Farming for Bees

Providing Habitat for Bees on Farms

Presented by Matthew Shepherd
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The Xerces Society for Invertebrate Conservation

Photo: Edward S. Ross

Importance of Pollinators

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

- Over 70% of flowering plants require a pollinator to move pollen
- Over $18.9 billion value of crops in U.S.
- One in three mouthfuls of food and drink we consume

Photo: USDA-ARS/Peggy Greb

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Bees: The Most Important Pollinators

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

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

- 50% decline in managed hives since 1950
- 70-100% decline in feral colonies

Disease, pests, and honey prices.

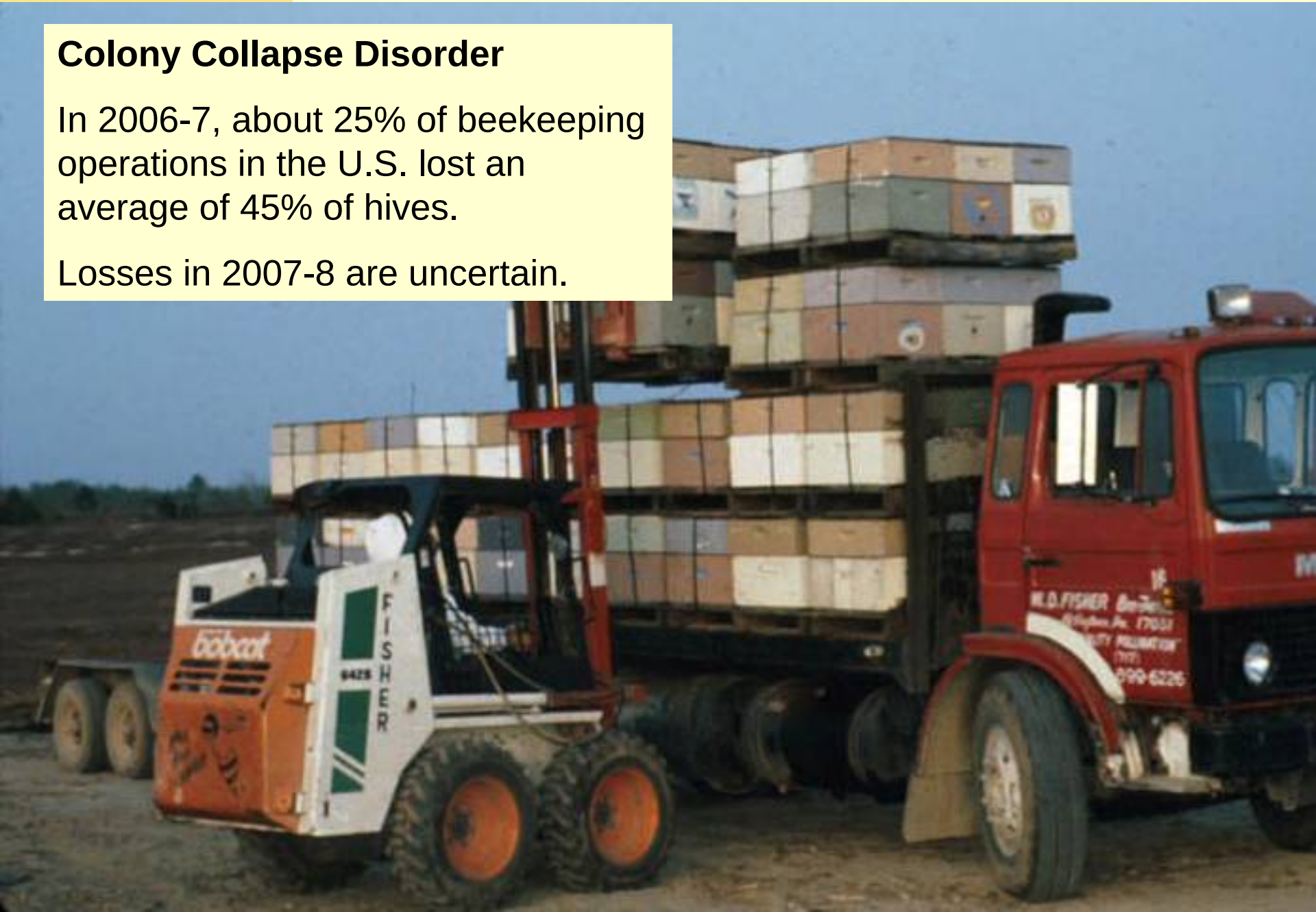
Photo: USDA-ARS/Scott Bauer

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.

