



Unsung Heroes: Meet the beneficial insects doing good work on your farm

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Conservation Planner and NRCS Partner
Biologist**

Practical Farmers of Iowa
Conference

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On the Ground Conservation

Pollinators Agricultural Biodiversity Endangered Species Aquatic Invertebrates Pesticides Urban Conservation



Xerces-NRCS Conservation Partnership

USDA Natural Resources Conservation Service

- Joint Staff Biologist positions with USDA NRCS
- Technical assistance for Farm Bill programs
- Developing / enhancing on-farm pollinator habitat
- Financial support for conservation
- Find out more at: www.nrcs.usda.gov



Photo: Kelsey Fleming



Overview

- Importance of pollinators and beneficial insects
- Pollinators, beneficial insects, and their habitat needs
- Role and protection of on-farm habitat



Photo: Barbara Driscoll/Xerces Society

Part 1: Importance of Pollinators and Beneficial Insects



Photo: Nancy Adamson, Xerces Society

“The Little Things that Run the World”

Only a small fraction (~2%) of insects are pests.
The rest are beneficial to humans or important for food webs



Photo: Piotr Naskrecki

Insect Pollinators: Ecological Keystone

More than 85% of flowering plants require an animal, predominantly insects, to transfer pollen



Photo: Long horned bee, Jennifer Hopwood, Xerces Society

Pollinator Conservation and Prairie Wildlife

- 25% of the bird and mammal diets consist of pollinator-produced seeds/fruit
- Pollinators are food for wildlife
- Pollinator conservation benefits other wildlife



Dickcissel (*Spiza americana*)

Photo: Bobby Harrison

Beneficial Insects: Pest Control



“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



Photo: Xerces Society / Nancy Adamson

Conservation Biological Control



Photo: Parasitoid wasp attacking a mottled tortoise beetle, by © Margy Green / www.margygreen.com

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

Losey & Vaughan. 2006.
BioScience:47 (11)

Conservation Biological Control



Photo: Parasitoid wasp attacking a mottled tortoise beetle, by © Margy Green / www.margygreen.com

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Part 2: Pollinators, Beneficial Insects, and Their Habitat



Meet the Pollinators



Photos: Sarah Foltz Jordan

Meet the Bees

- Bees actively collect and transport pollen
- Bees exhibit flower constancy
- Forage in around the nest area



Photo: Golden Northern bumble bee, Betsy Betros/Xerces Society

Honey Bees Are Not Typical Bees

The European honey bee – a unique species

- Social bees, caste system (queen, workers, drones), cooperative care
- Perennial colony, overwinters by feeding on honey stores
- Colonies managed for crop pollination: temporarily brought to farms to provide crop pollination



Photo: Robert W. Matthew (University of Georgia; bugwood.org)

Wild Native Bees

Nearly 3,600 species of native bees in the US



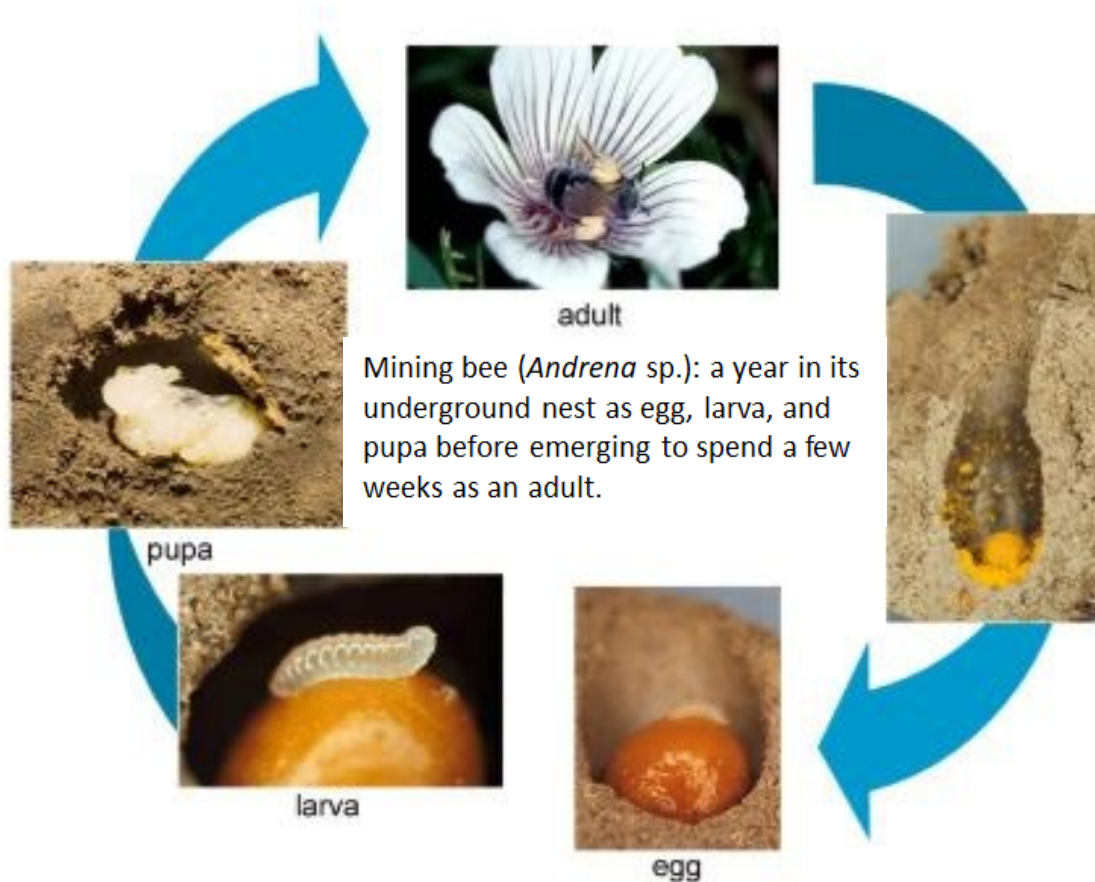
Photos: Doug Walsh, Bob Hammond, Mace Vaughn, Eric Lee-Mader, Nancy Adamson

