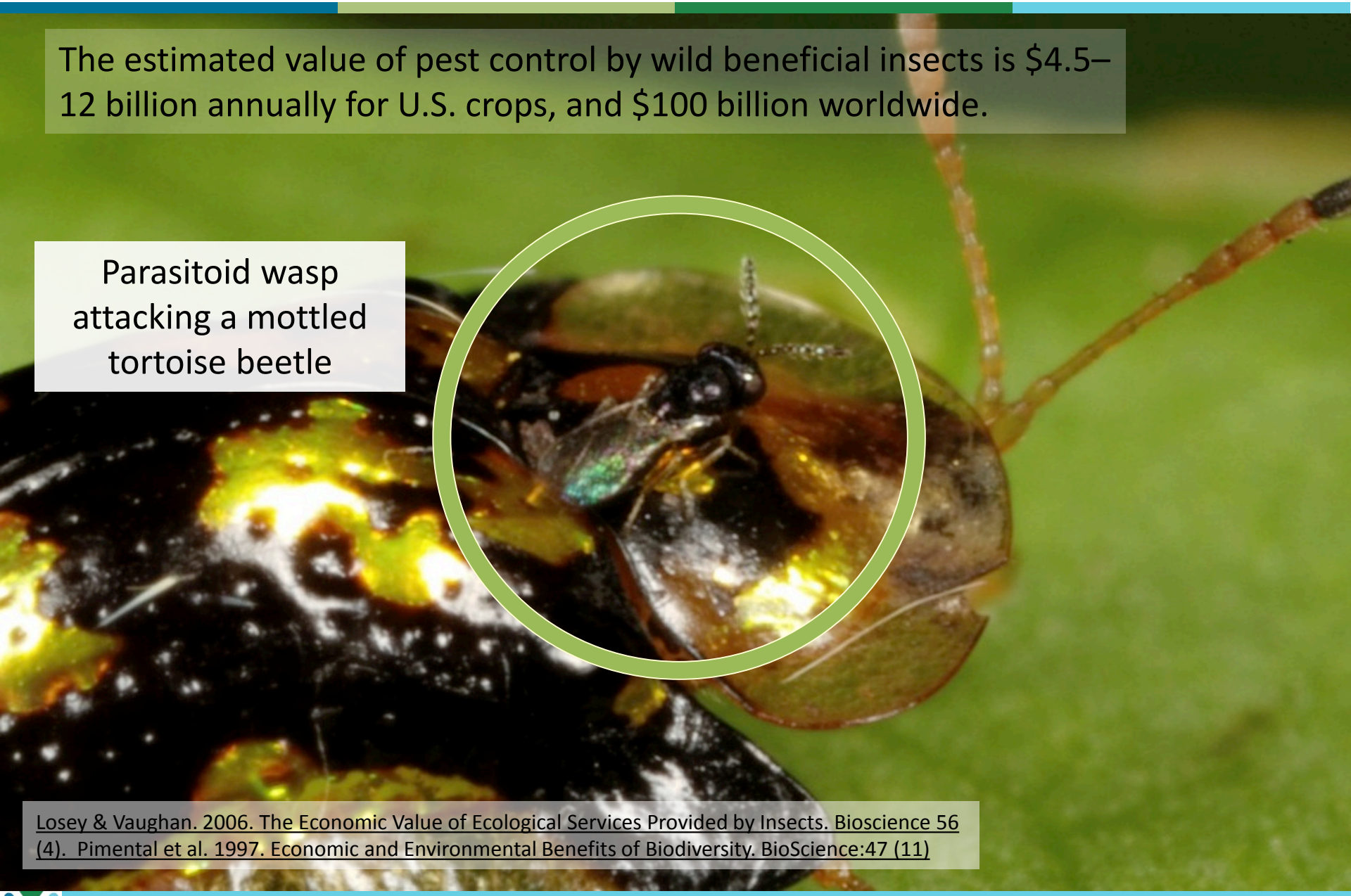
What is Conservation Biocontrol?

The estimated value of pest control by wild beneficial insects is $4.5–12 billion annually for U.S. crops, and $100 billion worldwide.



Parasitoid wasp attacking a mottled tortoise beetle

Losey & Vaughan. 2006. The Economic Value of Ecological Services Provided by Insects. Bioscience 56 (4). Pimental et al. 1997. Economic and Environmental Benefits of Biodiversity. BioScience:47 (11)

What is Conservation Biocontrol?

"The greatest single factor in preventing insects from overwhelming the rest of the world is the internecine warfare which they carry out among themselves"

- Dr. Robert Metcalf

Assassin bug eating stink bug on raspberry

Photo: Nancy Adamson

Some of the Issues

Photo: Hannah Gaines (University of Wisconsin)

Honey Bees in Decline

Fewer Honey Bees:

- 50% decline in managed hives since 1950
- Annual beekeeper losses
- 70-100% decline in wild colonies since 1995 in some areas of the US

