Farming for Bees

Conservation of Native Pollinators

Presented by Eric Mader, National Outreach Coordinator
The Xerces Society for Invertebrate Conservation

Photo: Edward S. Ross

What is the Xerces Society?

THE XERCES SOCIETY
FOR INVERTEBRATE CONSERVATION

Since 1971, the Society has worked to protect wildlife through the conservation of invertebrates and their habitat.

Major Programs:
- Endangered species
- Aquatic invertebrates
- Pollinator conservation

*** Xerces blue butterfly (*Glaucopsyche xerces*), the first U.S. butterfly to go extinct due to human activities**

Talk Outline

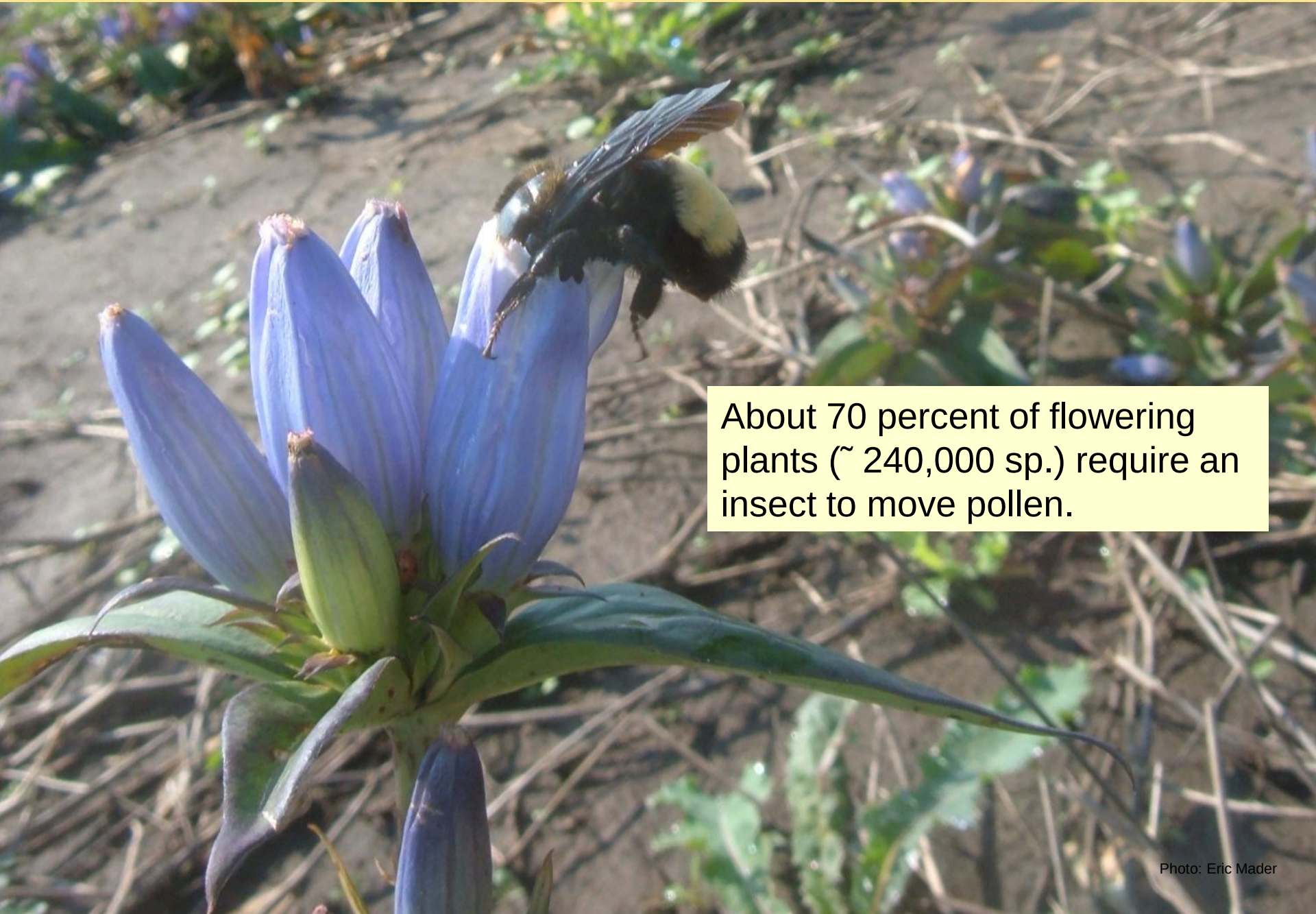
Overview

- Importance of pollinators
- Native bee diversity
- Value of natural areas to bees
- Restoring habitat for pollinators
- Pollinator-friendly farming
- Additional resources

Photo: Bruce Newhouse

Part 1. The Importance of Pollinators

Insect Pollinators: An Ecological Keystone



About 70 percent of flowering plants (˜ 240,000 sp.) require an insect to move pollen.

Photo: Eric Mader

Importance of Pollinators

Pollinators provide an ecosystem service that enables plants to produce fruits and seeds.

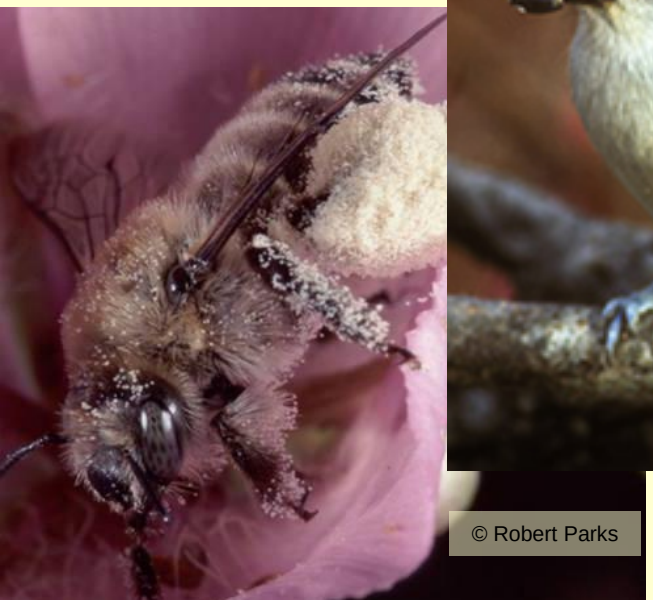
- 35% of crop production, worldwide
- Value of crops in U.S.: $18 to $27 billion
- One in three mouthfuls of food and drink we consume

Photo: USDA-ARS/Peggy Greb

Importance of Pollinators: Ecosystem Services

- Fruits and seeds are a major part of the diet of about 25% of birds, and many mammals

- Pollinators and the diverse insects associated with good pollinator habitat are food for wildlife



Main Groups of Pollinators






Photos: Mace Vaughan, Bob Hammond, David Inouye, Bruce Newhouse

Bees: The Most Important Pollinators

- Bees provide for their young
- Bees actively collect and transport pollen
- Bees exhibit flower constancy
- Bees regularly forage in area around nest

Photo: Edward S. Ross

Crop Pollination by Bees

Most crop pollination is done by the European honey bee.

This leaves us reliant on a single pollinator, one that is experiencing many problems.

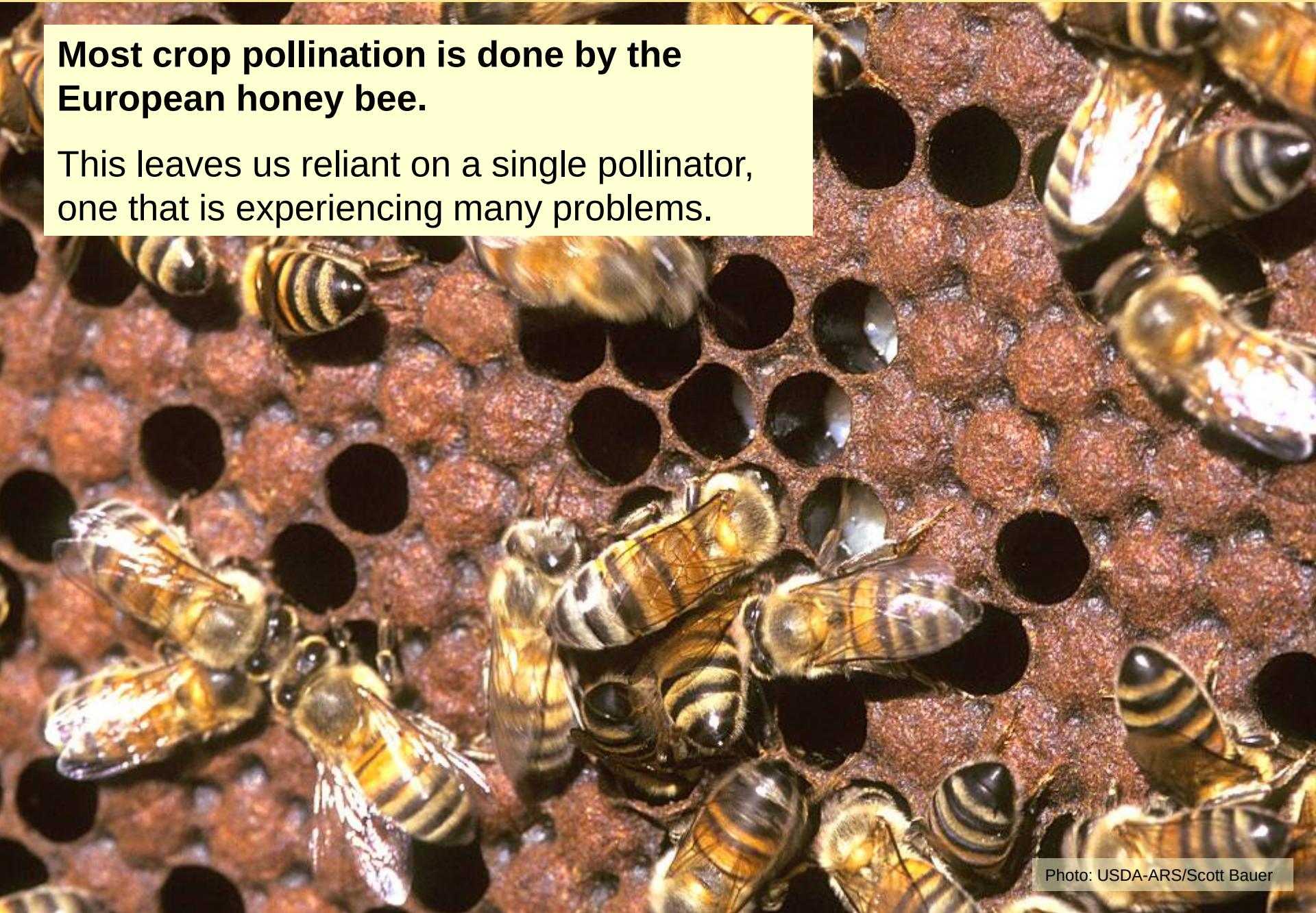


Photo: USDA-ARS/Scott Bauer

Crop Pollination: Honey Bees in Decline

Fewer honey bees available

- Over 50% decline in number of managed hives since 1950
- 70-100% decline in feral colonies since the 1990s

Causes: Disease, pests, honey prices, and Colony Collapse Disorder

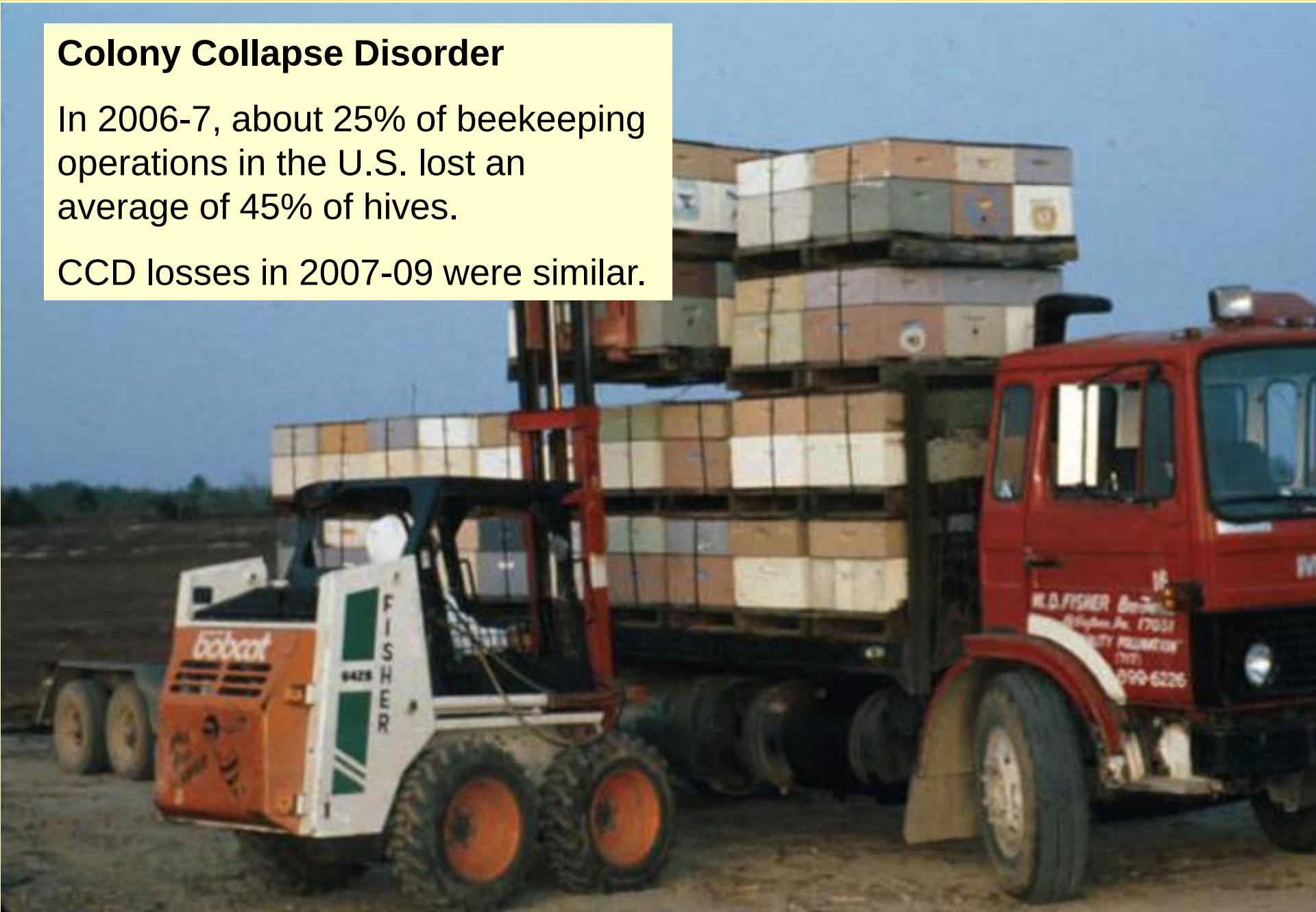
Photo: USDA-ARS/Scott Bauer

Crop Pollination: Honey Bees in Decline

Colony Collapse Disorder

In 2006-7, about 25% of beekeeping operations in the U.S. lost an average of 45% of hives.