Losses in 2007-8 are uncertain.



Crop Pollination: Honey Bees in Decline

Colony Collapse Disorder

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

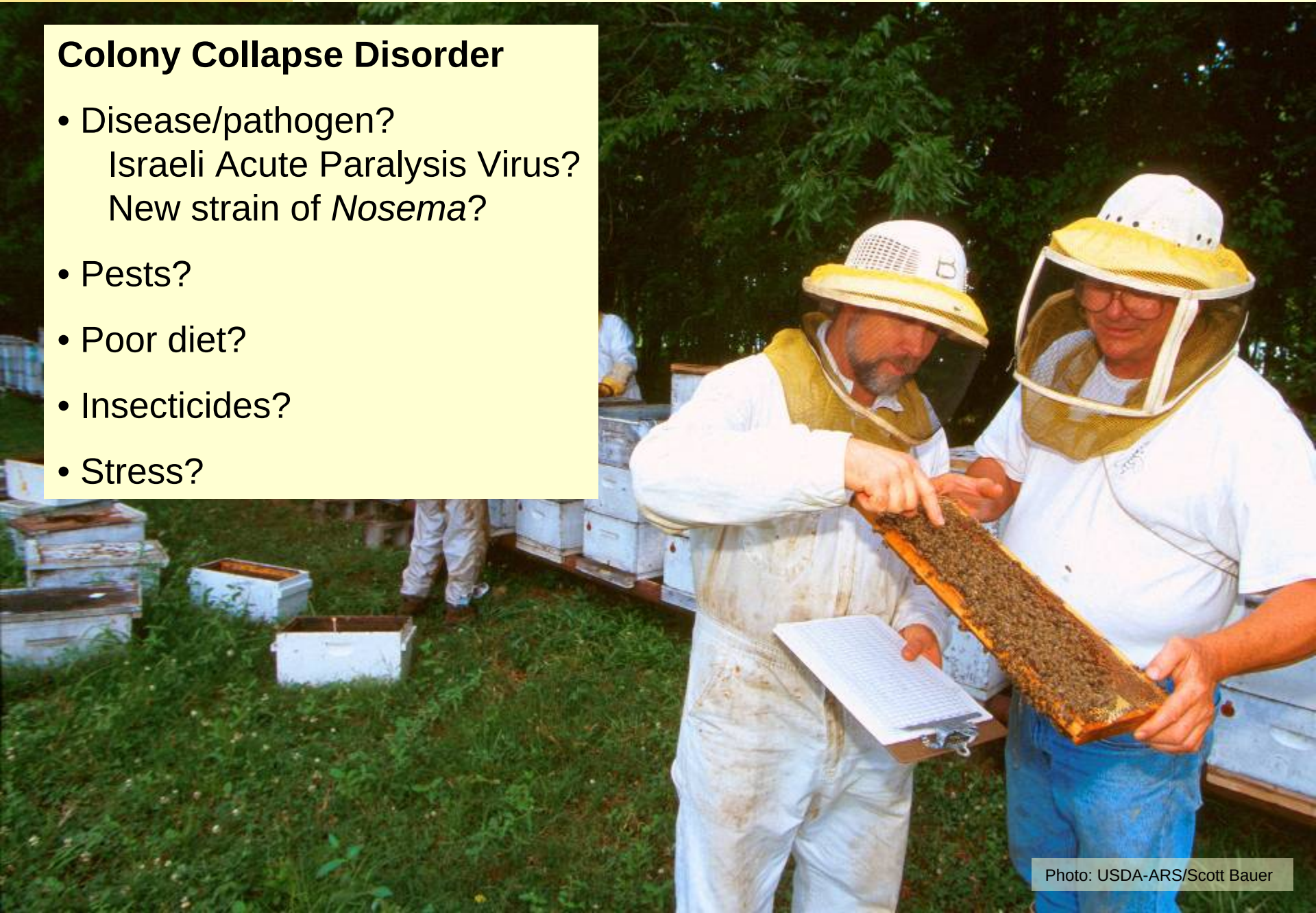
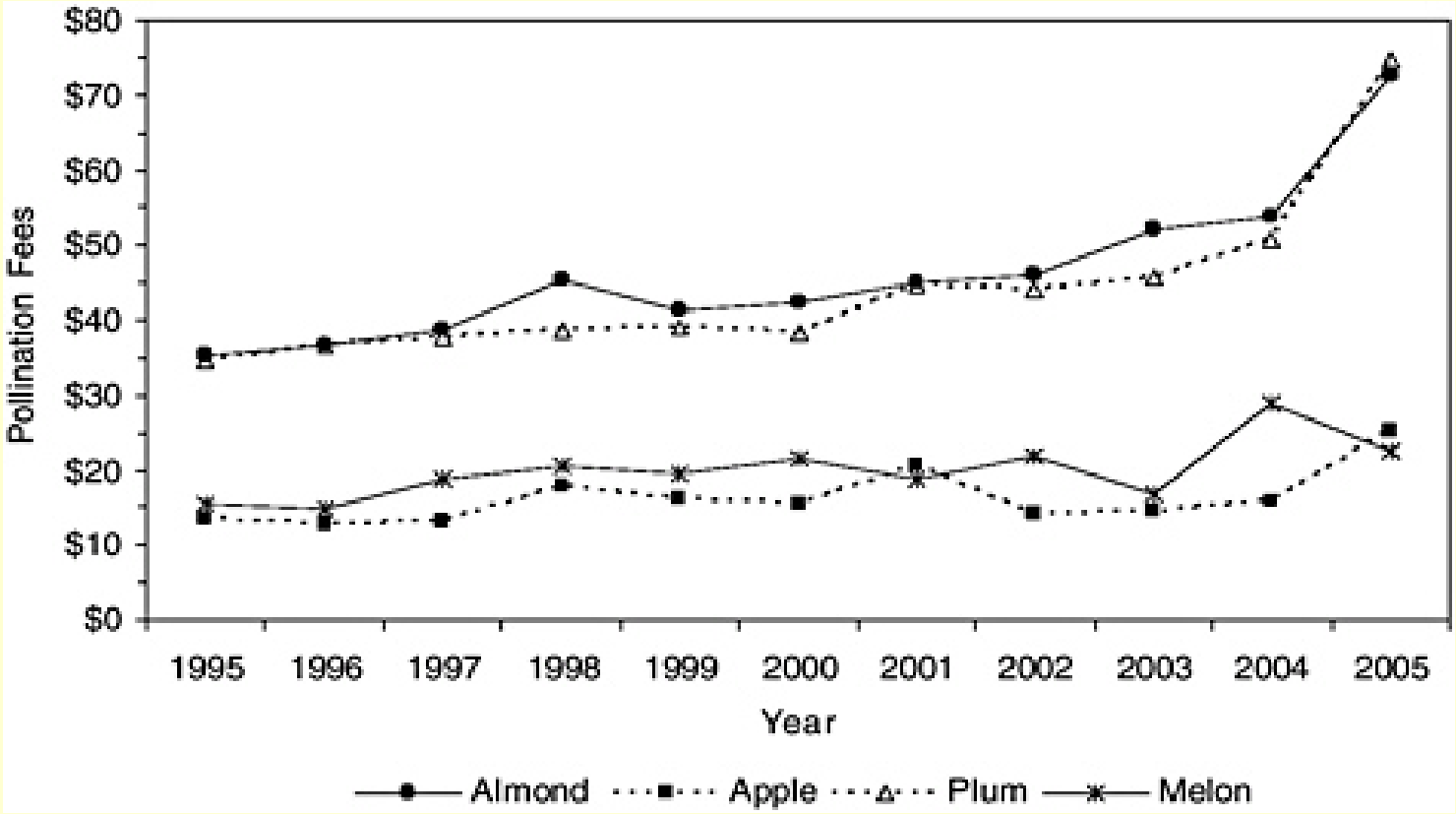