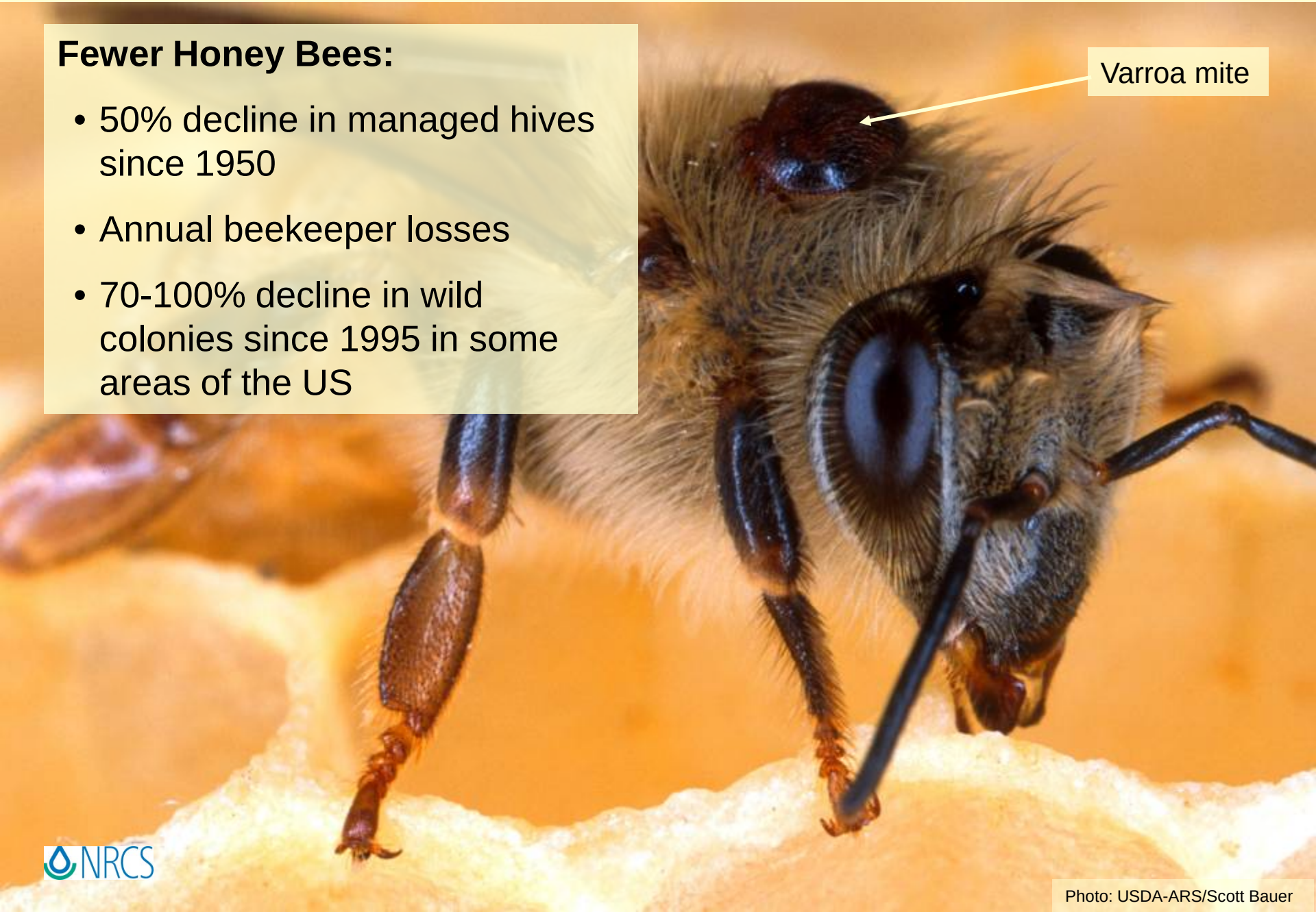


Photo: USDA-ARS/Scott Bauer

Possible Causes

Causes of bee losses:

- Insecticides?
- Poor diet (monocultures)?
- Lack of flowers/habitat?
- Disease/pathogen?
- Invasive plants?
- Pests?