CCD losses in 2007-09 were similar.



Crop Pollination: Honey Bees in Decline

Causes of Colony Collapse Disorder still unknown:

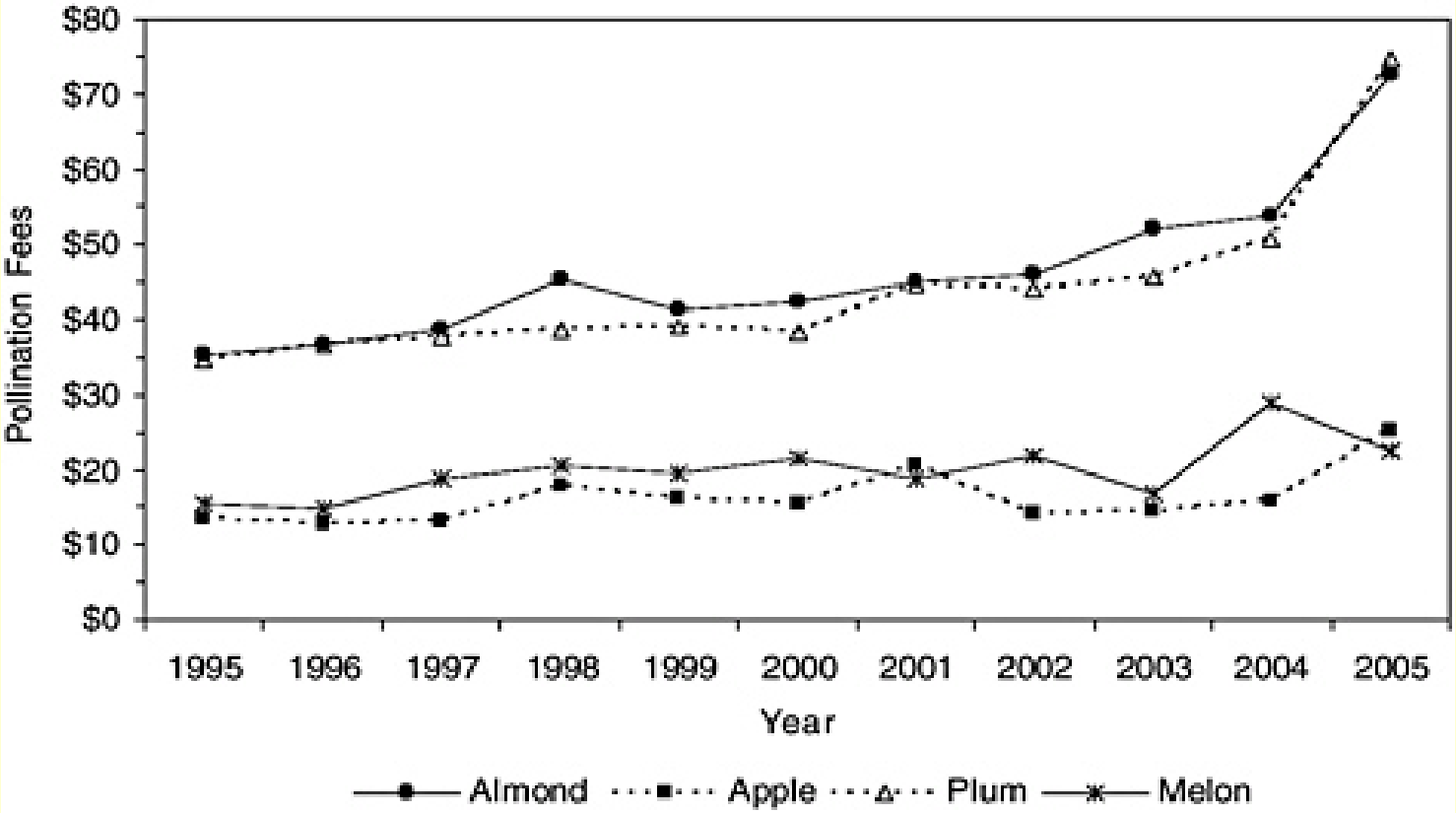
- Disease/pathogen?
  - Israeli Acute Paralysis Virus?
  - New strain of *Nosema*?
- Pests?
- Poor diet?
- Insecticides?
- Stress?

- **Not cell phones or Bt Corn**

Photo: USDA-ARS/Scott Bauer

Crop Pollination: Honey Bees in Decline

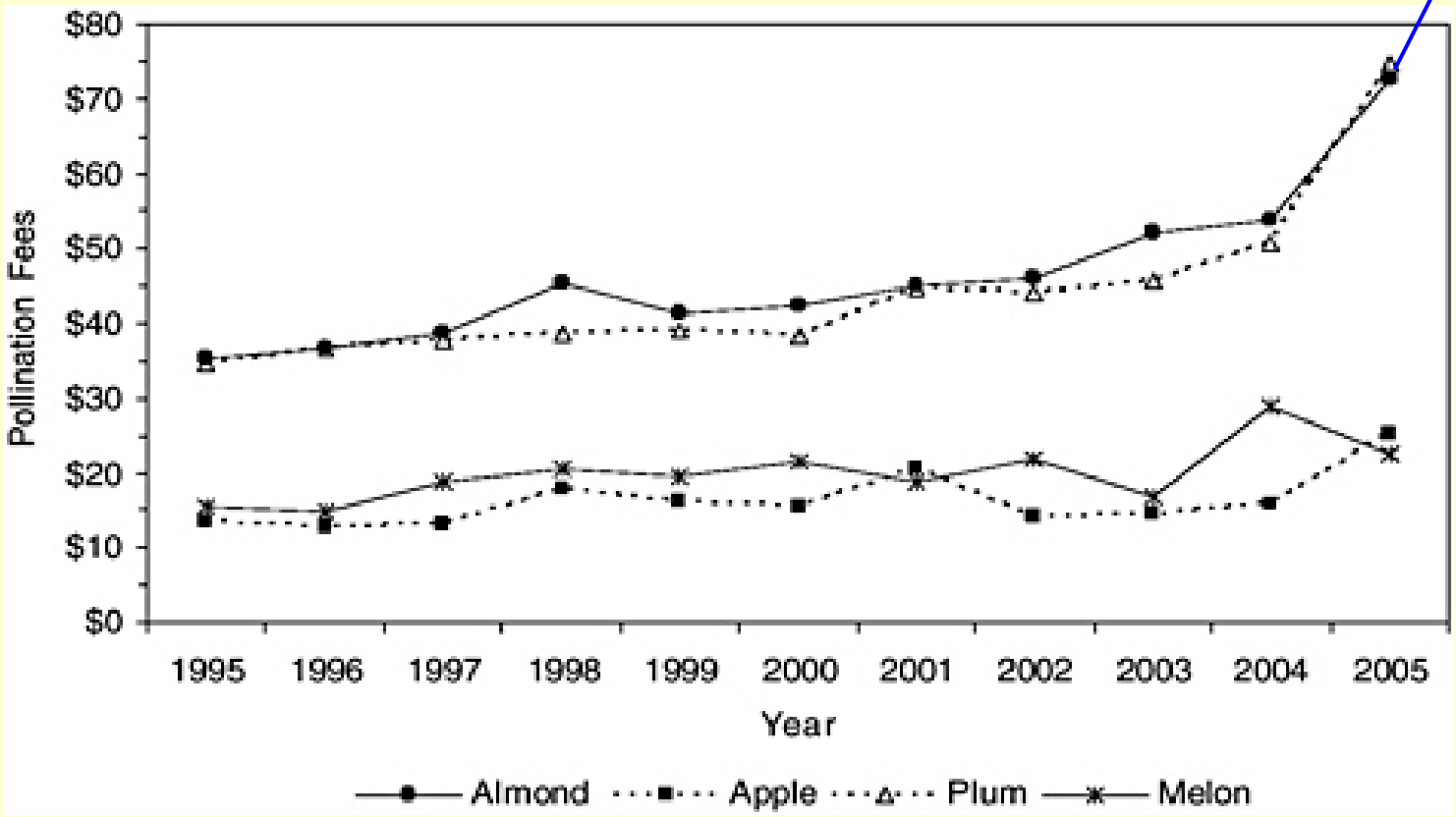
Honey bee colony rental rates for selected California crops, 1995–2005.



Crop Pollination: Honey Bees in Decline

Honey bee colony rental rates for selected California crops, 1995–2005.

Plus almonds, 2006-2008

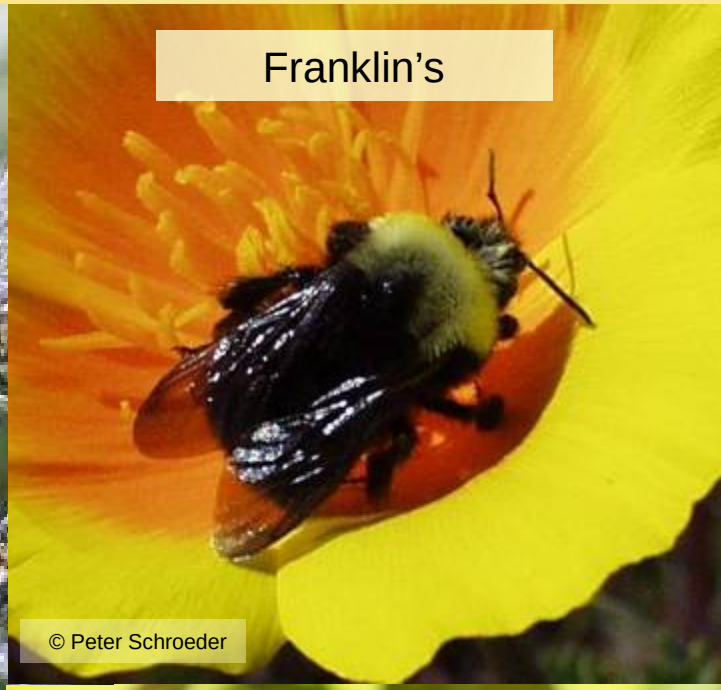


2006
2007
2008

Other Important Bees in Decline

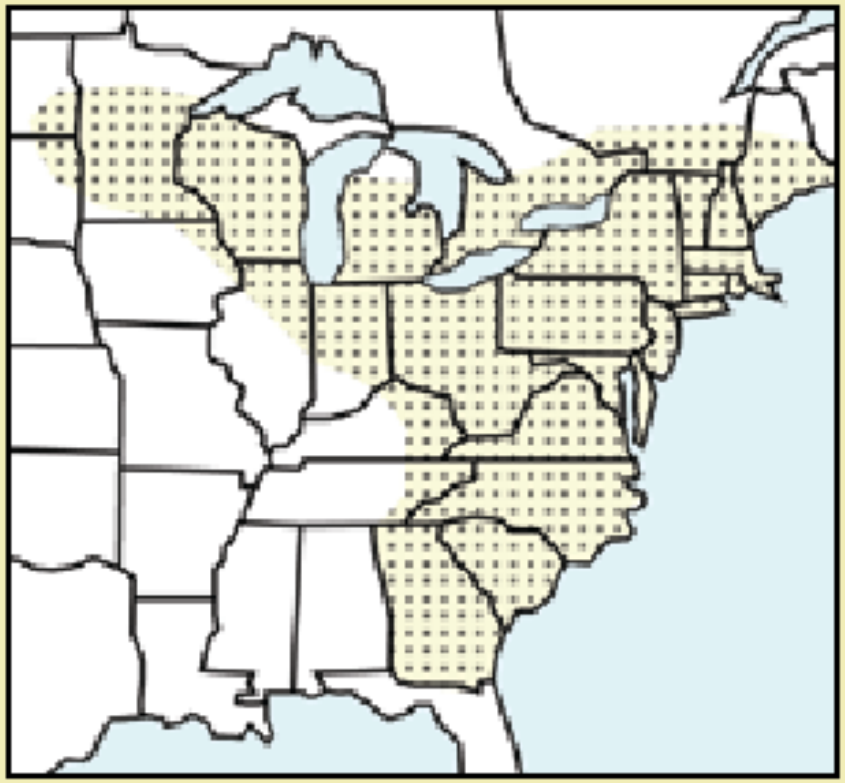
Native bees also in decline:

Four sister species of bumble bees



Declining Native Bees

HISTORIC RANGE OF BOMBUS AFFINIS



Map based on Milliron 1971, *A Monograph of the Western Hemisphere Bumblebees.*

The rusty patched bumble bee was once common in the eastern United States and the upper Midwest. They can still occasionally be found in isolated patches, but *B. affinis* has disappeared from most of its former range in recent years. Your efforts to search for this bee will help document their current range. The Xerces Society and scientists studying declining bumble bees will use this information to promote conservation of remaining *B. affinis* populations.