Photo: USDA-ARS/Scott Bauer

Crop Pollination: Honey Bees in Decline

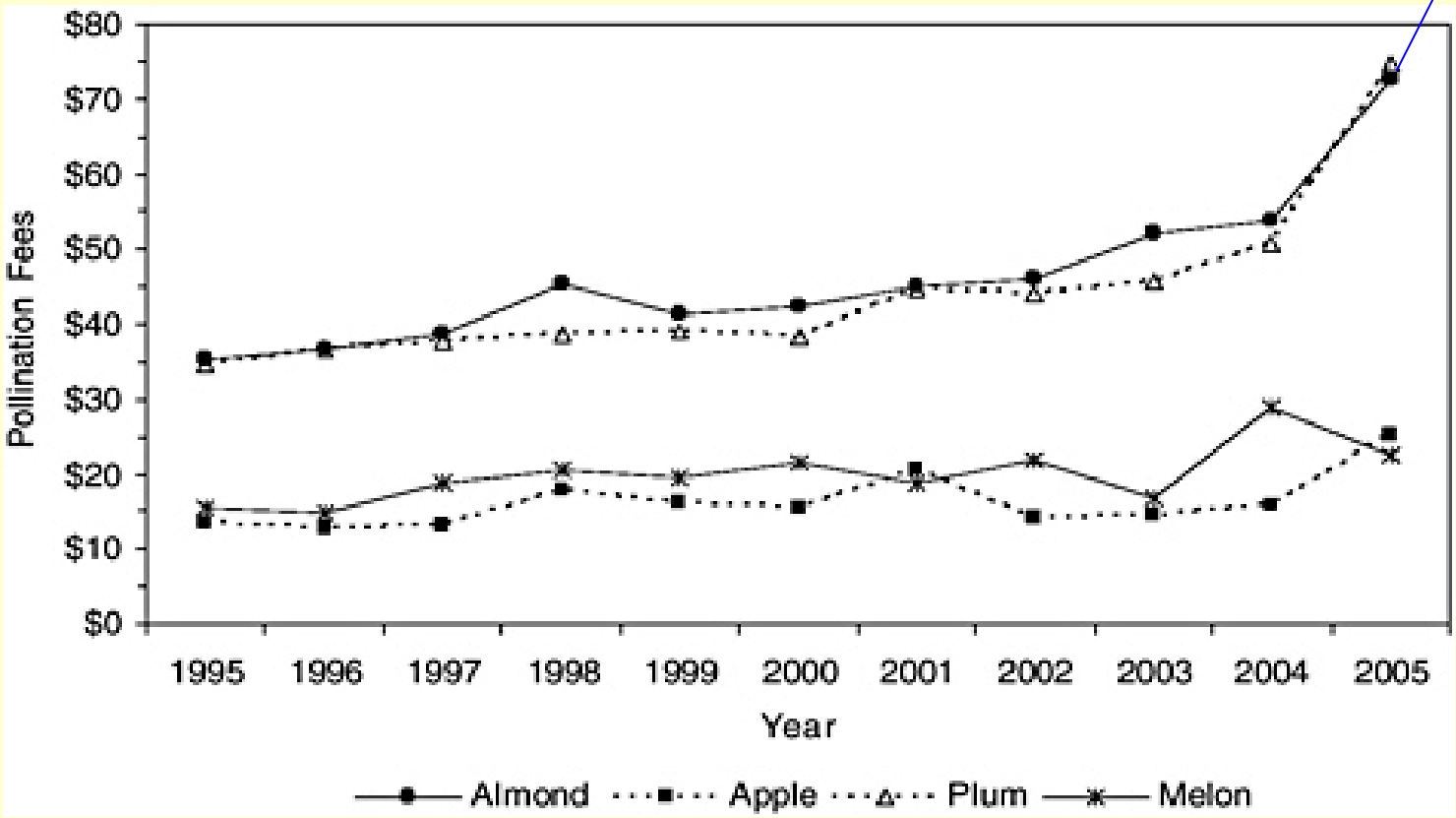
Honey bee colony rental rates for selected California crops, 1995–2005.