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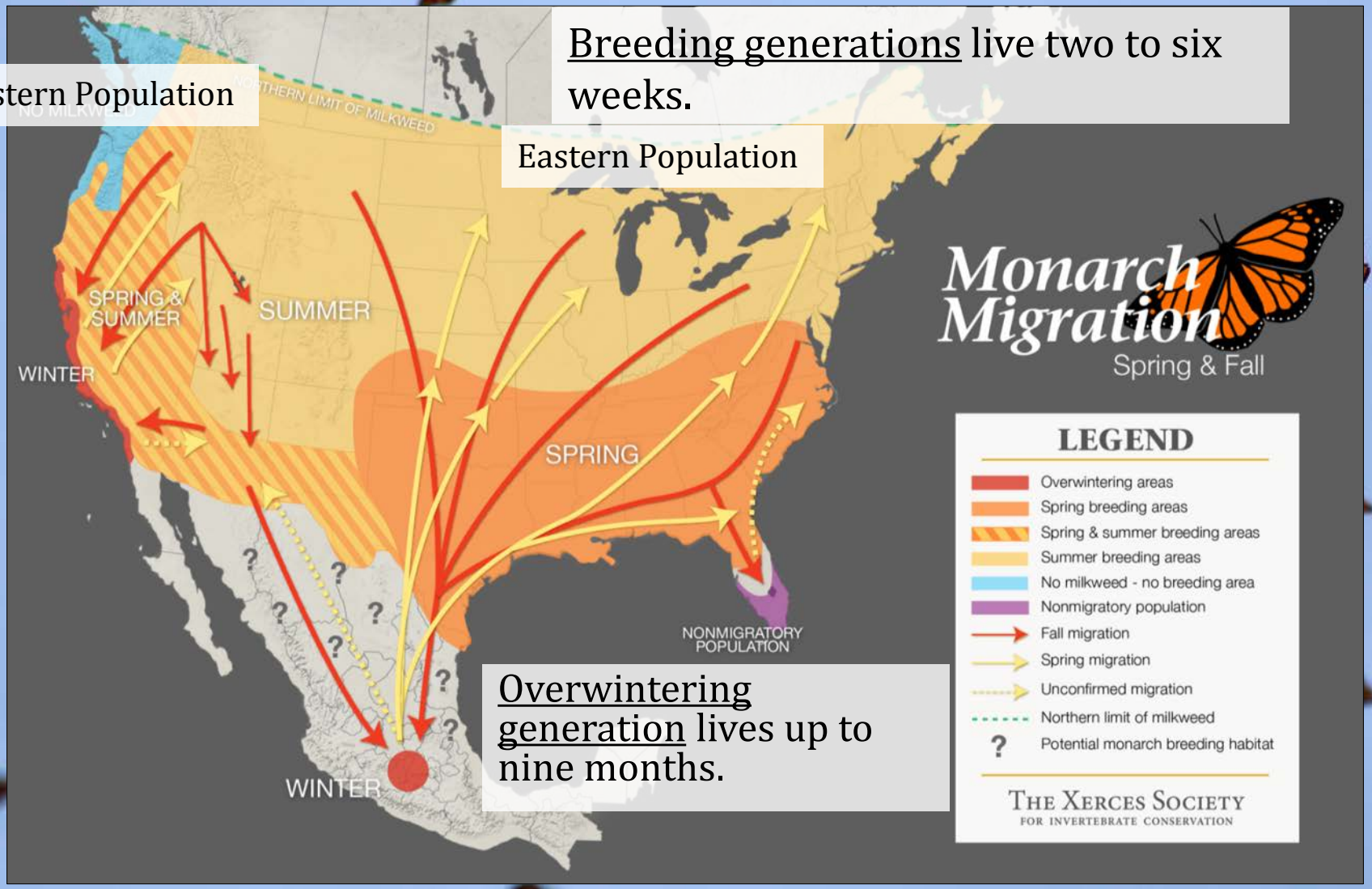
Photo: USDA-ARS/Scott Bauer