Rusty Patched Bumble Bee

- *Bombus affinis* was one of most common bumble bees in the Eastern U.S.
- Now gone from most of its historic range
- Most likely reason is disease and pathogens introduced in by commercially reared bumble bee colonies

Images: The Xerces Society

Pollination and Crop Security

Even as bees decline, crop acreage requiring bee pollination grows.

- 5,000 to 10,000 new acres of Wisconsin cranberries over the next decade
- 150,000 new acres of California almonds anticipated.
- From 1961 to 2006 percent of global cropland requiring bee pollination rose from 18.2% to 34.9%

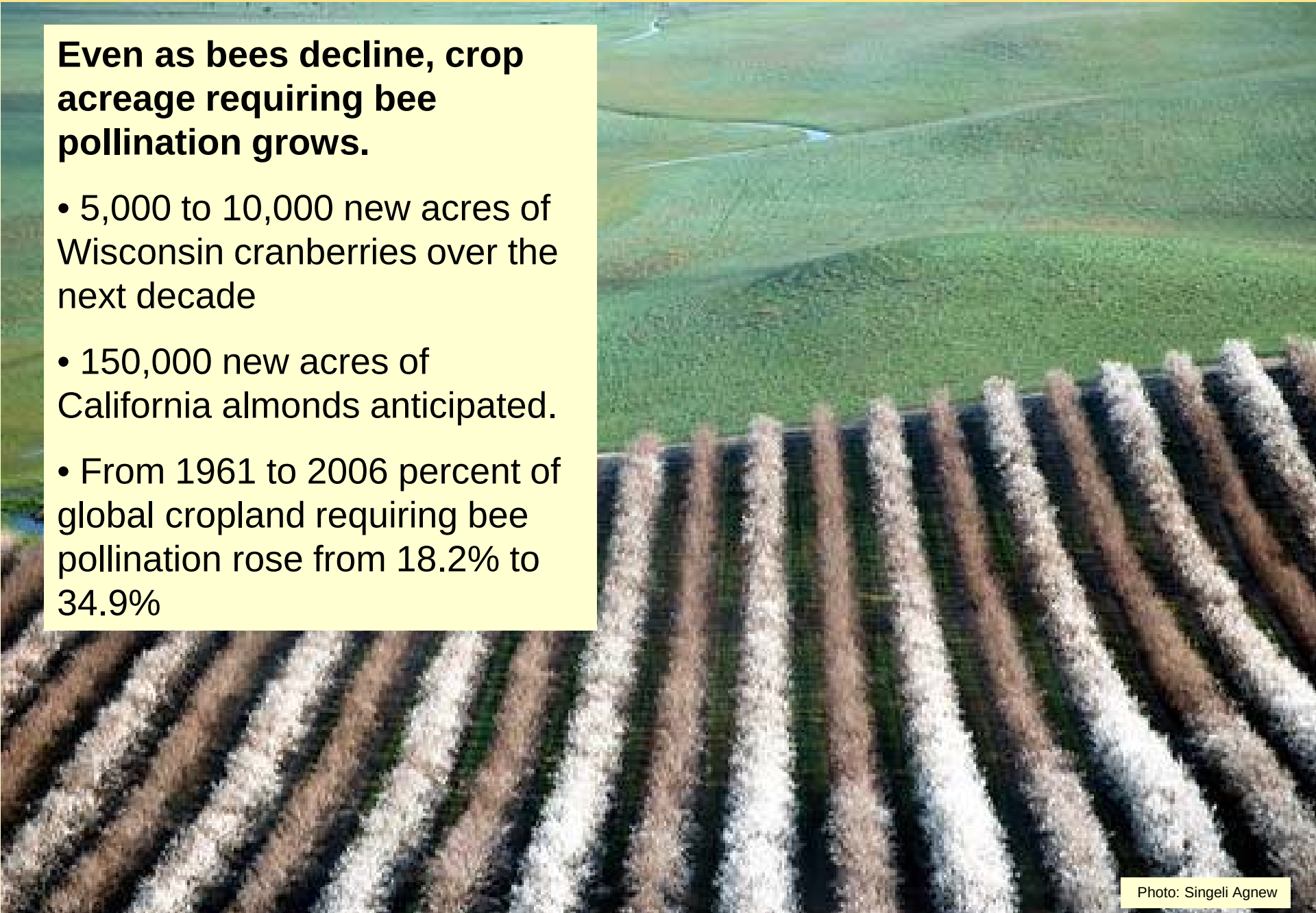


Photo: Singeli Agnew

Pollination and Crop Security

What does all this mean for the sustainability of crop pollination?

Photo: Business Week

Part 2. Native Bee Diversity

Photo: Rollin Coville

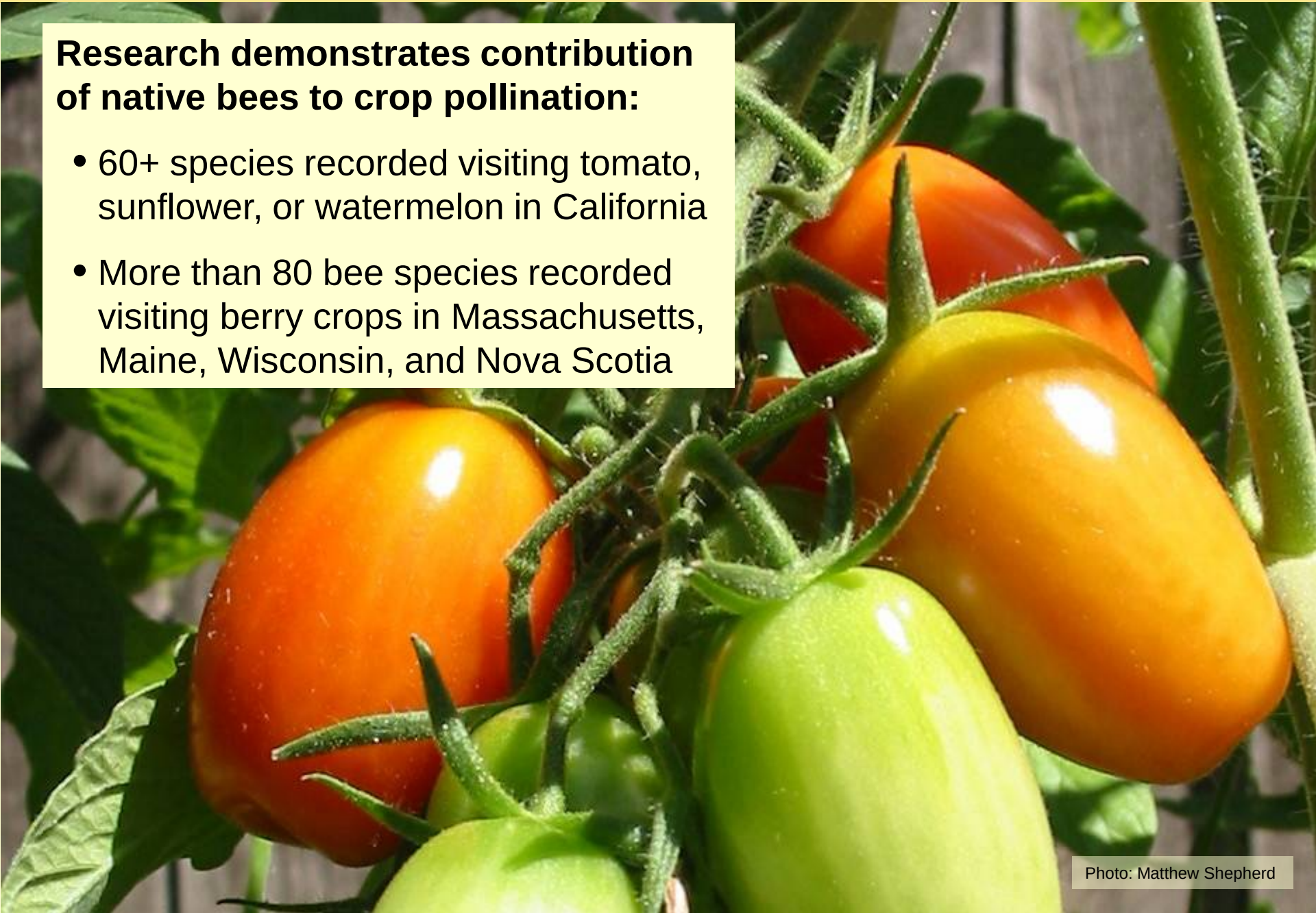
Crop Pollination: Important to Diversify

Fewer honey bees available

- Important to diversify pollinators for production agriculture
- Important to strengthen habitat and pesticide protection for all bees (honey and native)

Photo: Bob Hammond, CSU Coop Ext

Crop Pollination: Native Bees



Research demonstrates contribution of native bees to crop pollination:

- 60+ species recorded visiting tomato, sunflower, or watermelon in California
- More than 80 bee species recorded visiting berry crops in Massachusetts, Maine, Wisconsin, and Nova Scotia

Photo: Matthew Shepherd

Native Bee Diversity

North America is home to approximately 4,000 species of native bees.

Photo: Edward S. Ross

Recognize Pollinators: Native Bee Diversity

Photo: Stephen L. Buchmann

Three Broad Groups of Native Bees

Ground-nesting bees (solitary)

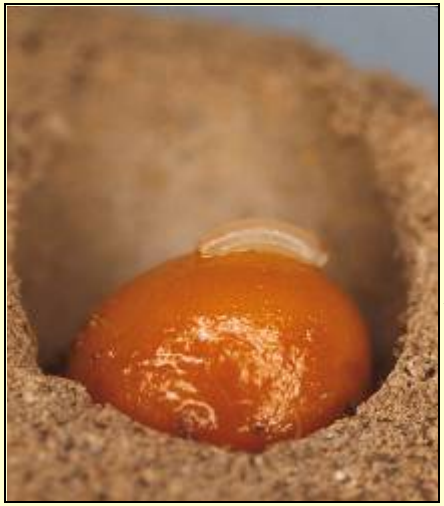
Tunnel-nesting bees (solitary)

Bumble bees (social)

Photos: Matthew Shepherd, Eric Mader, SA Cameron

Lifecycle of Solitary Bees

Mining bee (*Andrena* sp.); a year in its underground nest as egg, larva, and pupa before emerging to spend a few weeks as an adult.



Photos: Dennis Briggs

Ground-Nesting Solitary Bees

Roughly 70% of native bee species nest underground.

- Resemble ant-nests from above ground
- Nest chambers are lined with waxy glandular secretions, and can sometimes even resist flooding
- Very common bees
- Conserve sandy soil, bare ground

Photos: Jim Cane and Dennis Briggs

Wood-Nesting Bees

Roughly 30% of native species nest in hollow plant stems, or old beetle borer holes

- Nest tunnel partitions constructed of mud, leaf pieces, or sawdust

- Artificially managed for some crops

- Conserve snags, brush piles

Wood-Nesting Bees

Hollow stem example:

Cross-section of silk cocoons

Larva Pupa Adult

Pollen mass Egg Mud wall

Mud cap closure

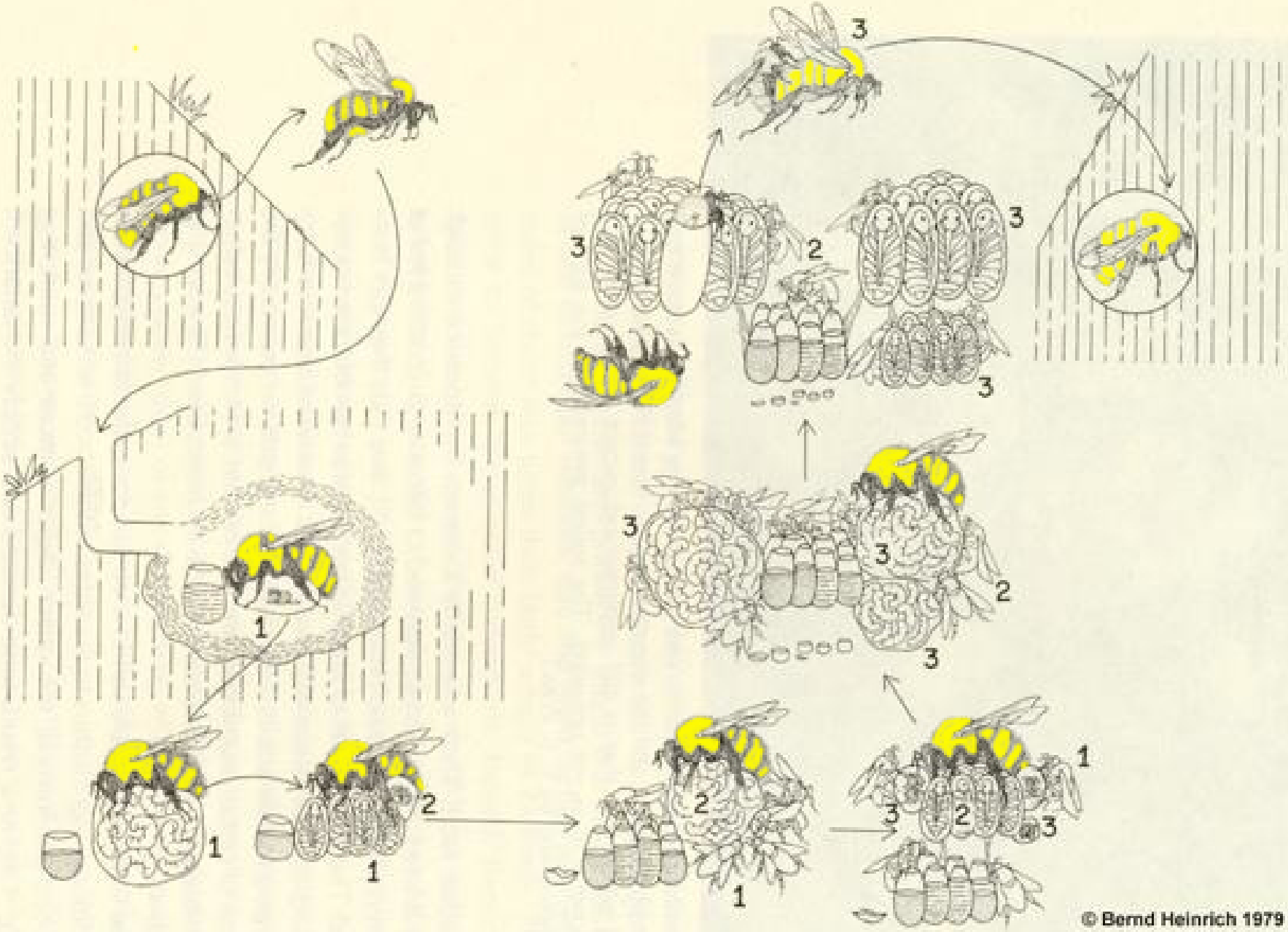
Silk cocoons with dormant bees inside

Bumble Bees

- 45 species in U.S.
- Social colonies founded by a single queen
- Colonies last only one season
- Nest may contain 100-300 workers
- Specialist pollinators of red clover, blueberry, cranberry, eggplant, tomato
- Conserve brush piles, un-mowed areas