~70% of Native Bees Nest Underground



- Resemble ant-nests from above ground
- Nest chambers are lined with waxy glandular secretions, and can sometimes even resist flooding

Solitary Bee Life Cycle



Annual Life Cycle

Adults live 3 to 4 weeks

Single female per nest

No workers to provision the nest

Adults emerge to feed and mate

Illustration: Xerces Society; All photographs in this illustration are by Dennis Briggs, except the photograph of the pupa, which is by Robbin Thorp.

Native Bee Diversity: Green Sweat Bees



Photo: Rollin Coville

Native Bee Diversity: Miner Bees



Native Bee Diversity: Long-horned Bees



Photo: Rollin Coville

Native Bee Diversity: Sunflower Bees



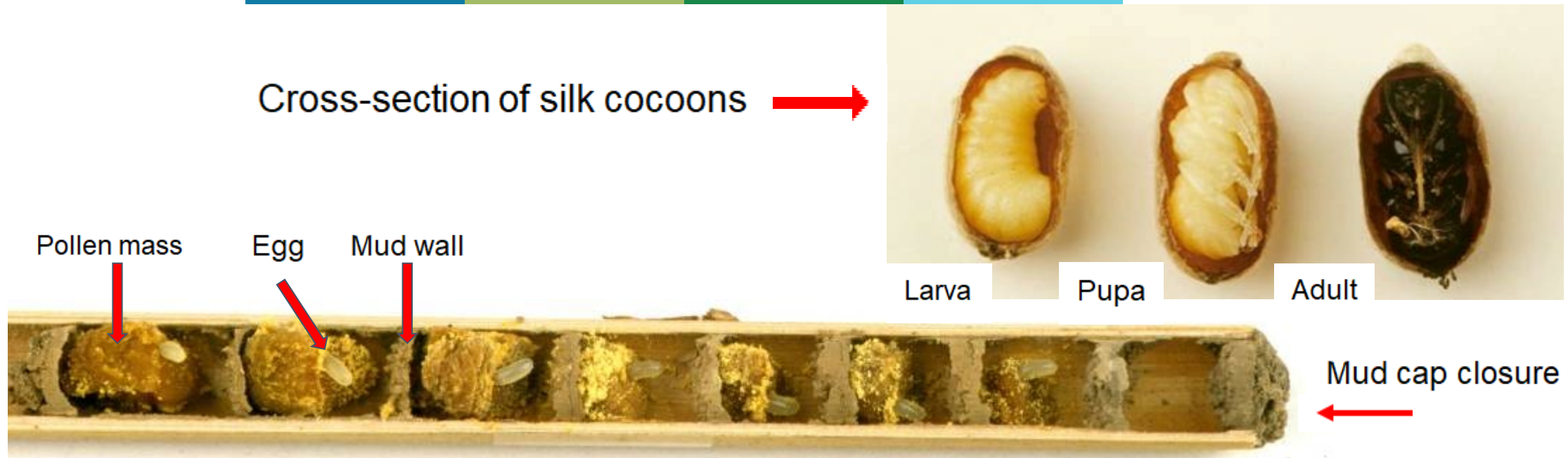
Photos: Rollin Coville; Hilary Sardinas/Xerces Society