North American Monarch Migration

Western Population

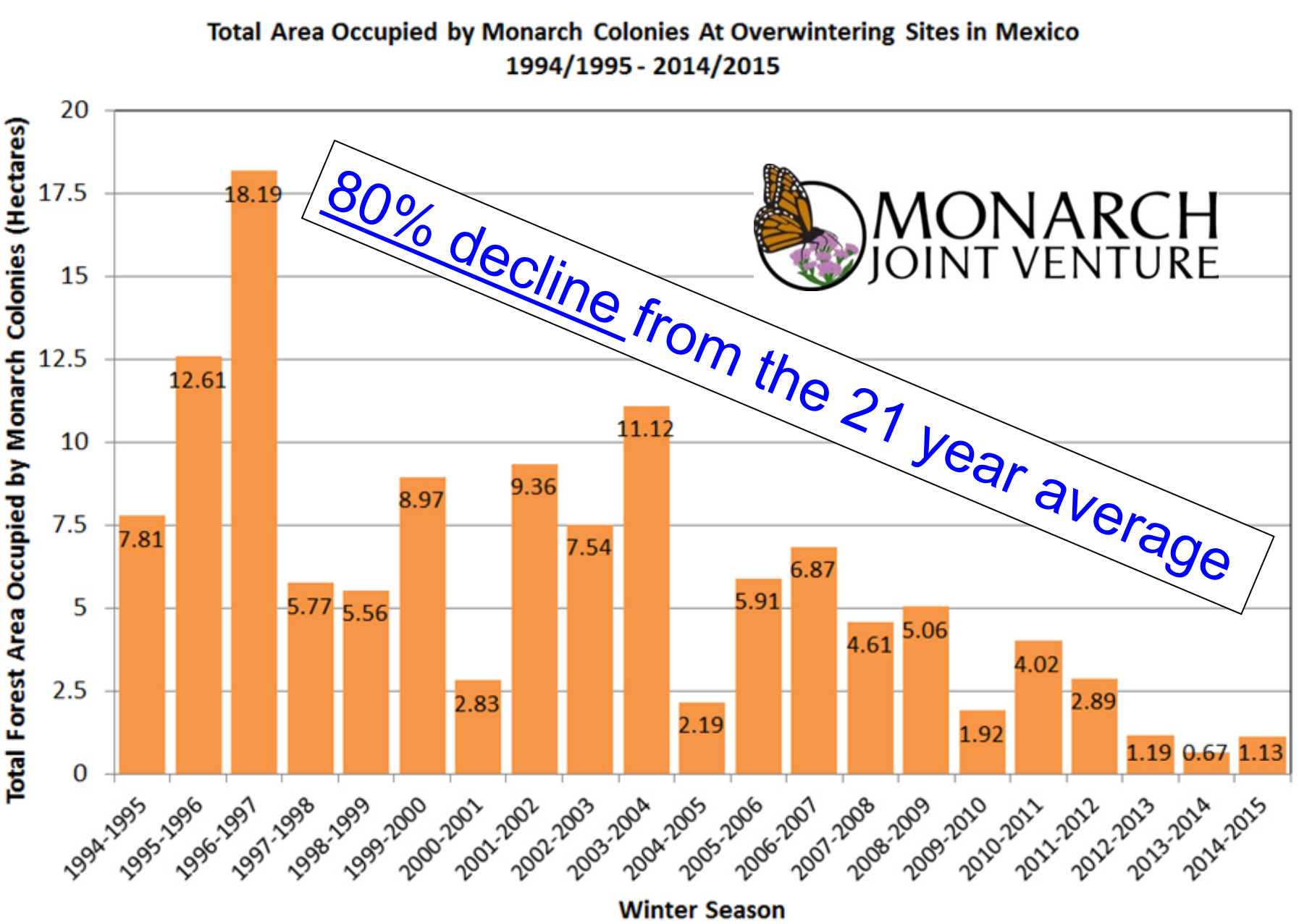
Eastern Population

Breeding generations live two to six weeks.



Overwintering generation lives up to nine months.

Photograph courtesy of Pablo Leautaud; map courtesy of The Xerces Society.



data from 1994-2003 were collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Protected Natural Areas (CONANP) in Mexico. Data from 2004-2015 were collected by the WWF-Telcel Alliance, in coordination with the Directorate of the MBBR. 2000-01 population number as reported by Garcia-Serrano et. al (The Monarch Butterfly : Biology and Conservation, 2004)

Primary Threats to the Monarch

- Loss of milkweed plants
- Large-scale use of insecticides
- Degradation/deforestation of overwintering sites in Mexico (Illegal logging)
- Climate change:
  - Extreme weather events (drought/rain)
- Natural enemies such as diseases, predators, and parasites

Photograph courtesy of Pablo Leautaud.

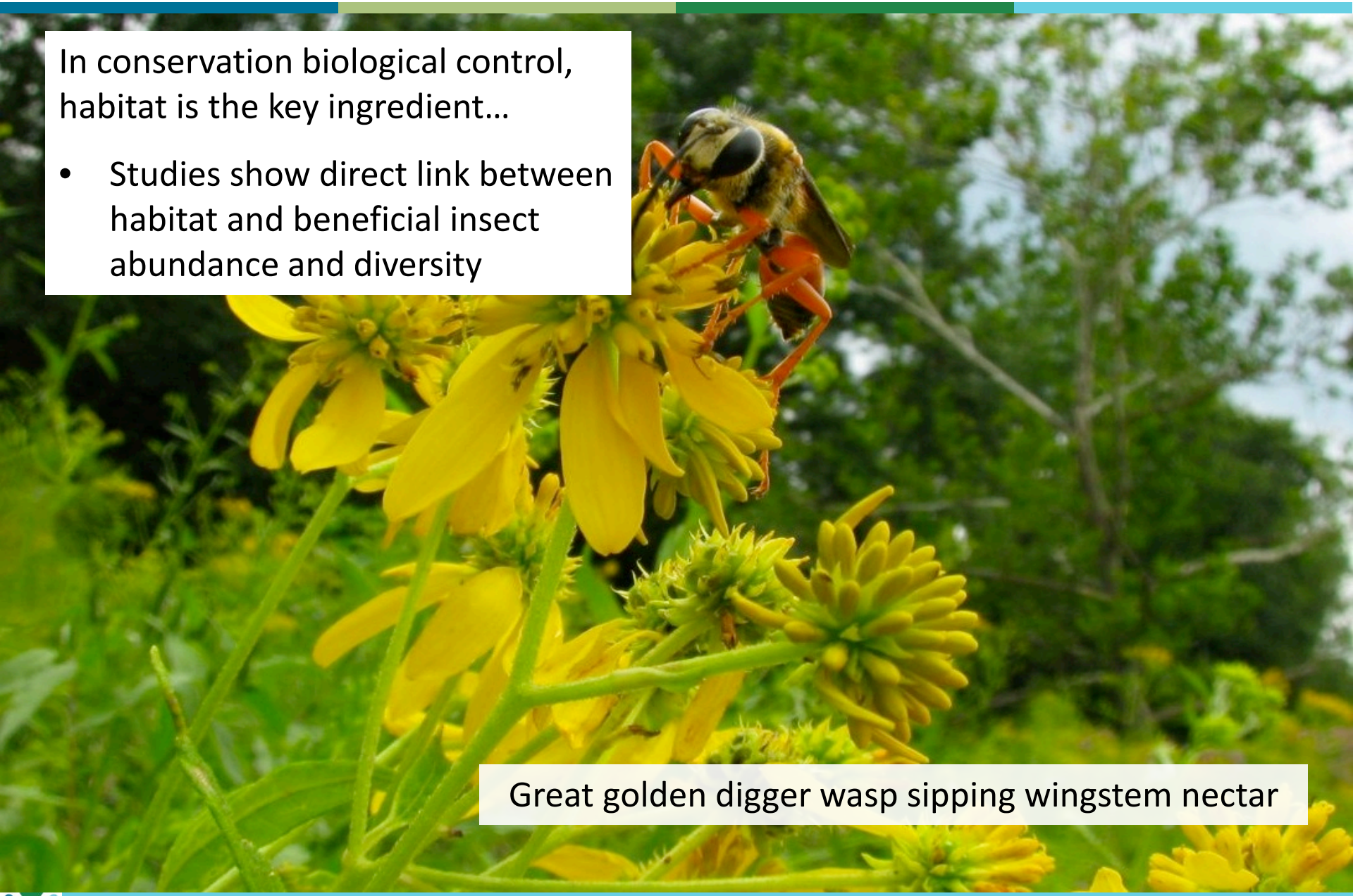
Habitat Needs

Photo: Hannah Gaines (University of Wisconsin)