Photos:Eric Mader, Elaine Evans

Life Cycle of a Bumble Bee Colony



Value of Native Bees

Native bees are very efficient:

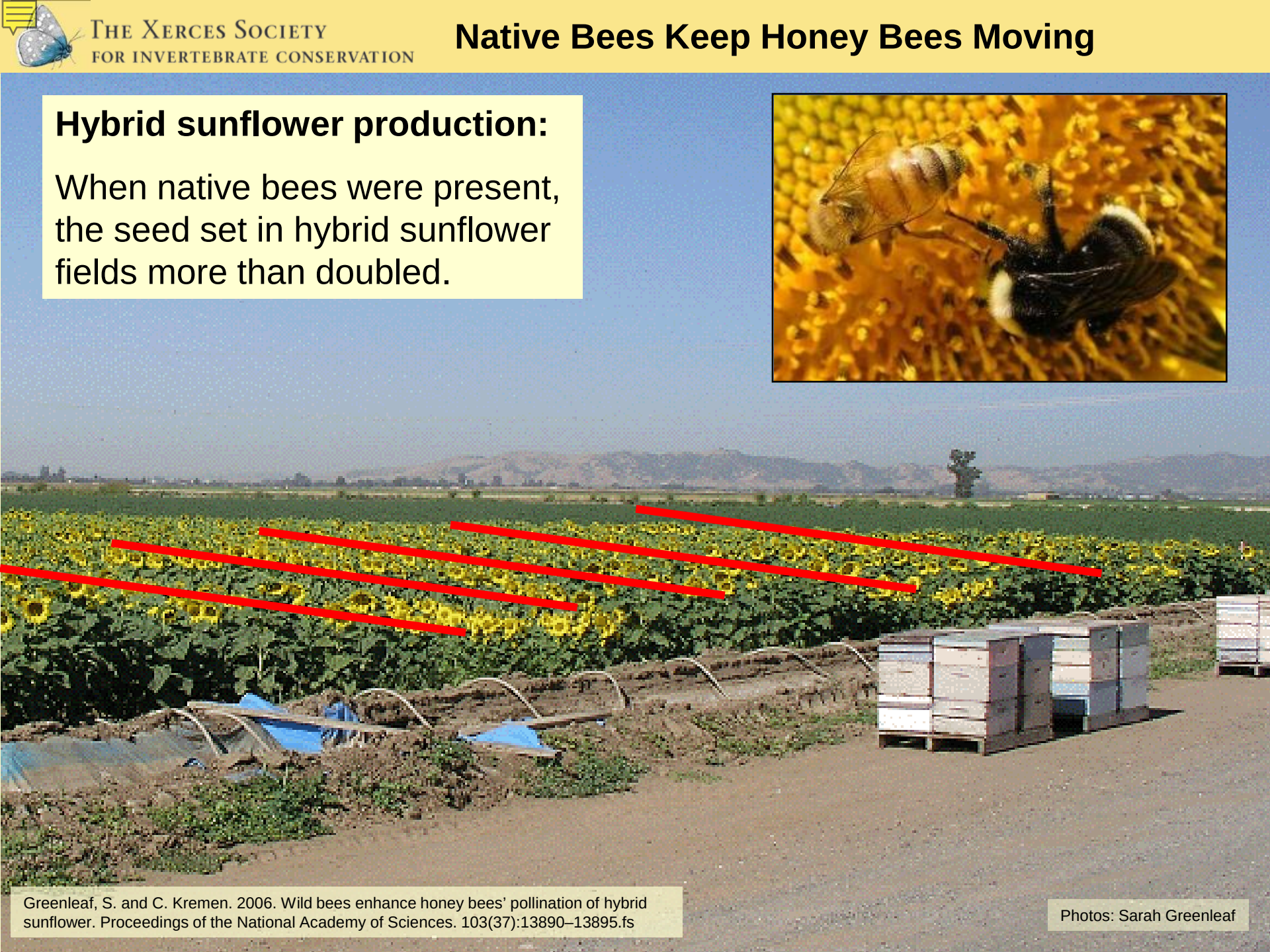
- Active earlier in season and day
- Collect both pollen and nectar
- Buzz pollination
- No rental fees

Native bees can supplement honey bees if they are hard to acquire.

Native Bees Keep Honey Bees Moving

Hybrid sunflower production:

When native bees were present, the seed set in hybrid sunflower fields more than doubled.



Greenleaf, S. and C. Kremen. 2006. Wild bees enhance honey bees' pollination of hybrid sunflower. Proceedings of the National Academy of Sciences. 103(37):13890–13895.fs

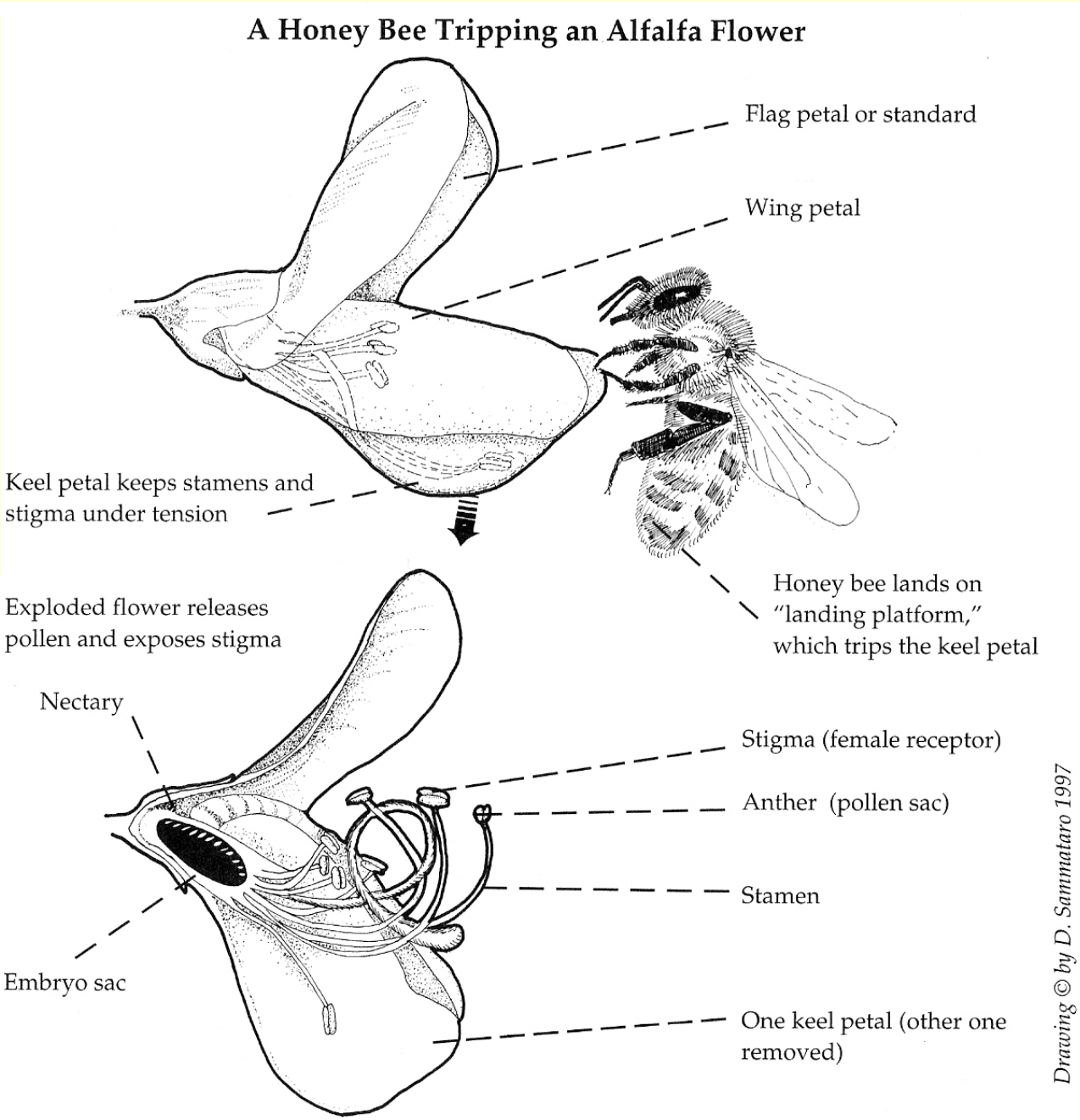
Photos: Sarah Greenleaf

Pollination of Complex Flowers

Native bees and alfalfa

- Honey bees dislike being hit on the head by the stamen and learn to bypass the pollination mechanism
- Most seed production by leafcutter and alkali bees

Photo: Eric Mader



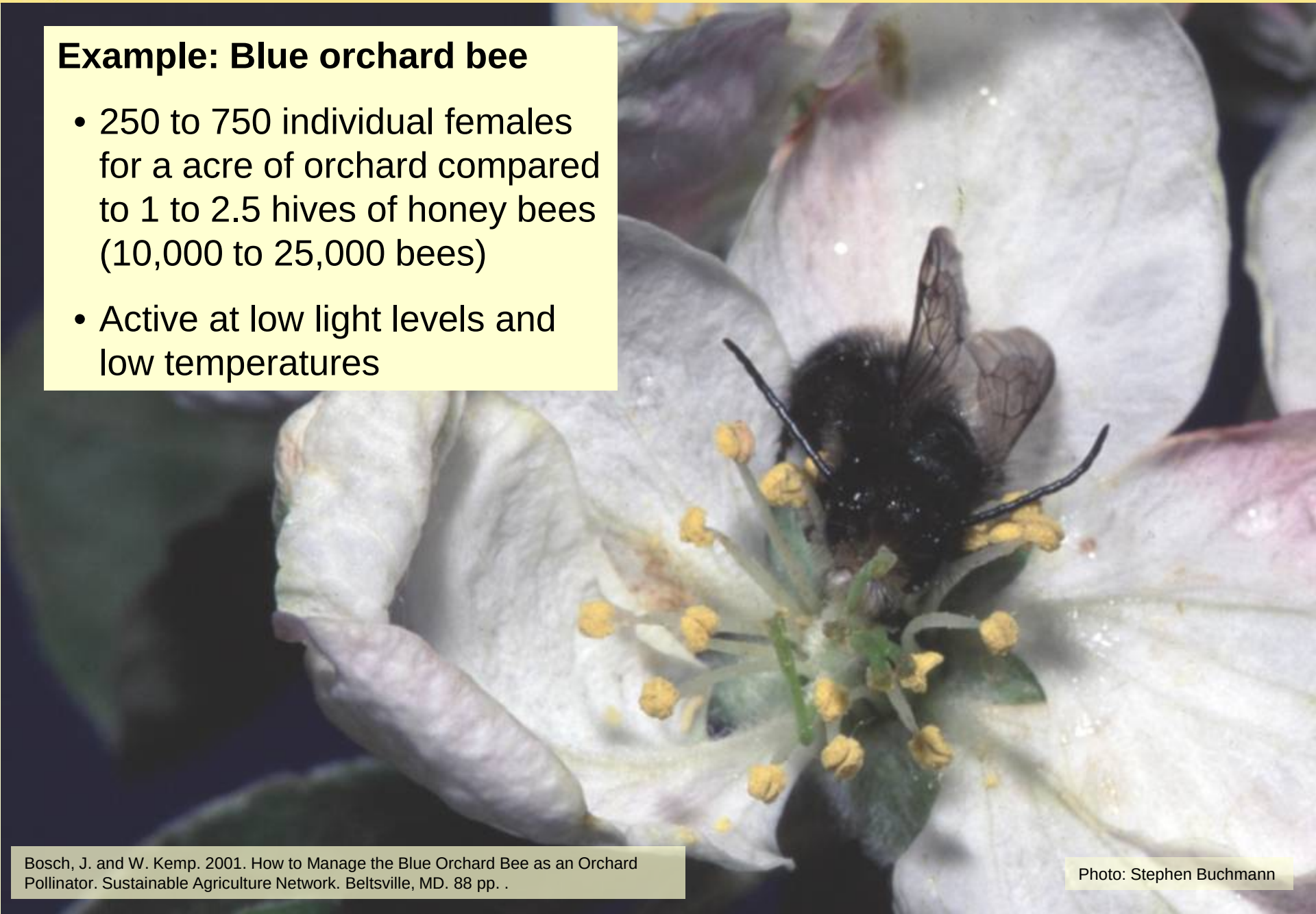
Buzz Pollination by Native Bees

Example: Cherry tomatoes

When native bees were present, the production of Sungold cherry tomatoes almost tripled.