~30% of Native Bees are Tunnel Nesting



Photos: Ed Ross, Eric Lee-Mader, Katharina Ullmann

Inside the Nest



Native Bee Diversity: Leaf-cutter Bees



Native Bee Diversity: Mason Bees



Photo: Mace Vaughn, Xerces Society

Native Bee Diversity: Carpenter Bees (large)



Photo:Katie Lamke

Native Bee Diversity: Carpenter Bees (small)



Social Colonies: Bumble Bees



46 species in North America

Social: Queen, workers, males

20-400 workers per nest

Annual colonies

Photos: Mace Vaughan, Elaine Evans, Eric Lee-Mader

Bumble Bee Colony Life Cycle

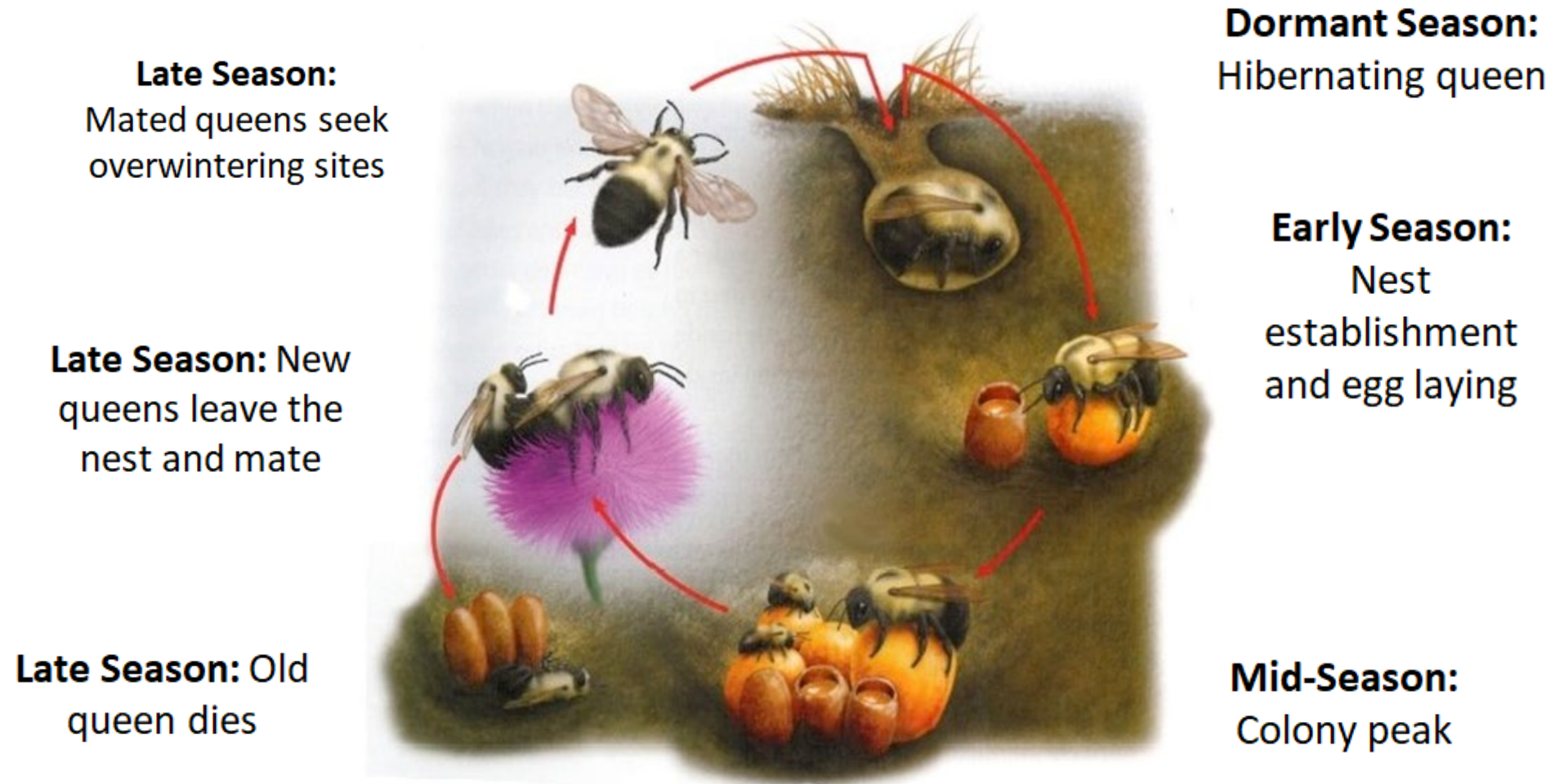


Illustration: David Wysotski

Bumble Bee Status

In the USA and Canada, approximately **one quarter of all bumble bee species** are in a Red List threatened or near threatened category, according to the International Union for the Conservation of Nature (IUCN) Red List Criteria.