Conservation Biocontrol and Habitat

In conservation biological control, habitat is the key ingredient…

- Studies show direct link between habitat and beneficial insect abundance and diversity



Great golden digger wasp sipping wingstem nectar

Photo: Nancy Adamson

What do beneficial insects need?

- Food
  - Nectar
  - Pollen
  - Larval food source
  - Prey
- Nesting Sites
  - Wood-cavity nesting
  - Ground nesting
- Overwintering Sites

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Food

Pollen & Nectar Sources:

- Flowers
- Clovers
- Shrubs
- Trees

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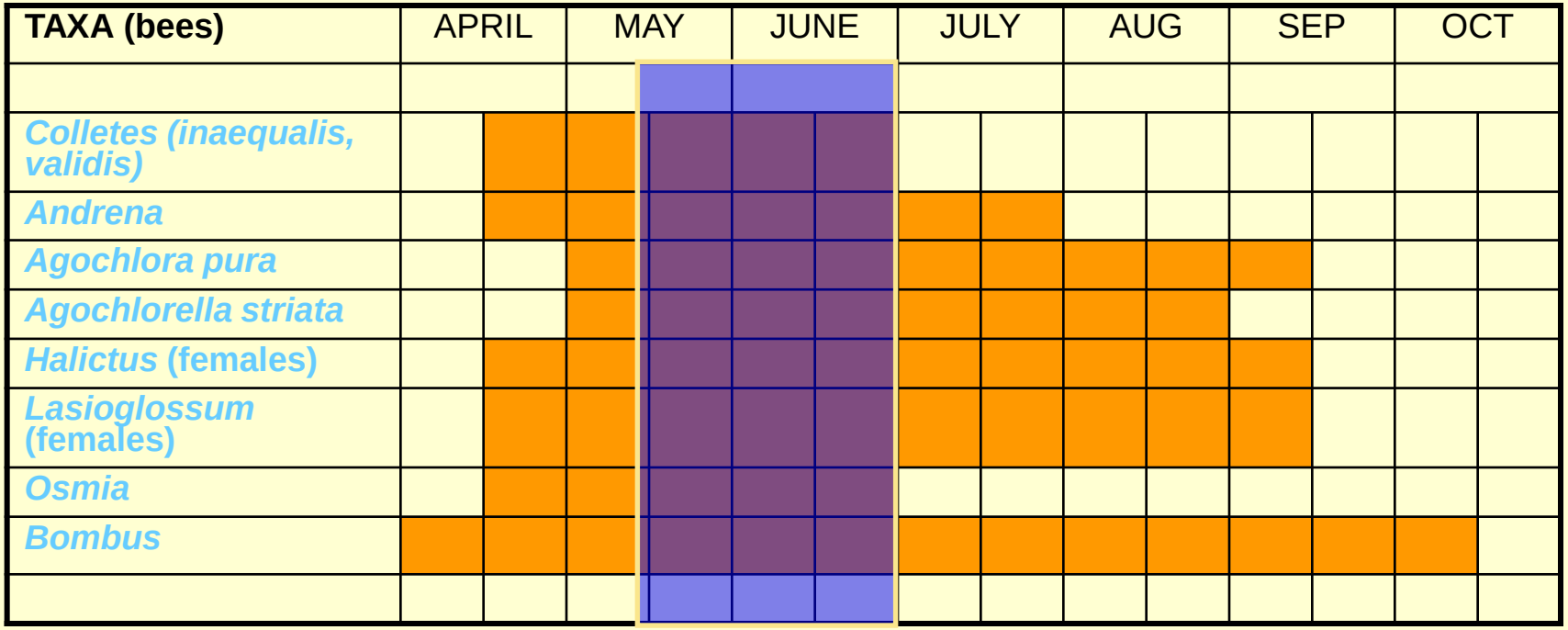
Pollinator Habitat

NEEDED: Forage to support bees before and after crop bloom

Example: Native bees flight periods vs blueberry bloom



Sample Planting list

Wildflower Genera	**APRIL**		MAY		JUNE		JULY		AUG		SEP		**OCT**	
Golden Alexanders *Zizia aurea*														
Blue false indigo *Baptisia australis*														
White beardtongue *Penstemon digitalis*														
Wild Bergamot *Monarda fistulosa*														
Mountain mint *Pycnanthemum virginianum*														
Swamp milkweed *Asclepias incarnata*														
Marsh Blazing star *Liatris spicata*														
Spotted Joe Pye weed *Eupatoriadelphus*														
Wingstem *Verbesina alternifolia*														
Common Ironweed *Vernonia fasiculata*														
Sneezeweed *Helenium autumnale*														
New England Aster *Symphyotrichum novae-angliae*														

What do beneficial insects need?