Greenleaf, S. S.,and C. Kremen. 2006. Wild bee species increase tomato production and respond differently to surrounding land use in Northern California. Biological Conservation 133:81-87.

Native Bees Active Earlier in Season



Example: Blue orchard bee

- 250 to 750 individual females for a acre of orchard compared to 1 to 2.5 hives of honey bees (10,000 to 25,000 bees)
- Active at low light levels and low temperatures

Bosch, J. and W. Kemp. 2001. How to Manage the Blue Orchard Bee as an Orchard Pollinator. Sustainable Agriculture Network. Beltsville, MD. 88 pp. .

Photo: Stephen Buchmann

Part 3: The Value of Natural Areas

Photo: Whitney Cranshaw, Colorado State University; bugwood.org

The Value of Natural Areas

Pollinators Need Habitat

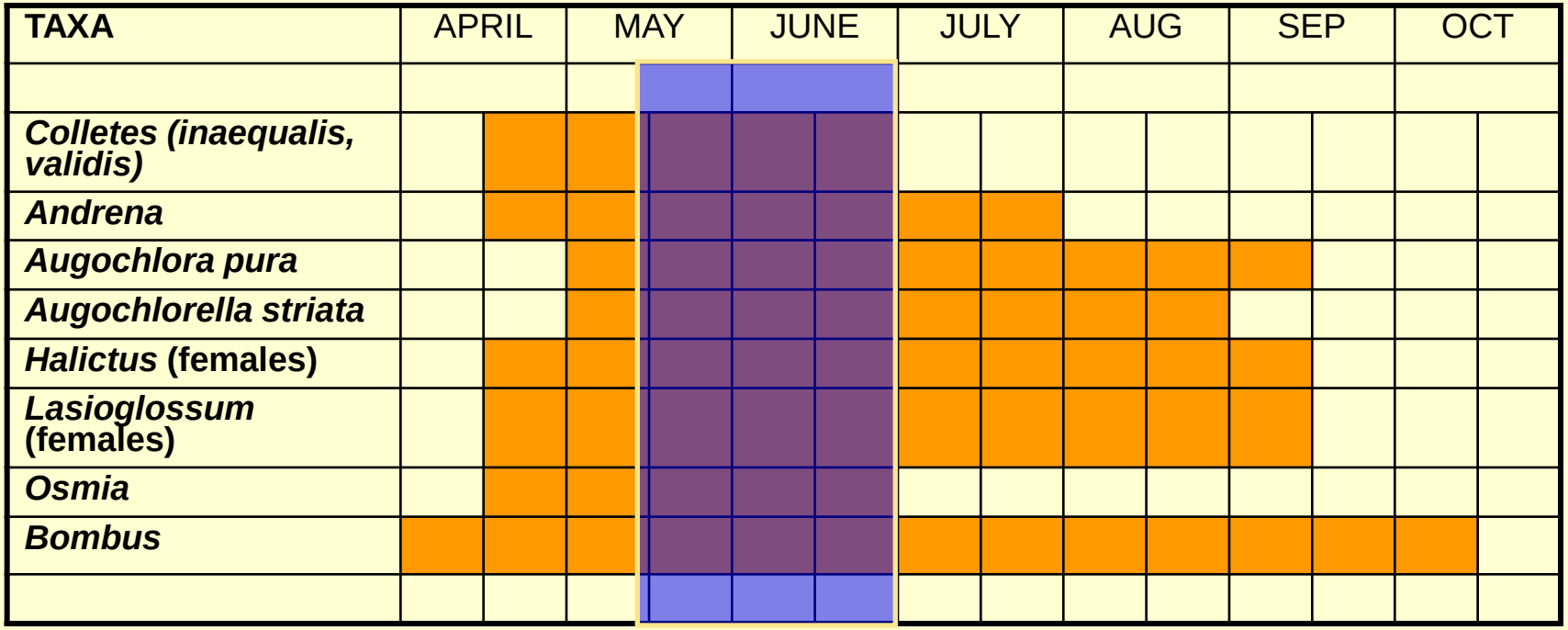
The amount of natural area on or close to the farm is a major influence on the diversity and abundance of bees.

Photo: Rollin Coville

Pollinator Habitat Needs: Non-Crop Flowers

Provide forage to support bees before and after crop bloom.

Example: Flight periods of native bees in relation to blueberry bloom.



The Xerces Society
for Invertebrate Conservation

A Year-Long Succession of Blooming Plants







Photos: Elaine Haug NRCS, Matthew Shepherd; Mace Vaughan, Eric Mader, Jeff McMillan NRCS, Berry Botanic Garden

Natural Areas Case Study

Example: Farms in Mid-Atlantic region

In 90% of farms studied in New Jersey and Pennsylvania, wild native bees provided all pollination needed for watermelon.

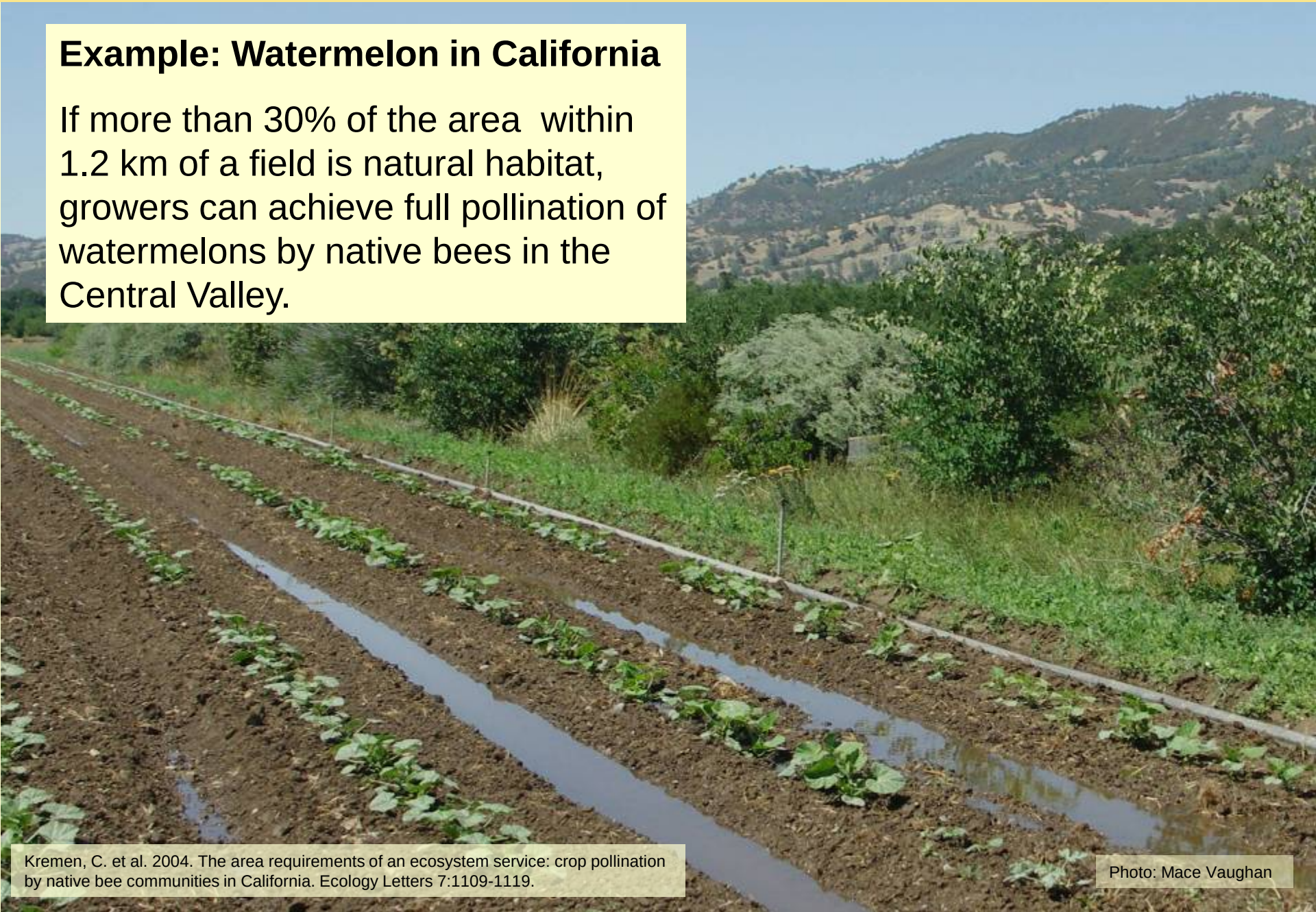
Winfree, R. et al.. 2008. Wild bee pollinators provide the majority of crop visitation across land-use gradients in New Jersey and Pennsylvania, USA. Journal of Applied Ecology 45:793-802.

Photo: Rachael Winfree

Natural Areas Case Study

Example: Watermelon in California

If more than 30% of the area within 1.2 km of a field is natural habitat, growers can achieve full pollination of watermelons by native bees in the Central Valley.



Kremen, C. et al. 2004. The area requirements of an ecosystem service: crop pollination by native bee communities in California. Ecology Letters 7:1109-1119.

Photo: Mace Vaughan

Natural Areas Case Study

Example: Canola in Canada

In the absence of honey bees, canola growers make more money on their land if 30% is in natural habitat, rather than planting it all.

Morandin, L., and M. Winston. 2006. Pollinators provide economic incentive to preserve natural land in agroecosystems. Agriculture, Ecosystems and Environment 116:289-292.

Photo: Mace Vaughan

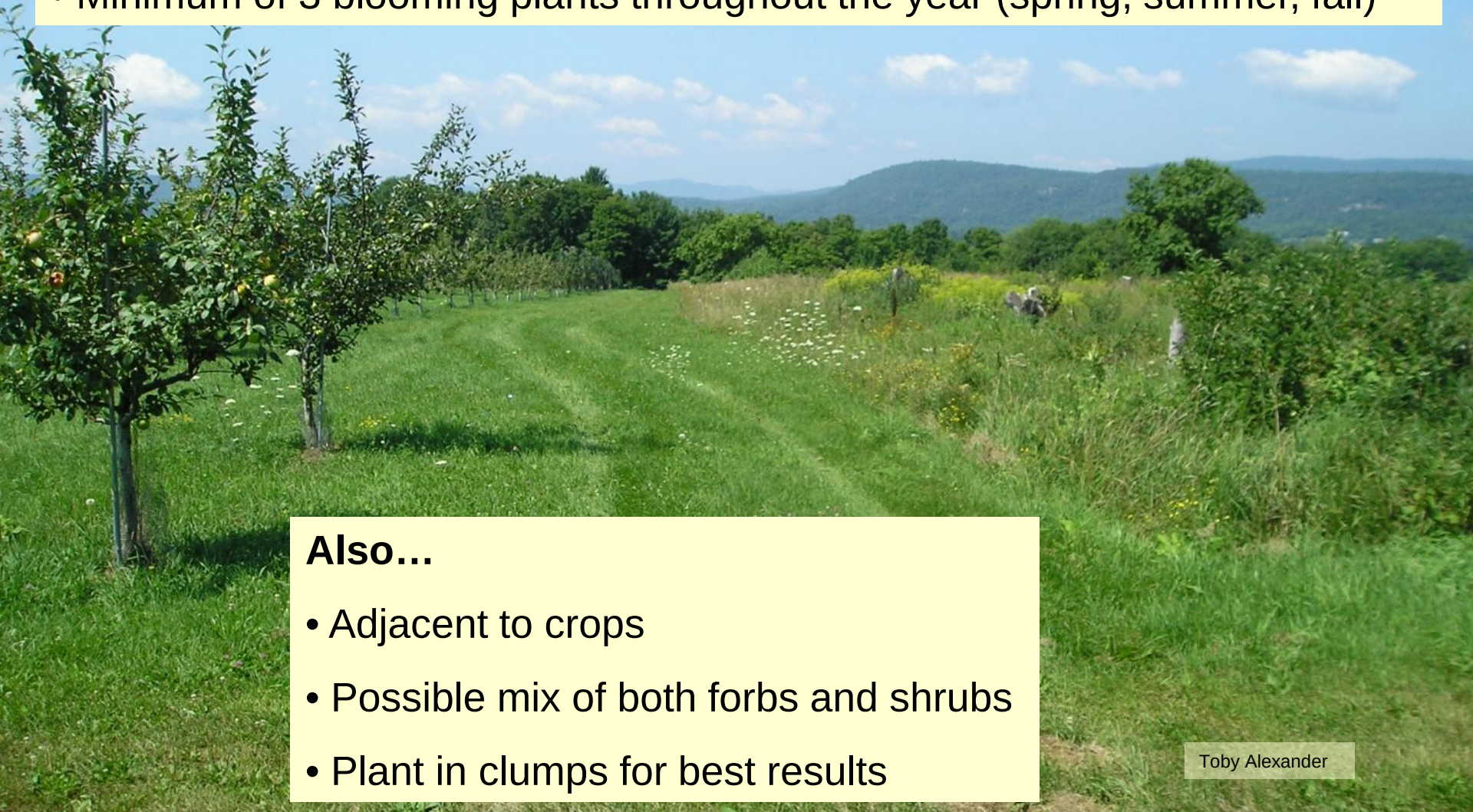
Part 4. Enhance and Restore Habitat

Photo: Matthew Shepherd

Planning Pollinator Habitat

Design and Establishment Considerations:

- Native wildflowers
- Minimum of 3 blooming plants throughout the year (spring, summer, fall)



Also…

- Adjacent to crops
- Possible mix of both forbs and shrubs
- Plant in clumps for best results

Toby Alexander

Plant Selection: How Do You Know?