Five species at risk in Iowa

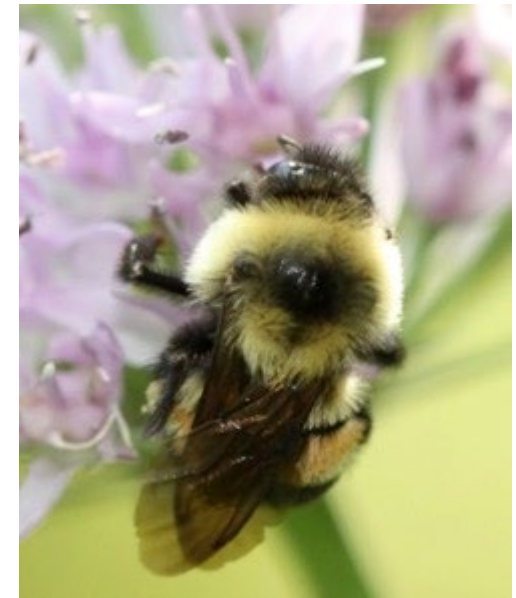
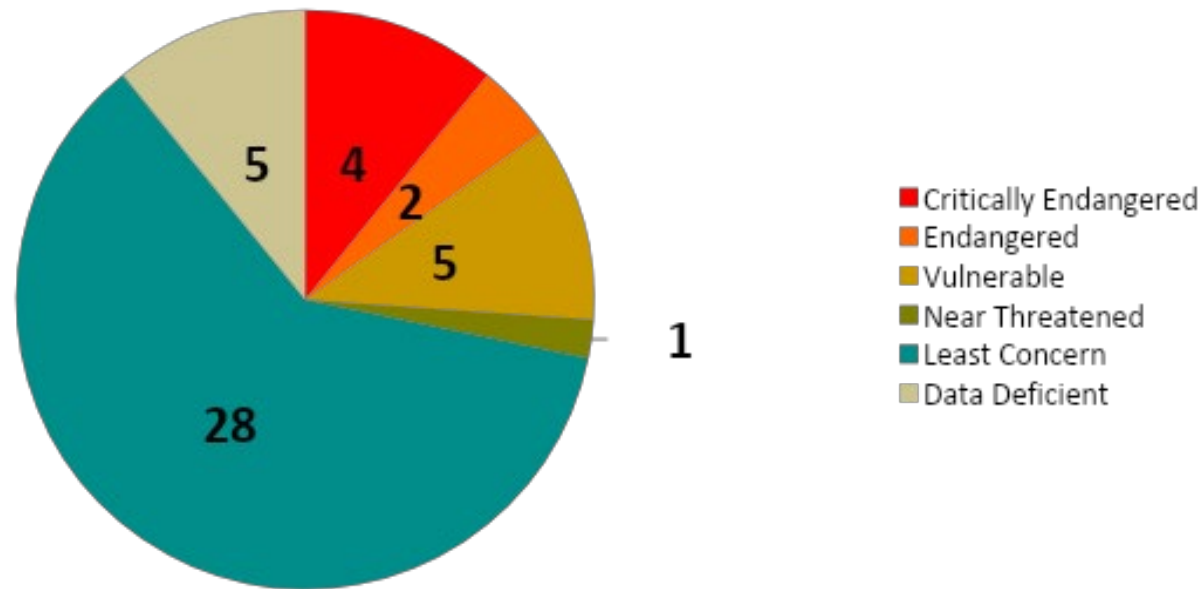




Photo: Lacewing larva consuming aphid by Alex Wild

Common Beneficial Insect Groups

Insect Predators

Insect Parasitoids

- Generalist vs. Specialists

Non-insects

- Spiders, centipedes, predatory mites, nematodes

Some are also pollinators:

- Flies, wasps, beetles

Predators: Lacewings

Larvae can consume 400+ aphids per week!