- Food
  - Nectar
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  - Larval food source
- Nesting Sites
  - Wood-cavity nesting
  - Ground nesting
- Overwintering Sites

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Nesting Sites:

- About 30% of native pollinators nest in holes or tunnels in wood
- Native bees will not use traditional honey bee artificial hives

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Nesting Sites

70% of native pollinators nest in the Ground

Dennis Briggs (UC Davis)

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What do beneficial insects need?

- Food
  - Nectar
  - Pollen
  - Larval food source
- Nesting Sites
  - Wood-cavity nesting
  - Ground nesting
- Overwintering Sites

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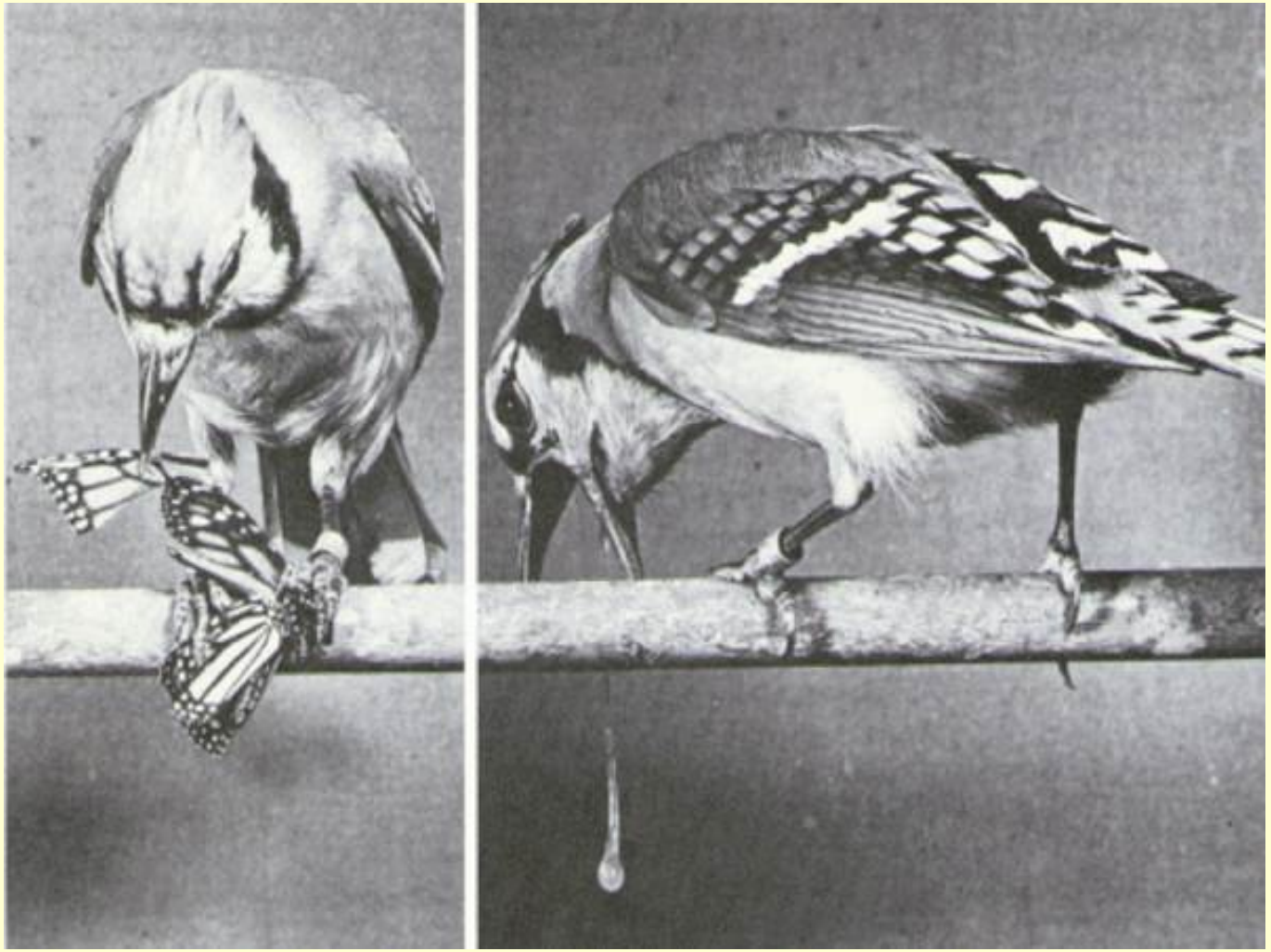
Bumble Bee Queens need protected sites in which to overwinter. These often occur in the soft humus, leaf litter, or other sites protected from extreme winter weather into which they can burrow

Monarch Habitat – The Missing Link: Milkweed

- Milkweed is THE host plant for monarchs
- Only plant Monarchs lay their eggs on
- Only food source for monarch larvae
- Milkweed is disappearing from the landscape:
  - Weed Control Efficiency
  - Mowing/spraying of odd areas/rd. ditches
  - Urban sprawl and development

Wikimedia Commons



Planning for beneficial insects

Photo: Hannah Gaines (University of Wisconsin)

Planning for Beneficial Insects

1. Integrated Pest Management
2. Protect, Enhance, and Establish habitat.
   a. Do Not Disturb (“Never-Till”)
   b. Diversity (nectar, pollen, cover)
   c. Soil health management systems!