But…what to plant?!?

(Acres of *Rudbeckia* and not a bee in site.)

Photos: Eric Mader

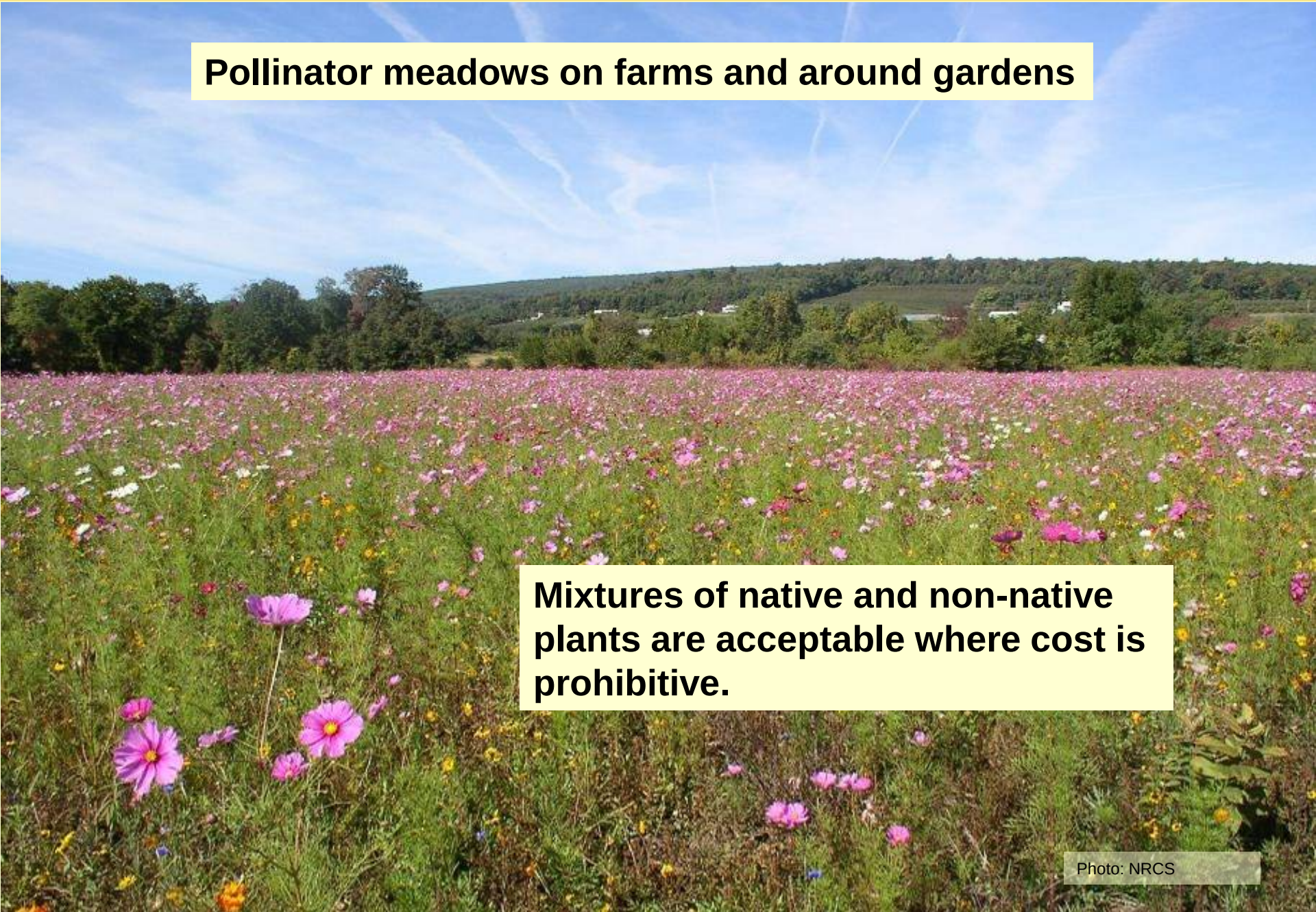
Plant Selection: A Few Good Bets for the East

Native wildflowers:

- Mountain Mint
- Beebalm
- Goldenrod
- Asters
- Lupine
- Milkweed
- Hyssop
- Annual sunflower
- Penstemon
- Culver's Root
- Spiderwort
- Waterleaf
- Blue Lobelia
- Blazingstar
- Blanketflower
- Cupplant
- Joe Pye Weed

Photos: Eric Mader

Where to Plant: Bee Pastures



Where to Plant: Hedgerows

Hedgerows: Featuring a succession of flowering shrubs

- Redbud
- Apple
- Plum
- Basswood
- Wild Rose
- Pussy Willow
- Hawthorn
- Raspberry
- Blueberry

Where to Plant: Orchard Understories

Orchard Ground Covers:

- White Dutch Clover
- Siberian squill
- Weeds

(Dandelion, Creeping Charlie)

Where to Plant: Ditches, Field Edges, Septic Tanks

Buffers with wildflowers support more insects.

Photo: Mace Vaughan, Xerces Society

Where to Plant: Farm Cover Crops

Clover, alfalfa, and purple vetch. Don't cut the entire hay crop!

Photo: NRCS/Toby Alexander

Site Preparation for Pollinator Habitat

Weed Abatement:

- Herbicides, tillage, black plastic smothering

Seed Bed Preparation:

- Burn or rake off debris, disk and harrow to smooth surface

Photos: Jessa Guisse

Planting Pollinator Habitat

Planting Techniques:

• Drill, broadcast, or frost seeding forbs

Equipment:

• Drop spreaders, broadcasters, native seed drills (Tye, Truax, etc.), rollers

Photos: Jessa Guisse

Managing Established Pollinator Habitat

Initial Weed Control:

- Mowing, selective herbicides

Maintaining Early Successional Habitat:

- Rotational mowing, burning, grazing, brush cutting

Other:

- Mulching shrubs, deer fencing, vole cages

Photos: Jessa Guisse

Enhance Nest Habitat: Wood-Nesting Bees

Retain or create tunnels

- Protect snags wherever possible
- Provide artificial nests???

Photos: Mace Vaughan; Katharina Ullman

Enhance Habitat: Ground-Nesting Sites

Ground-nesting native bees need access to the soil.

- Sandy soil
- Bare embankments

Photos: Mace Vaughan, Matthew Shepherd

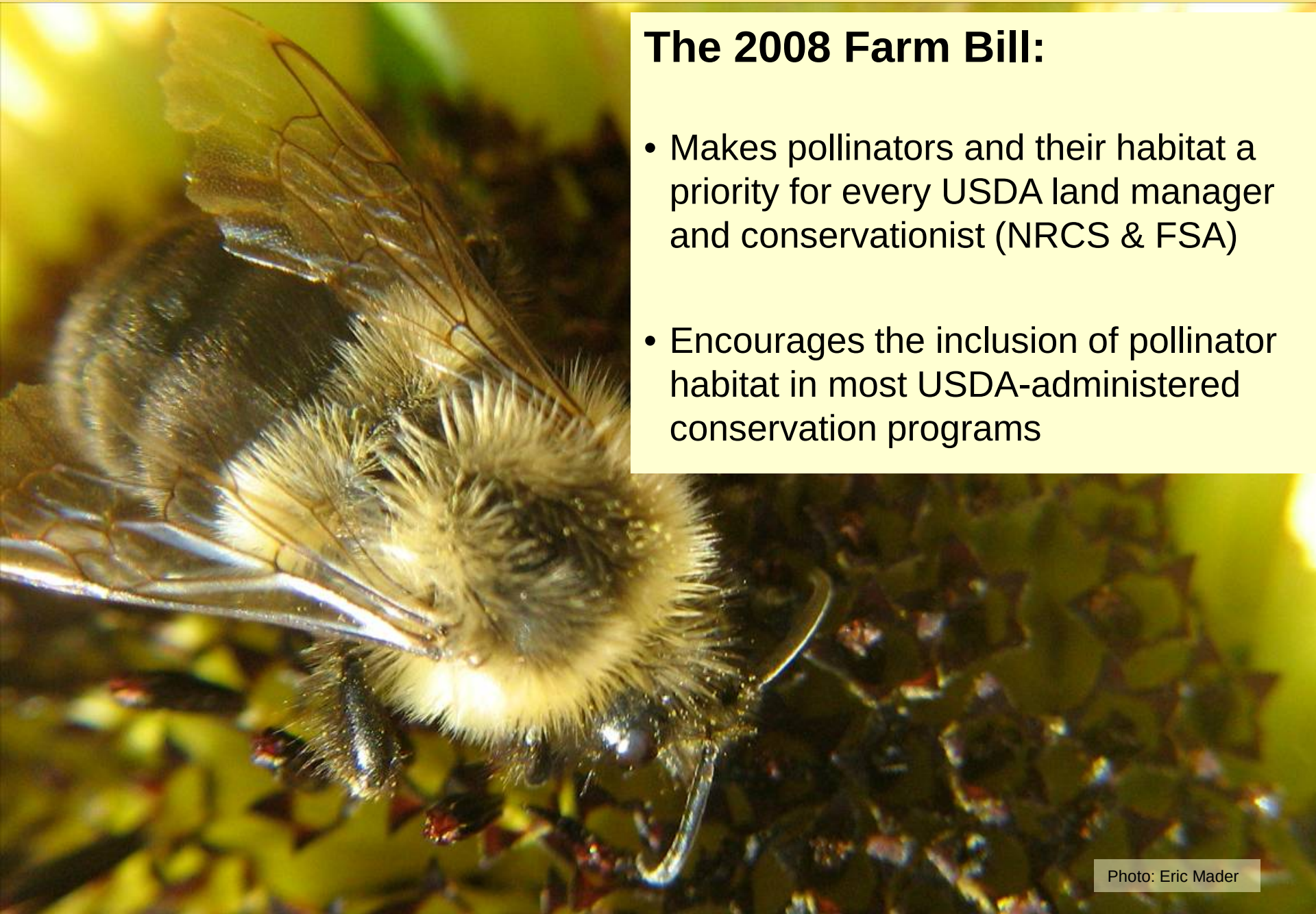
Enhance Habitat: Bumble Bee Nests

Retain or create nest sites.

- Grassy margins
- Maximize “wild” areas on and around farm
- Provide artificial nests???

Photos: Matthew Shepherd; NRCS/Lynn Betts

New Pollinator Conservation initiatives



The 2008 Farm Bill:

- Makes pollinators and their habitat a priority for every USDA land manager and conservationist (NRCS & FSA)
- Encourages the inclusion of pollinator habitat in most USDA-administered conservation programs

Photo: Eric Mader

Farm Bill Implementation

Farm Bill conservation programs: EQIP, WHIP, CSP, CRP, GRP, WRP, etc

Many NRCS conservation practices can create or manage habitat for pollinators:

- Tree/Shrub Establishment
- Conservation Cover
- Hedgerow Planting
- Field Border
- Restoration and Management of Rare or Declining Habitats
- Range Planting
- Upland Wildlife Habitat Management
- Pest Management
- Early Successional Habitat Development/ Management

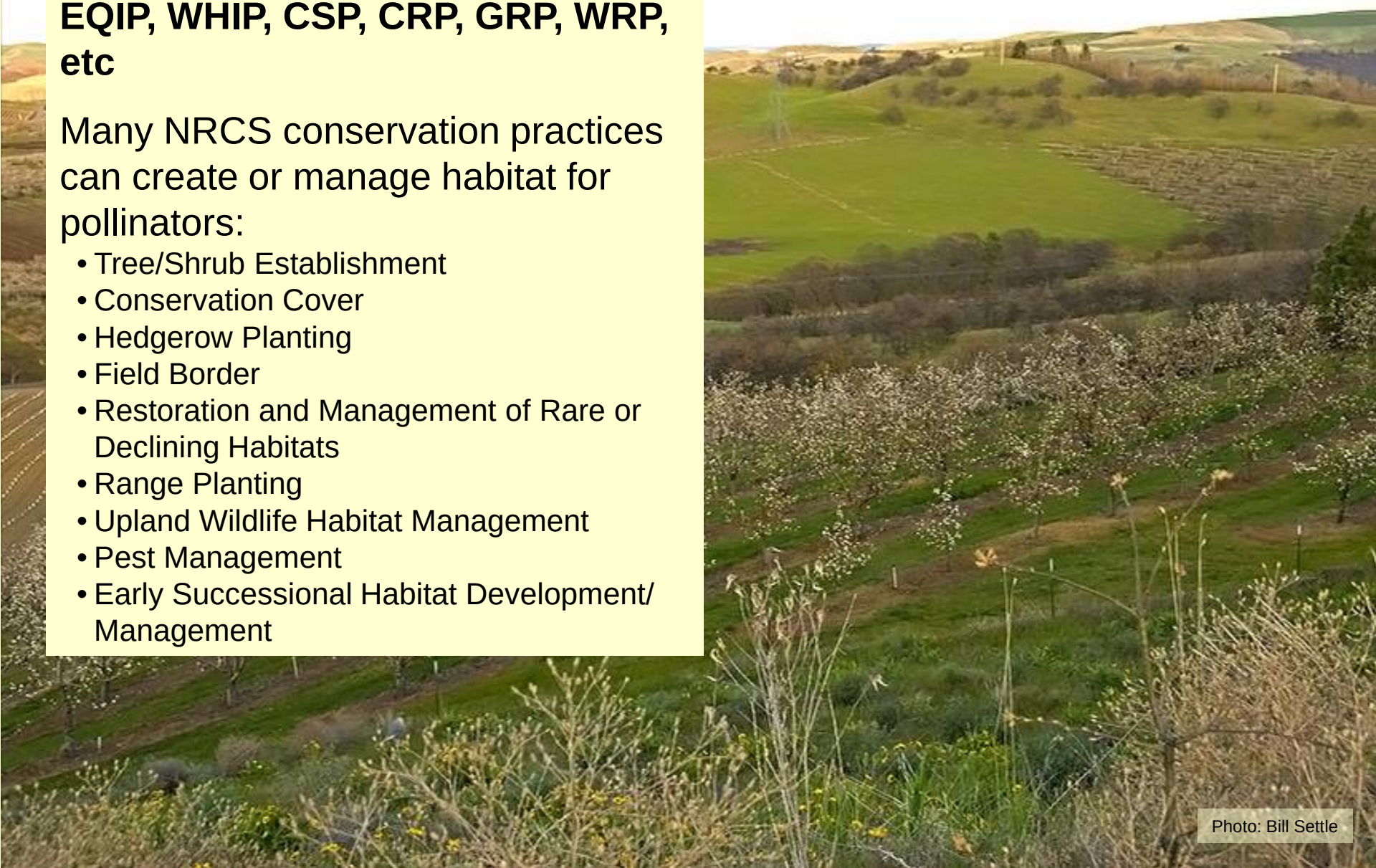


Photo: Bill Settle

Farm Bill Implementation

Example of Wisconsin USDA Environmental Quality Incentives Program (EQIP):