Crop Pollination: Honey Bees in Decline

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

Plus almonds, 2006-2008



2006

2007

2008

Importance of Native Bees

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

Photo: Mace Vaughan

Native Bees and Agriculture

Research demonstrates contribution of native bees to crop pollination:

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

Photo: Matthew Shepherd

Importance of Native Bees: Crop Pollination

Example: hybrid sunflowers

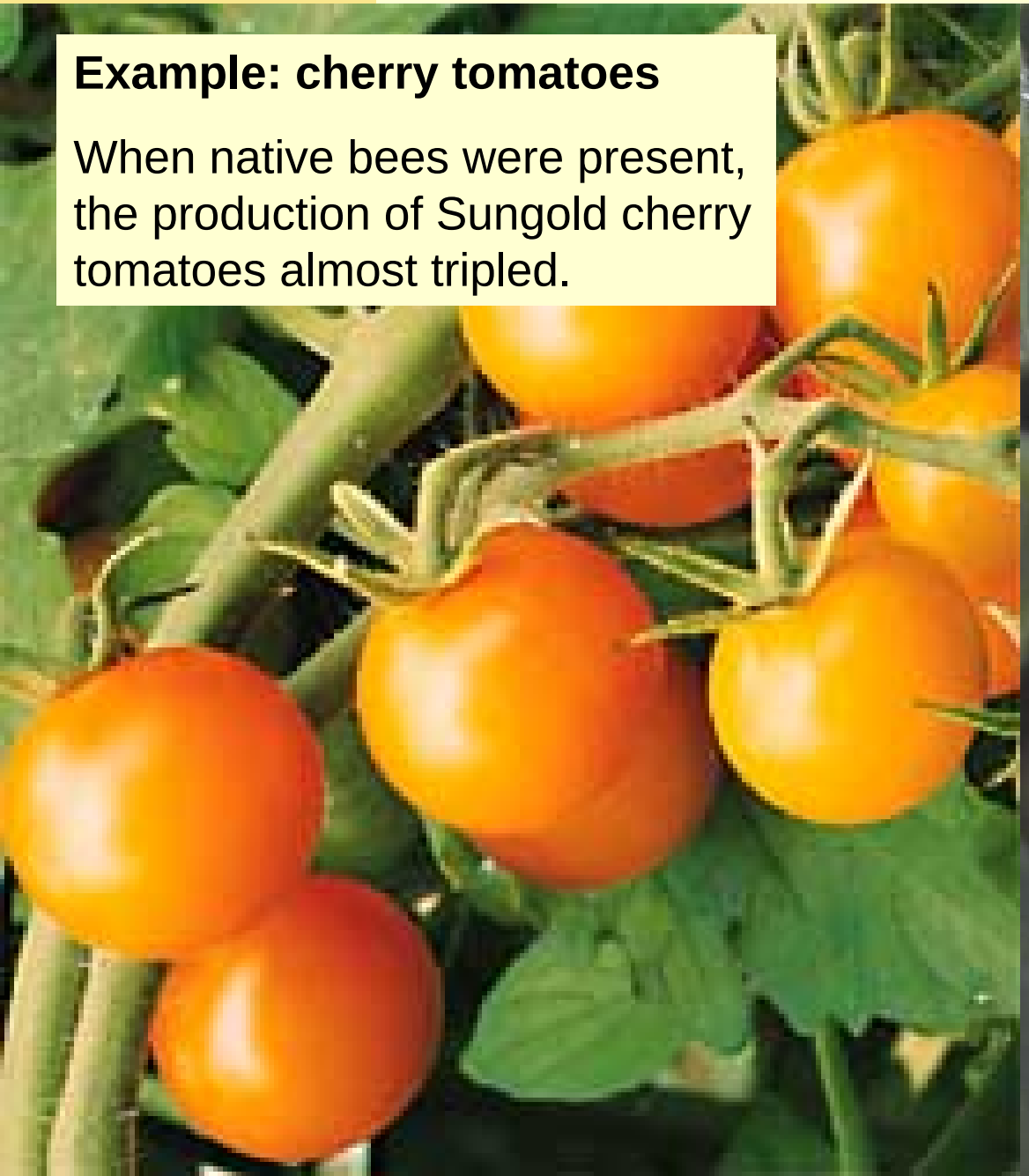
When native bees were present, the seed set in hybrid sunflower fields more than doubled.