Adults of some species also predaceous, and eat nectar, pollen

Overwinter in leaf litter, soil, under bark

More active in cool weather than other predators



Photos: Adult green lacewing on flower head, Sarah Foltz Jordan; Lacewing eggs, by Sylvia Delfino; Lacewing larva – Katja Schulz via flickr

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

Predators: Ground Beetles

- Larvae and adults are important predators of soil pests
- Non prey foods include weed seeds, pollen, fungi, detritis
 - Overwinter in bunch grass clumps



Photos: Sarah Foltz Jordan, Grinnell Heritage Farm



Predators: Predatory Wasps

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



Photos: Sarah Foltz Jordan; Xerces Society

Predators: Parasitic Wasps

- Lay eggs on or in hosts or host eggs, larval stage feeds and eventually kills host



Photo: Alex Wild, Vegedge, UMN



Habitat Needs of Natural Enemies

Necessary for certain life stages
e.g. Protein for egg development



Alternate food
source

Increases
reproduction
and longevity



Photos: Predatory wasp on apple, Xerces Society/Nancy Adamson; Syrphid fly, Adam Varenhorst; Lady beetle eating pollen, Thelma Heidel-Baker

Natural Enemies Need Alternative Prey

Habitat can
provide alternate
prey when crop
pests are absent

*Lady beetle larva
eating oleander aphids
(not a crop pest) on
milkweed*



Photo: Alex Wild

Habitat provides shelter and egg-laying sites

Brush piles, rock piles, woody and pithy stems, leaf litter, **undisturbed ground**



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Part 3: The Role and Protection of Farm Habitat



Photo: Michael Ware, 14 yr old CRP Planting, Jasper County

What Habitat Provides



Photo: Sarah Nizzi

Nesting cover

Food (nectar & pollen,
host plants)

Breeding opportunities

Overwintering sites

Protection from
pesticides

Flowers provide pollen and nectar

Pollinators need a succession of bloom

**Early season,
spring blooms**



Early-summer
blooms



Late-summer
blooms



Fall blooms



Photos: Karin Jokela
Flowers left to right: Blue-eyed grass, Prairie rose, Sneezeweed, New England aster

The Role of Farm Habitat



Photo: Cameron Newell, Xerces Society; Grinnell Heritage Farm

If more than 20% of a farm is diverse habitat, pest control by beneficial insects is observed throughout fields (Tscharntke et al. 2002).