- Field Border (Pollinator Seed Mix: $350/acre)
- Tree/Shrub Establishment (Pollinator Shrubs: $425/acre)

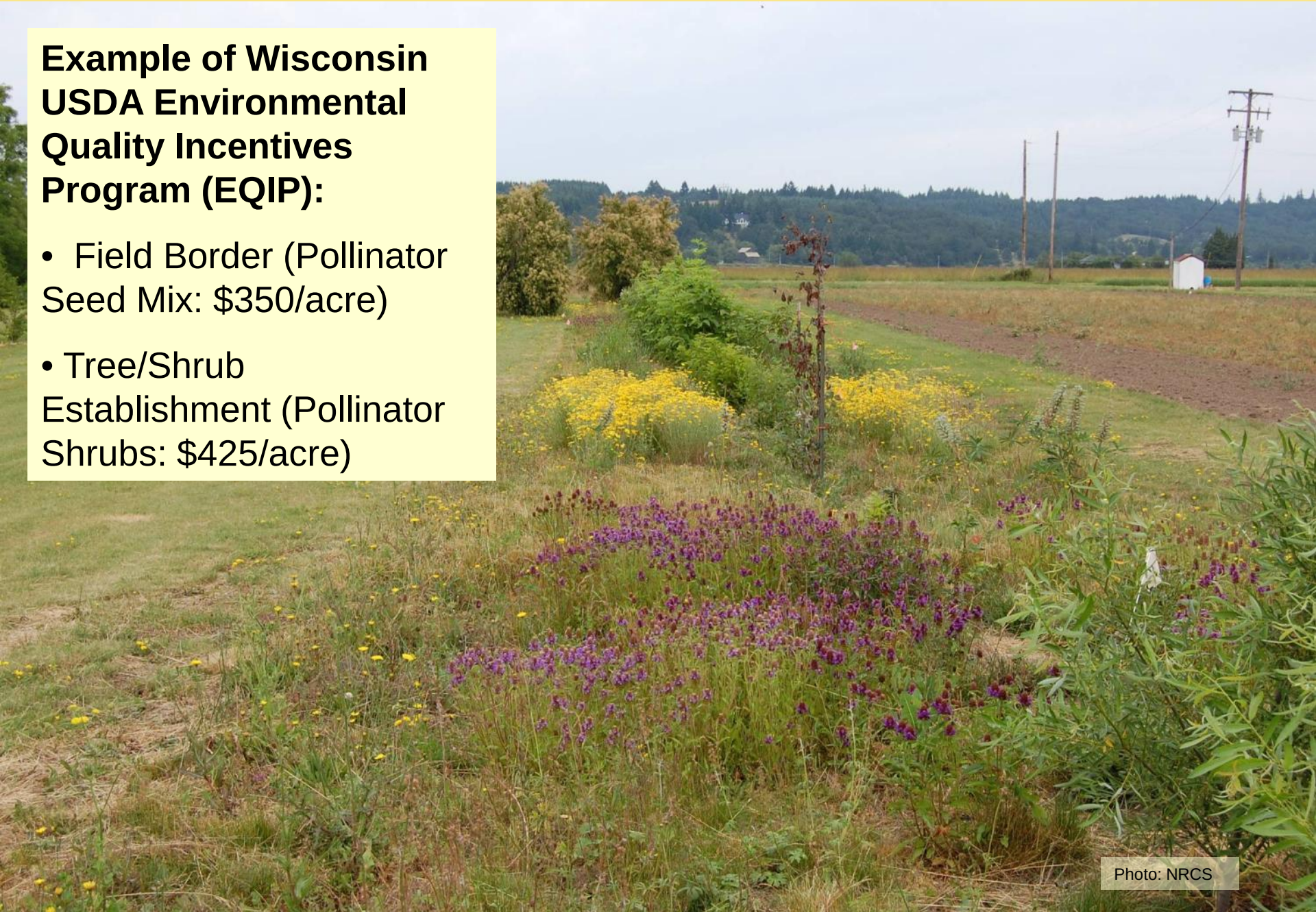


Photo: NRCS

Incentive Programs Available to Support Growers

USDA

POLLINATOR HABITAT PLANTING
Michigan CRP - SAFE CP-38E Pollinator

Natural Resources Conservation Service (NRCS) July 2008

Photo courtesy of USDA NRCS

WHAT IS A POLLINATOR HABITAT PLANTING?

A pollinator habitat planting consists of native shrubs, grasses and/or wildflowers which provide cover, nectar and pollen for native pollinators. Native pollinators include a wide range of insects including bees, beetles, butterflies, and moths, as well as birds.

To encourage and support a diverse group of pollinators this program will establish a diverse stand of grasses and wildflowers. Grass seeding rates have been reduced to a maximum of two pounds per acre and wildflower seeding rates have been increased to a minimum of two pounds per acre to establish a heavy stand of flowers with an abundant and diverse source of pollen and nectar. Wildflowers should be selected to provide not only a large diversity of species, but also to provide a diversity of flower color and structure, and to ensure flowering throughout the growing season.

Pollinators provide a very important ecological service. Approximately three quarters of all flowering plants rely upon animals to pollinate their flowers. In addition to agricultural crops such as fruits and many vegetables, these plants include seed producing wildflowers, fruit producing shrubs and nut producing trees which provide a source of food for many wildlife species.

Native grasses were present in Michigan when Europeans arrived. Many of these grasses are associated with native prairies, barrens and savannas. Some of the more common native grasses that grow well in Michigan include warm-season grasses such as big bluestem, little bluestem, and Indian grass as well as native cool season grasses such as Canada wild rye and Virginia wild rye. Common wildflowers include black-eyed susan, purple coneflower, coreopsis, and others.

Native grasses and wildflowers will live a long time after establishment. However, like most long-lived plant species, they generally establish slowly. Therefore, it is important to establish these grasses properly and to have patience when evaluating the results.

ELIGIBILITY

To be eligible for this practice, the land must be located in the CRP SAFE project target area which is a band two counties wide along Lake Michigan in the Lower Peninsula. (See map). The land must have a cropping history (4 out of 6 years from 1996 - 2001). and/or be part of a working orchard or vineyard. These plantings may consist of a block or border planting, whole field planting or a field border planting. The installed practice must be a minimum of 2 acres in size with a minimum width of 100 feet.

PLANTING

It is very important to plant grasses, wildflowers and shrubs into a weed-free, firm seedbed. If the field is currently in cropland, weed control efforts should begin prior to planting. Use herbicide or tillage to eliminate competing vegetation. If necessary for erosion control, seed a temporary cover. Eliminate the temporary vegetation at planting time with tillage or herbicides.

For optimum pollinator habitat, plant a diversity of grasses and wildflowers. The mixture will consist of a maximum of 2 PLS/Acre of native grasses and a minimum of 2.0 LBS/Acre of wildflowers. Suggested mix is 1 lb of little blue stem, 0.5 lb of big bluestem and 0.5 lb of Indian grass. Wildflowers mixtures will include

Example of CRP-SAFE:

Michigan case study

- Targets western fruit growing region
- Bee-friendly wildflowers
- 2,500 acre enrollment
- Annual rental payments
- Sign-up incentive payment
- 90% establishment cost-share
- 2 acre minimum per farm
- Maintenance agreement

Photo: USDA-NRCS

Part 5: Pollinator-Friendly Farming

Photo: USDA-NRCS/Irv Cole

Managing Habitat: Seven Issues

Adapt management to avoid causing harm:

- Tillage
- Fire
- Grazing
- Insecticides

Photo:Jessa Guisse

Manage Habitat: Tillage Reduction

Protect ground-nesting bees:

- Reduce tillage
- Avoid plastic mulch

Photo: USDA-ARS

Tillage and Bee Conservation

No-till and squash

- Virginia: No-till farms hosted three times more native squash bees than did conventional farms

Shuler, et al. 2005. Farming Practices Influence Wild Pollinator Populations on Squash and Pumpkin. *Journal of Economic Entomology*. 98(3):790-795

Photo: Bob Hammond, CO Coop Ext

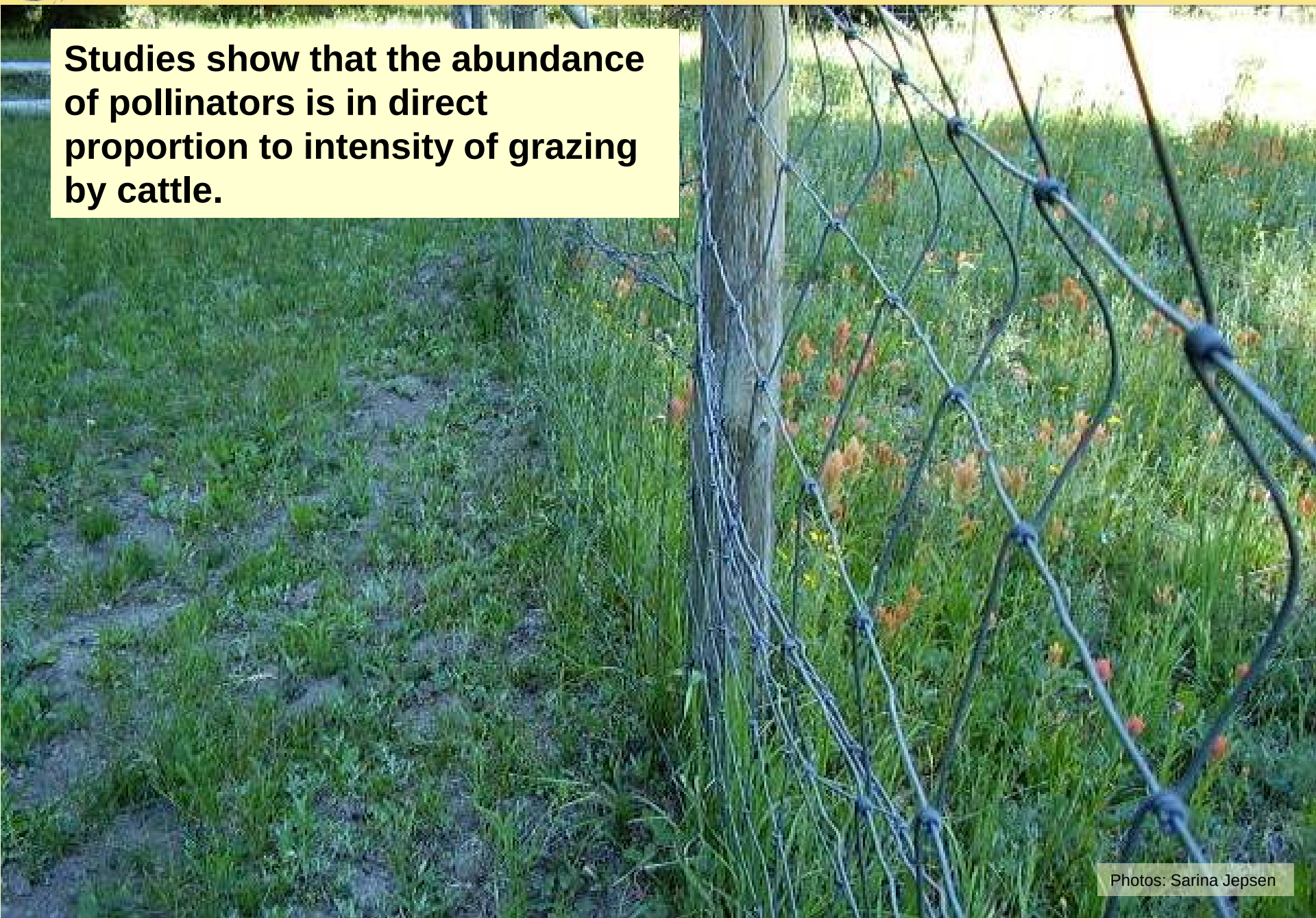
Managing Habitat: Fire

Burning of prairies with populations of pollinator insects could extirpate the pollinators if not done carefully.

Photo: USDA-NRCS/Jeff Vanuga

Managing Habitat: Grazing

Studies show that the abundance of pollinators is in direct proportion to intensity of grazing by cattle.