Photo: Nancy Adamson (Xerces Society)

Soil Health Management Systems:

Soil Health Principles

What is *Soil Health*?

- **Soil Health Key Indicators =**
  - Increas**ing** organic matter
  - Improv**ing** aggregate stability
  - Increas**ing** water infiltration
  - Increas**ing** water-holding capacity
  - Improv**ing** nutrient cycling
  - Enhanc**ing** and diversify**ing** **SOIL BIOLOGY**

Soil Health is not a destination...it's a Journey

Achieving soil health takes a *SYSTEMS* Approach

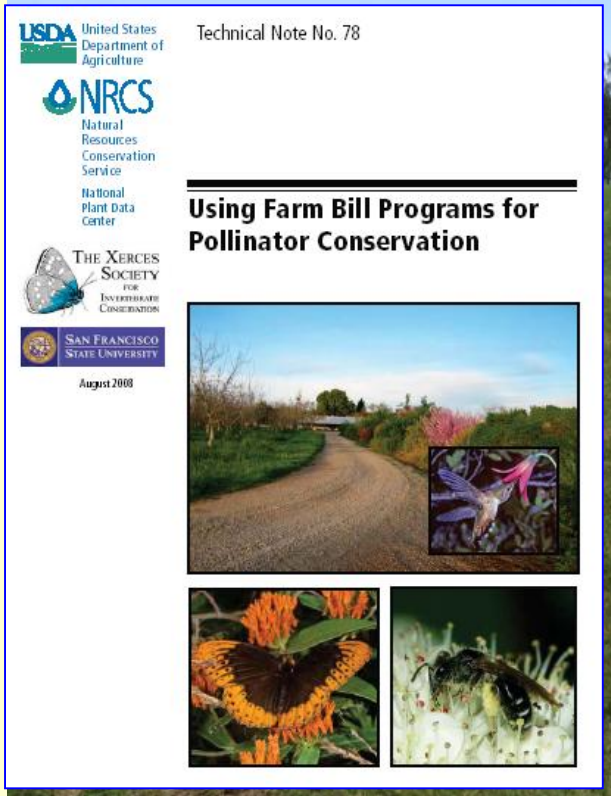
- A Quality No-till (Never-Till) System
- Diverse and Strategic Cover Crops
- Adapted Nutrient Management
- Integrated Weed & Pest Management
- Diverse Crop Rotations
- Precision Farming Technology
- Prescriptive Buffers and other edge-of-field practices

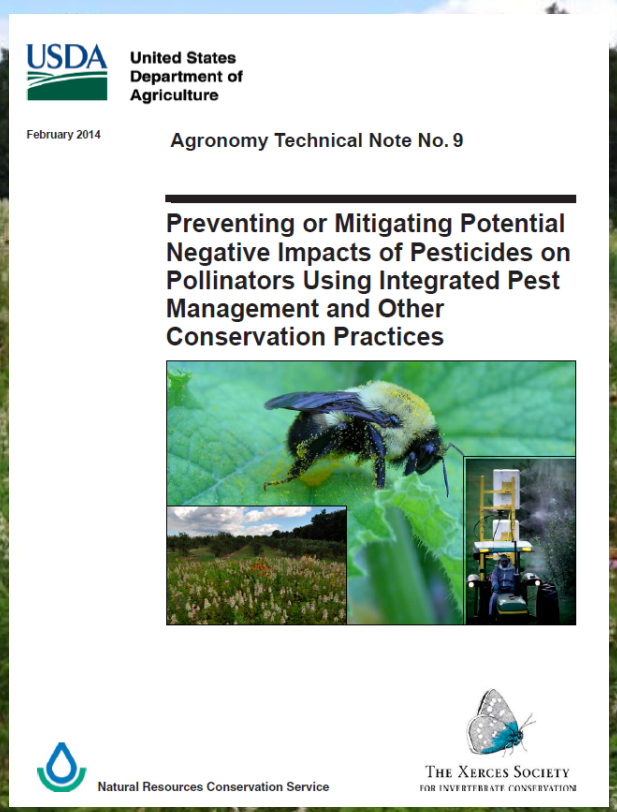
Soil Health is not a destination...it's a Journey

Monarch (and others) What Can We Do?

- Plant or manage for Milkweeds!
- Fuel the annual migration with Mid- & Late-blooming species including:
  - New England Aster
  - Stiff Goldenrod
  - Tall Ironweed
  - Spotted Joe-Pye Weed
  - Rough Blazing Star