The Role of Farm Habitat

Field Borders

Diverse native forb plantings

Hedgerow Plantings

Diverse flowering native shrubs

Cover Crops

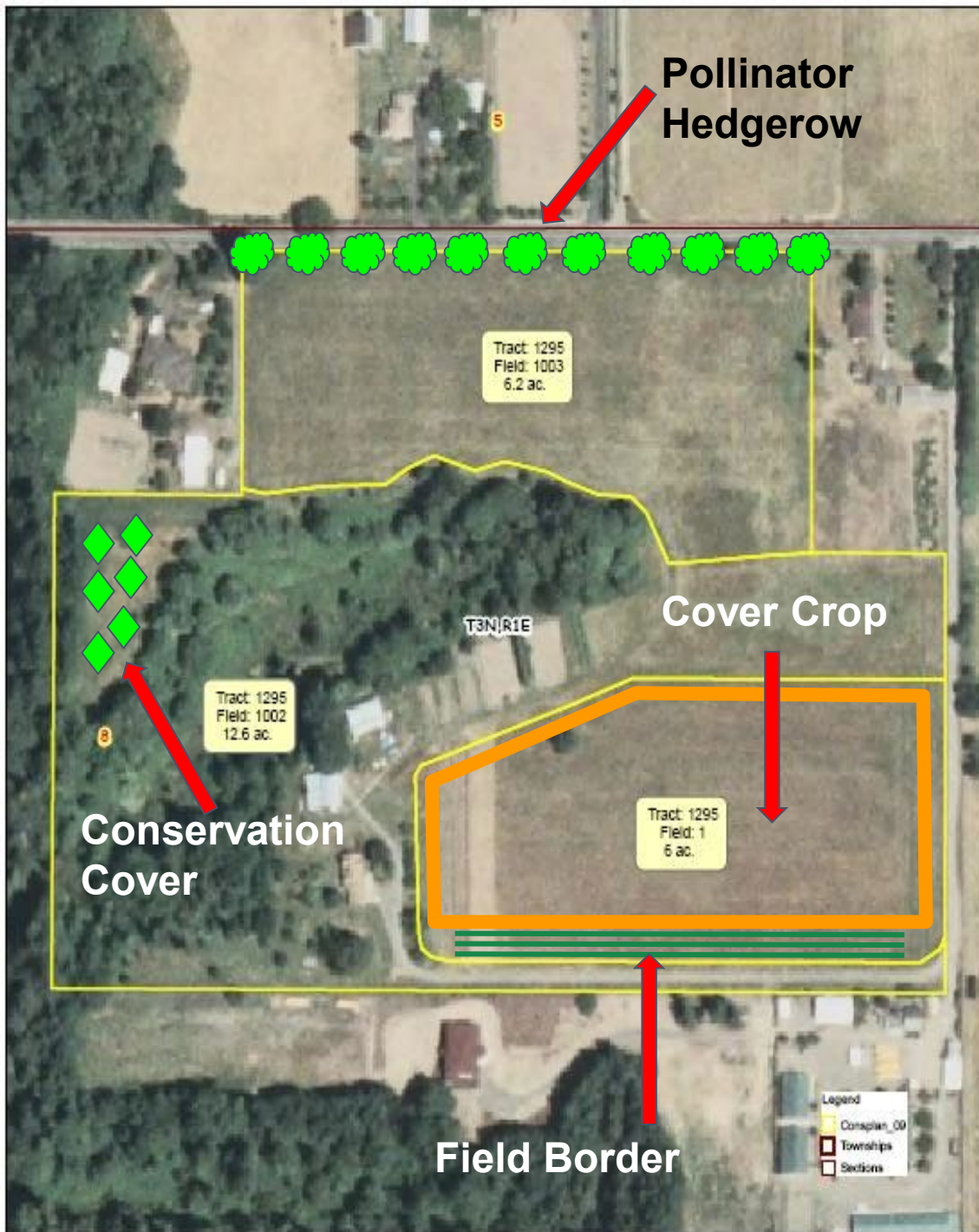
Crimson clover, buckwheat

Conservation Cover

Mixture of native grasses and forbs

Windbreak/Shelterbelts

Conifers for drift protection



The Role of Farm Habitat

Beetle Banks

Provide overwintering and nesting habitat

Native bunch grasses with some diversity of forbs

Generally 2-6' wide

Intercropped w/vegetables or row crops

Plugs or seeds can be used



Photo: Iowa Valley RC&D, Amana, IA



USDA-ARS

Protecting Habitat from Disturbance

Control Drift and Over Application

Calibrate equipment annually

Select proper nozzle type

Avoid temperature inversion and windy conditions

Establish buffer strips

Protecting Farm Habitat from Disturbance

Vegetative barriers

If barrier is too dense, air may be pushed up and over on habitat

Air should filter through vegetation