Photos: Sarina Jepsen

Managing Habitat: Insecticides

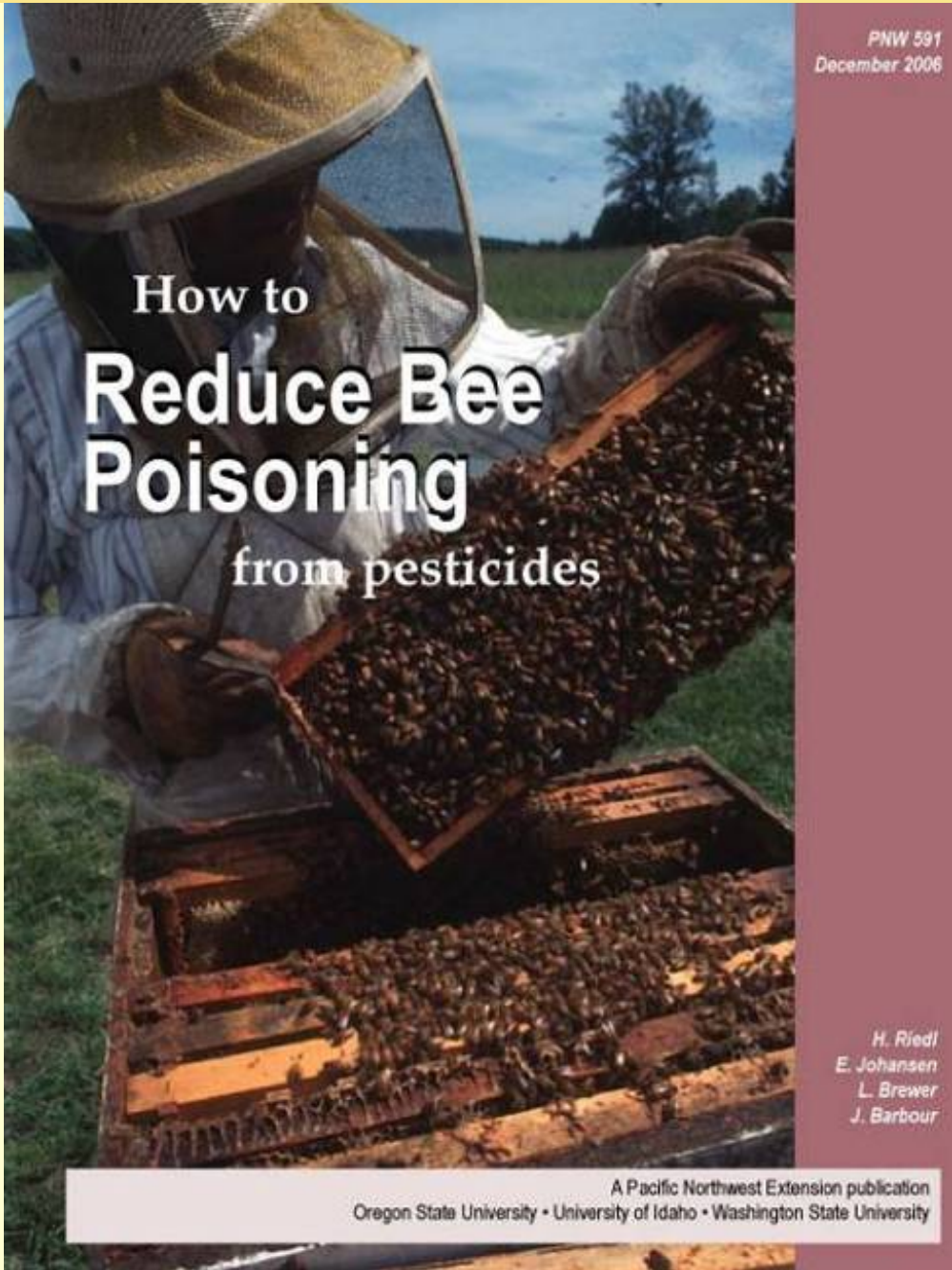
Insecticide use causes significant damage to pollinator insect populations.

- Avoid using insecticides

If you do use insecticides:

- Minimize their use
- Follow labels carefully
- Read *How to Reduce Bee Poisoning from Pesticides*

But be warned: even when bee caution labels are followed there is limited protection for many native bees



Managing Habitat: Insecticides

Conservation Biocontrol

• Many of the same flowering plants that support pollinators also support predatory and parasitic insects.

Soldier beetle

Parasitoid wasp

Ladybird beetle

Syrphid fly drinking raspberry nectar

Photos: Mace Vaughan, Paul Jepson, Mario Ambrosino

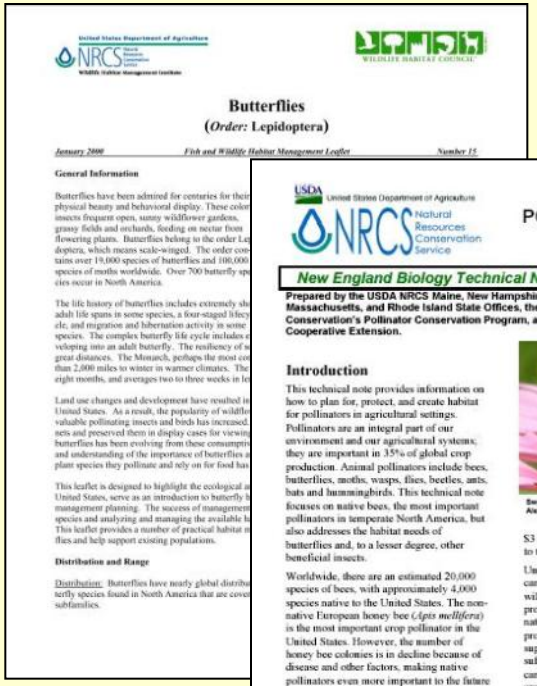
Part 7. Additional Resources

Photo: Rollin Coville

Further Information: USDA-NRCS

USDA-Natural Resources Conservation Service

- NEW: State and regional Technical Notes
- *Farming for Pollinators* brochure
- Agroforestry Notes
- PLANTS Database



Butterflies
(*Order:* Lepidoptera)

January 2000 — Fish and Wildlife Habitat Management Leaflet — Number 15

General Information

Butterflies have been admired for centuries for their physical beauty and behavioral display. These colorful insects frequent open, sunny wildflower gardens, grassy fields and orchards, feeding on nectar from flowering plants. Butterflies belong to the order Lepidoptera, which means scale-winged. The order contains over 19,000 species of butterflies and 100,000 species of moths worldwide. Over 700 butterfly species occur in North America.

The life history of butterflies includes extremely short adult life spans in some species, a four-staged lifecycle, and migration and hibernation activity in some species. The complex butterfly life cycle includes developing into an adult butterfly. The resiliency of many great distances. The Monarch, perhaps the most famous than 2,000 miles to winter in warmer climates. The eight months, and averages two to three weeks in length.

Land use changes and development have resulted in United States. As a result, the popularity of wildlife valuable pollinating insects and birds has increased. nets and preserved them in display cases for viewing butterflies has been evolving from these consumptive and understanding of the importance of butterflies and plant species they pollinate and rely on for food has

This leaflet is designed to highlight the ecological United States, serve as an introduction to butterfly management planning. The success of management species and analyzing and managing the available This leaflet provides a number of practical habitat flies and help support existing populations.

Distribution and Range

Distribution: Butterflies have nearly global distribution. terfly species found in North America that are covered subfamilies.

USDA United States Department of Agriculture
NRCS Natural Resources Conservation Service

POLLINATOR BIOLOGY AND HABITAT

New England Biology Technical Note — April 2009

Prepared by the USDA NRCS Maine, New Hampshire, Vermont, Connecticut, Massachusetts, and Rhode Island State Offices, the Xerces Society for Invertebrate Conservation's Pollinator Conservation Program, and the University of Maine Cooperative Extension.

Introduction

This technical note provides information on how to plan for, protect, and create habitat for pollinators in agricultural settings. Pollinators are an integral part of our environment and our agricultural systems; they are important in 35% of global crop production. Animal pollinators include bees, butterflies, moths, wasps, flies, beetles, ants, bats and hummingbirds. This technical note focuses on native bees, the most important pollinators in temperate North America, but also addresses the habitat needs of butterflies and, to a lesser degree, other beneficial insects.

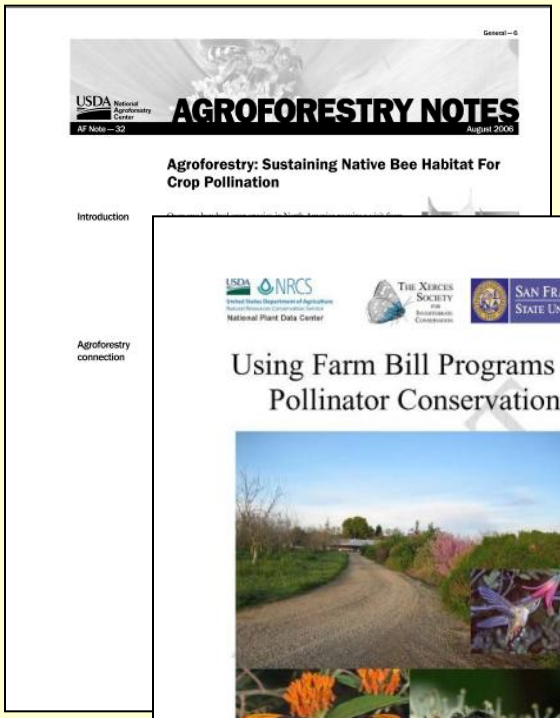
Worldwide, there are an estimated 20,000 species of bees, with approximately 4,000 species native to the United States. The non-native European honey bee (*Apis mellifera*) is the most important crop pollinator in the United States. However, the number of honey bee colonies is in decline because of disease and other factors, making native pollinators even more important to the future of agriculture. Native bees provide free pollination services, and are often specialized for foraging on particular flowers, such as squash, berries, or orchard crops. This specialization results in more efficient pollination and the production of larger and more abundant fruit from certain crops. Native bees contribute an estimated

Sweat bee (*Agapostemon* sp.). Photo: Toby Alexander, Vermont NRCS.

$3 billion worth of crop pollination annually to the U.S. economy.

Undeveloped areas on and close to farms can serve as long-term refugia for native wild pollinators. Protecting, enhancing or providing habitat is the best way to conserve native pollinators and, at the same time, provide pollen and nectar resources that support local honey bees; on farms with sufficient natural habitat, native pollinators can provide all of the pollination for some crops.

Pollinators have two basic habitat needs: a diversity of flowering native or naturalized plants, and egg-laying or nesting sites. The Natural Resources Conservation Service (NRCS) can assist landowners with providing adequate pollinator habitat by, for example, suggesting locally appropriate plants and offering advice on how to provide nesting or egg-laying habitat.



AGROFORESTRY NOTES

AF Note—32 — August 2006

Agroforestry: Sustaining Native Bee Habitat For Crop Pollination

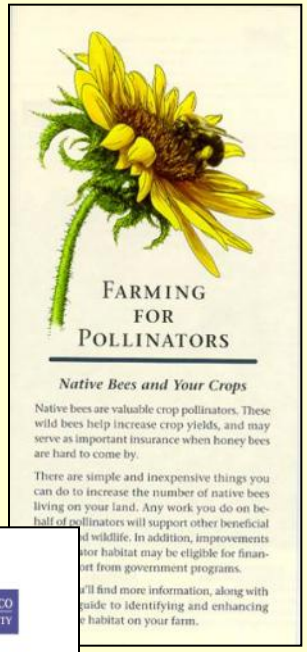
Introduction

USDA NRCS National Plant Data Center
The Xerces Society for Invertebrate Conservation
San Francisco State University

Agroforestry connection

Using Farm Bill Programs for Pollinator Conservation

July 2008



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 wildlife. In addition, improvements habitat may be eligible for financ- from government programs.

find more information, along with guide to identifying and enhancing habitat on your farm.

Further Information: The Xerces Society

- Xerces Society publications
- www.xerces.org

Further Information: The Xerces Society

New Pollinator Conservation Resource Center

Region-specific Information from Extension, USDA, and other sources, including:

- Plant Lists
- Conservation Guides
- Pesticide Guidelines

www.xerces.org/pollinator-resource-center

Take Home Message

Wildflower-rich habitat that supports a diversity of pollinators also supports a diversity of other wildlife species.

Focus on:

- Providing season-long blooming plants
- Protecting nest sites
- Minimizing the effects of pesticides

www.xerces.org
(follow links to pollinator program)

Photo: Elaine Evans

What's Old is What's New?

In 1938, Dr. Patch predicted that by the year 2000

…the President of the United States would issue a proclamation claiming that land areas at regular intervals throughout the U.S. would be maintained as "Insect Gardens," under the direction of government entomologists. These would be planted with milkweed, hawthorn, and other plants that could sustain populations of butterflies and bees. She predicted that some time in the future, "Entomologists will be as much or more concerned with the conservation and preservation of beneficial insect life as they are now with the destruction of injurious insects."

Dr. Edith Patch (1916)
President, Entomological Society of America

Photo:The Friends of Edith Patch (www.edithpatch.org)

Thank You!

NRCS-ENTSC

Many excellent scientists, conservationists, and farmers

Financial support from

- Xerces Society Members
- NRCS: West National Tech Center, Ag Wildlife Conservation Center
- Ceres/Greater Milwaukee Foundation
- Natural Resources Foundation of Wisconsin
- USDA-SARE
- Turner Foundation
- CS Fund
- Dudley Foundation
- Bullitt Foundation
- Disney Wildlife Conservation Fund
- Richard and Rhoda Goldman Foundation
- Panta Rhea Foundation
- Gaia Fund
- Bill Healy Foundation
- Bradshaw-Knight Foundation
- Wildwood Foundation
- Organic Farming Research Foundation
- Organic Valley
- USFWS

Photo: Mace Vaughan