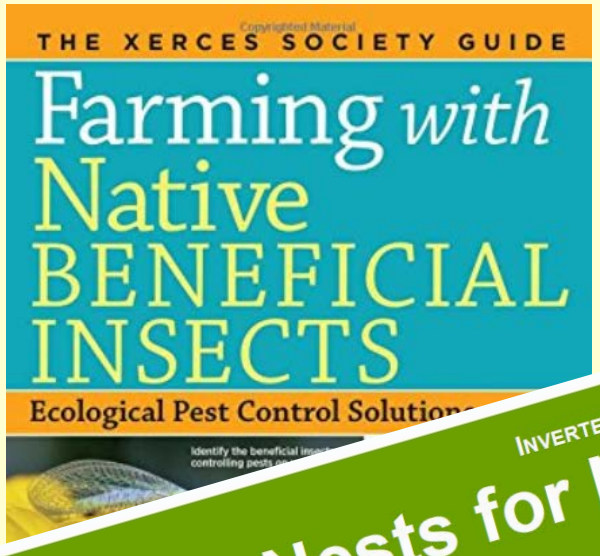
NRCS Technical Notes

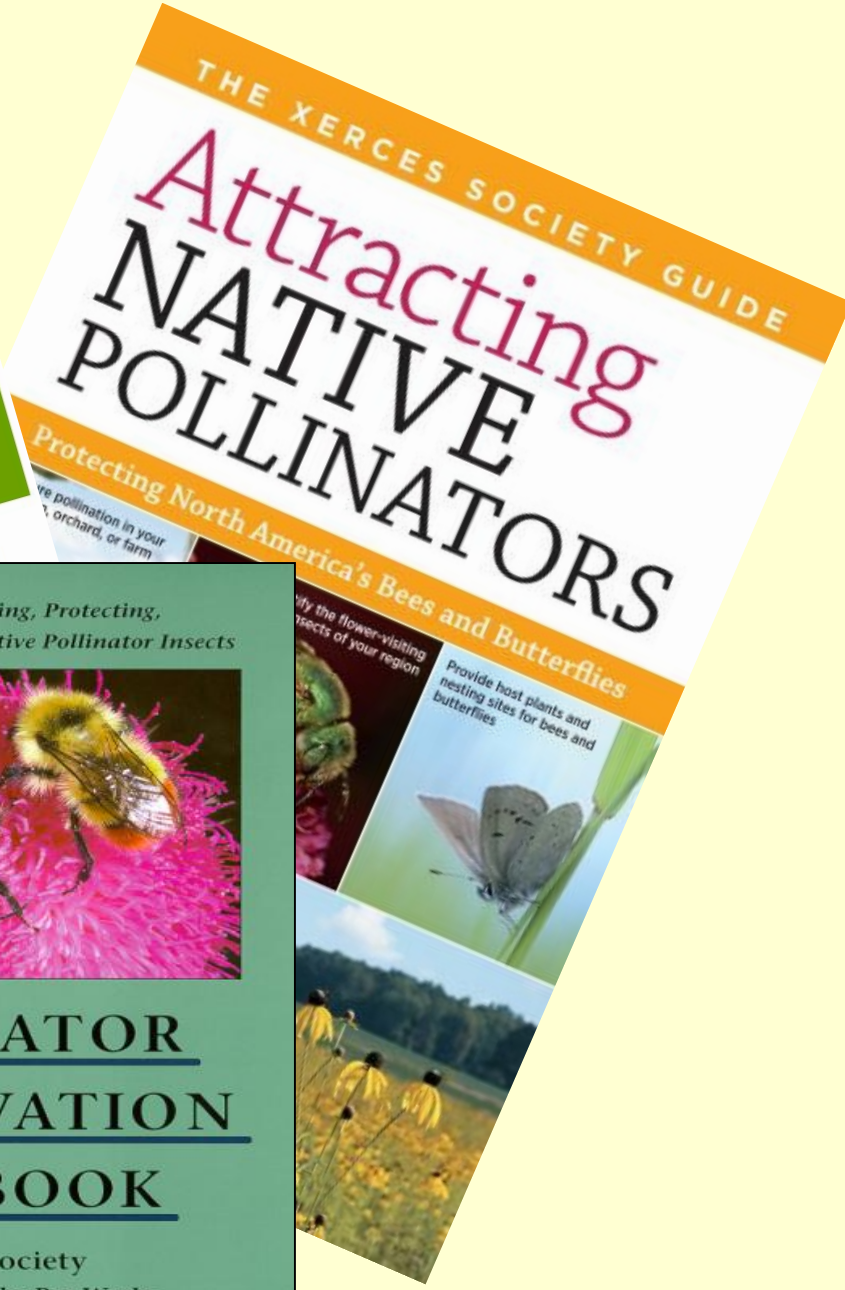




Photos: Don Keirstead, NRCS

The Xerces Society Pubs





Purdue Pesticide Pubs

- **Protecting Honey Bees From Pesticides (includes pesticide toxicities):**
  http://extension.entm.purdue.edu/publications/E-53.pdf
- **Midwest Vegetable Production Guide for Commercial Growers 2014 (ID-56):**
  http://www.btny.purdue.edu/pubs/ID/ID-56/
- **How to Minimize Pesticide Damage of HBs:**
  http://extension.entm.purdue.edu/publications/E-260.pdf
- **Purdue Bee Hive:**
  http://extension.entm.purdue.edu/beehive/

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Photos: Kathy Keatley Garvey (University of California, Da

Take Home Message:

- Agricultural insects are important!
- Agricultural insects need food & a home
- Beneficial Insects can be helped by:
  - Planting or managing (season-long) flowering plants – including Milkweed
  - Provide undisturbed soil
  - Using insecticides wisely (IPM)

Photos: Mace Vaughan (Xerces Society)

Any questions?

Photograph courtesy of Samuel.