Photos: Sarah Greenleaf

Importance of Native Bees: Crop Pollination

Example: cherry tomatoes

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



Advantages of Native Bees

Native bees are very efficient:

- active earlier in season and day
- buzz pollination
- collect both pollen and nectar
- keep honey bees moving
- no rental fees

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

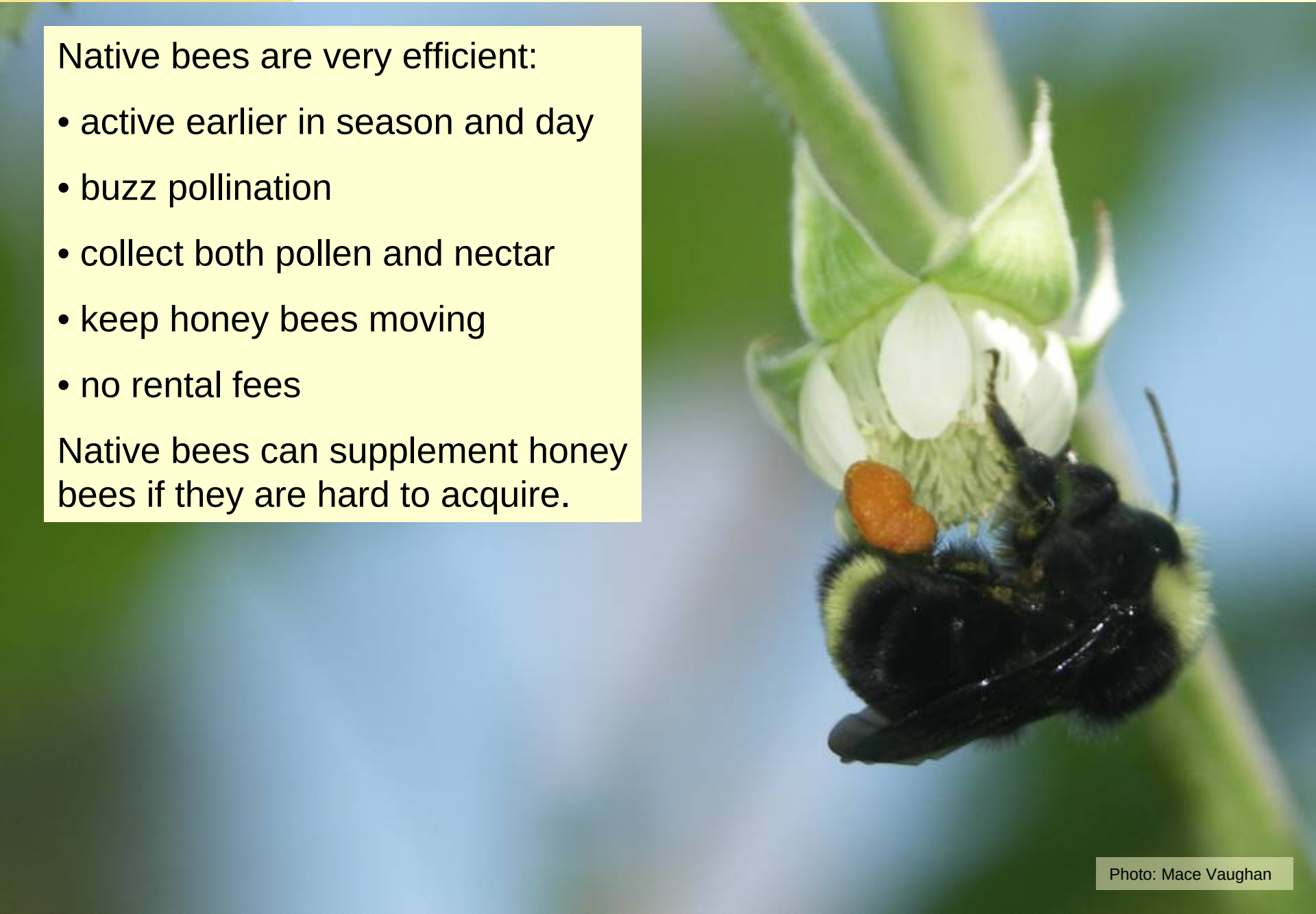


Photo: Mace Vaughan

Advantages of Native Bees

Example: Blue orchard bee

- active earlier in season and day
- forages in cooler and damper conditions
- 250 individual females for a acre of orchard compared to 1 to 2.5 hives of honey bees (10,000 to 25,000 bees)