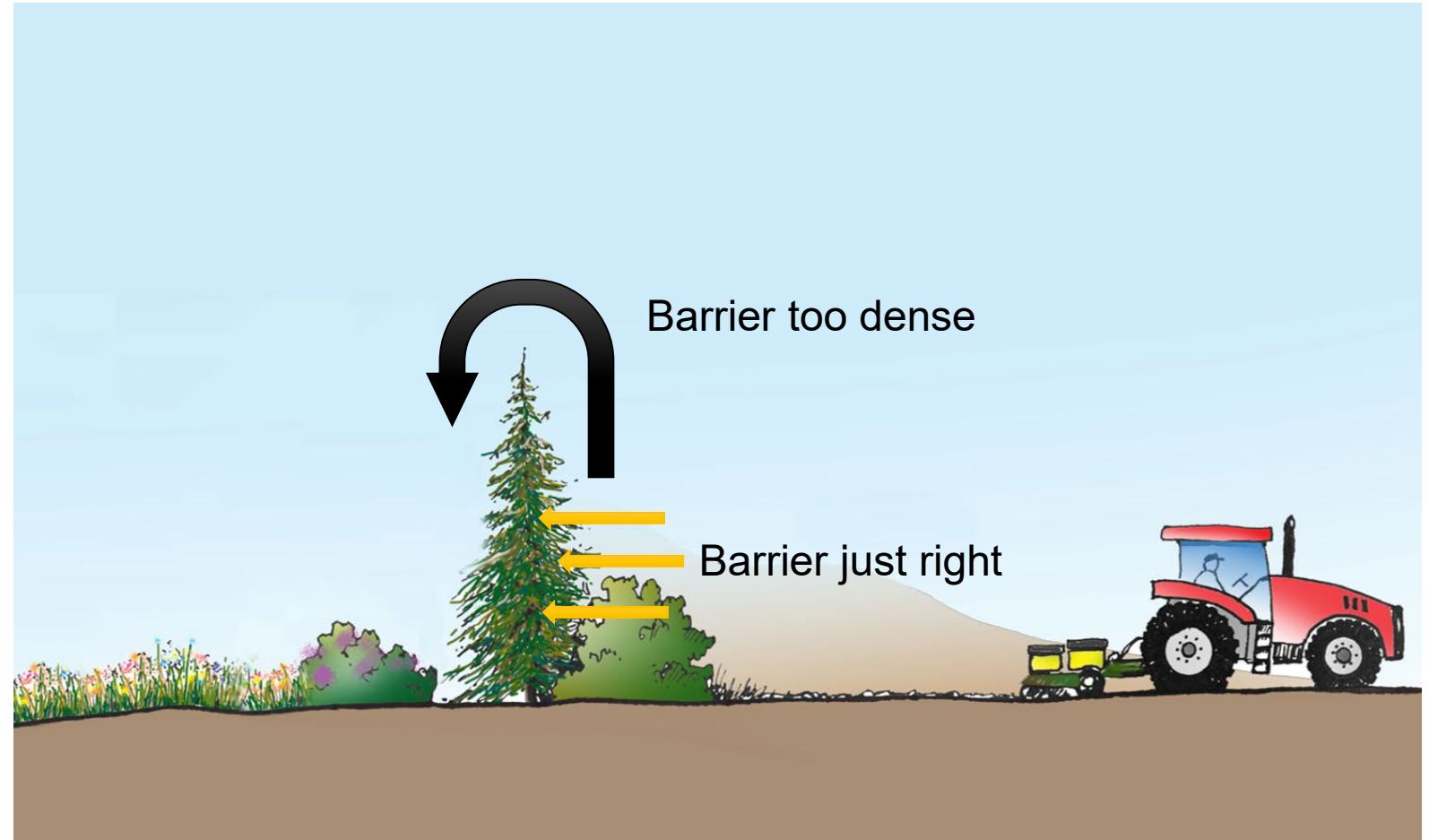


Illustration adapted from USDA National Agroforestry Center

Managing Insecticides: Alternative Options

Safer options are available!



Photos: David Biddinger, Penn State University

Managing Insecticides: Alternative Options

Alternatives to Pesticides:

- Floating row covers
- Fruit bagging
- Crop rotation and diversity
- Resistant varieties
- Sanitation



Managing Insecticides: Conservation Biocontrol

Habitat that supports pollinators also can support predatory and parasitic insects!



Photo: Syrphid fly on brassica flower, Thelma Heidel-Baker

Rewilding Agriculture for Biodiversity Conservation!



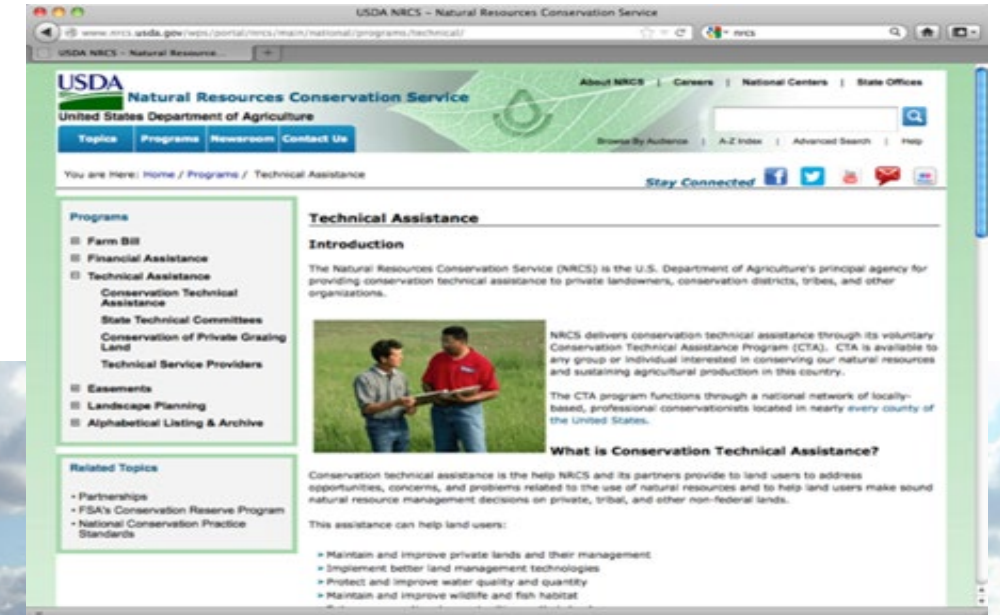
Habitat Opportunities in Ag Landscapes

- Field borders
- Retired cropland
- Fallow areas
- Pollinator / Insectary strips
- Beetle banks
- Cover crops
- Flowering hedgerows
- Filter strips
- Understory plantings
- Riparian areas
- Drift protection



Illustration: Andrew Holder, Xerces Society

Additional Resources



Farm Bill and State Cost-Share Opportunities to Address Resource Concerns



CRP - Conservation Reserve Program



EQIP - Environmental Quality Incentives Program



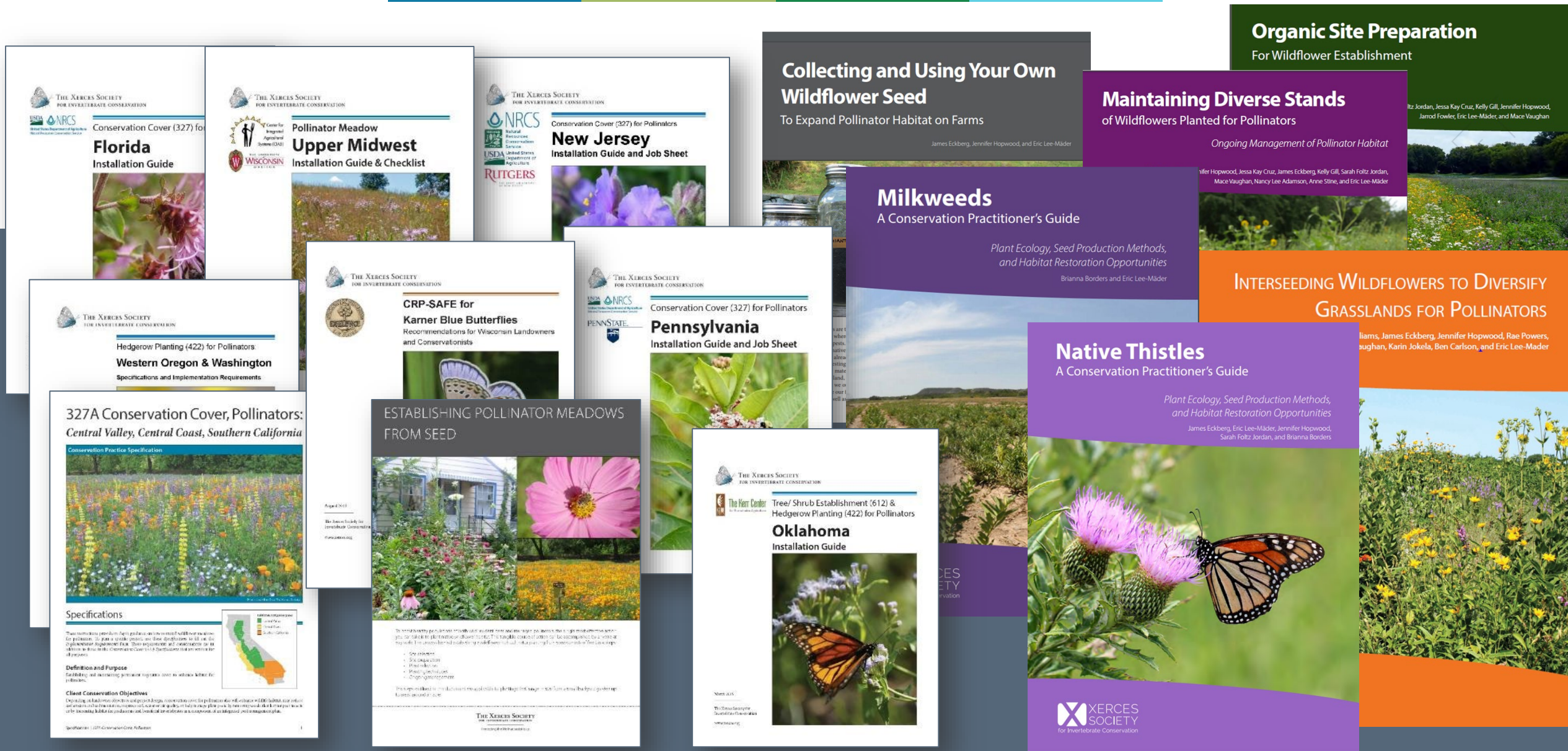
CSP - Conservation Stewardship Program



REAP - Resource Enhancement and Protection Program - Iowa Dept of Ag
and Land Stewardship

Prairie Partners - Iowa DNR

Guidance for planting and maintaining pollinator habitat

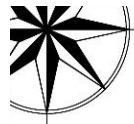


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Rusty-patched bumble bee, © Clay Bolt

Acknowledgements

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Thank you! Questions?

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