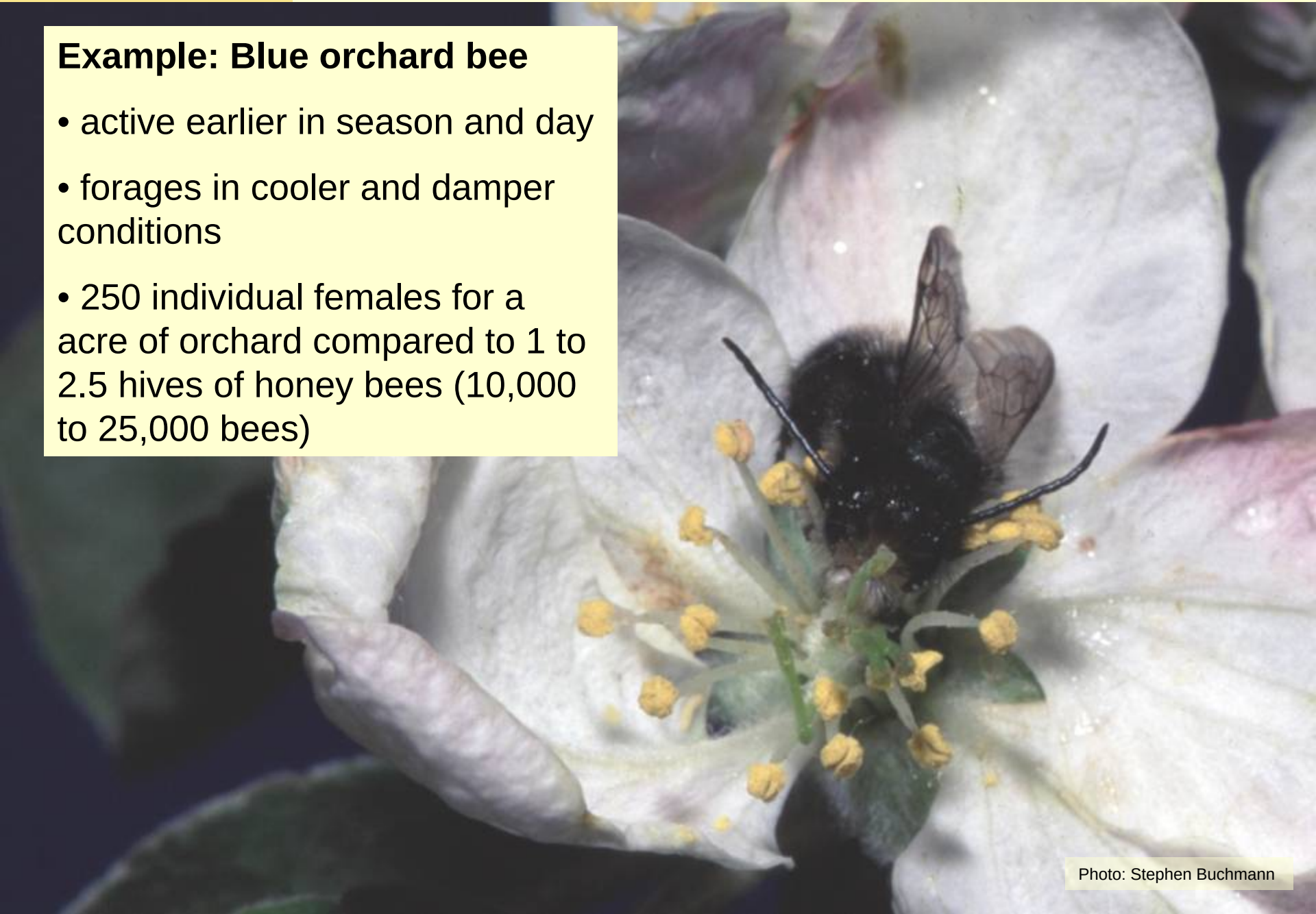


Photo: Stephen Buchmann

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Value of Natural Areas

Pollinators need habitat.

The amount of natural areas on or close to the farm is a major influence.

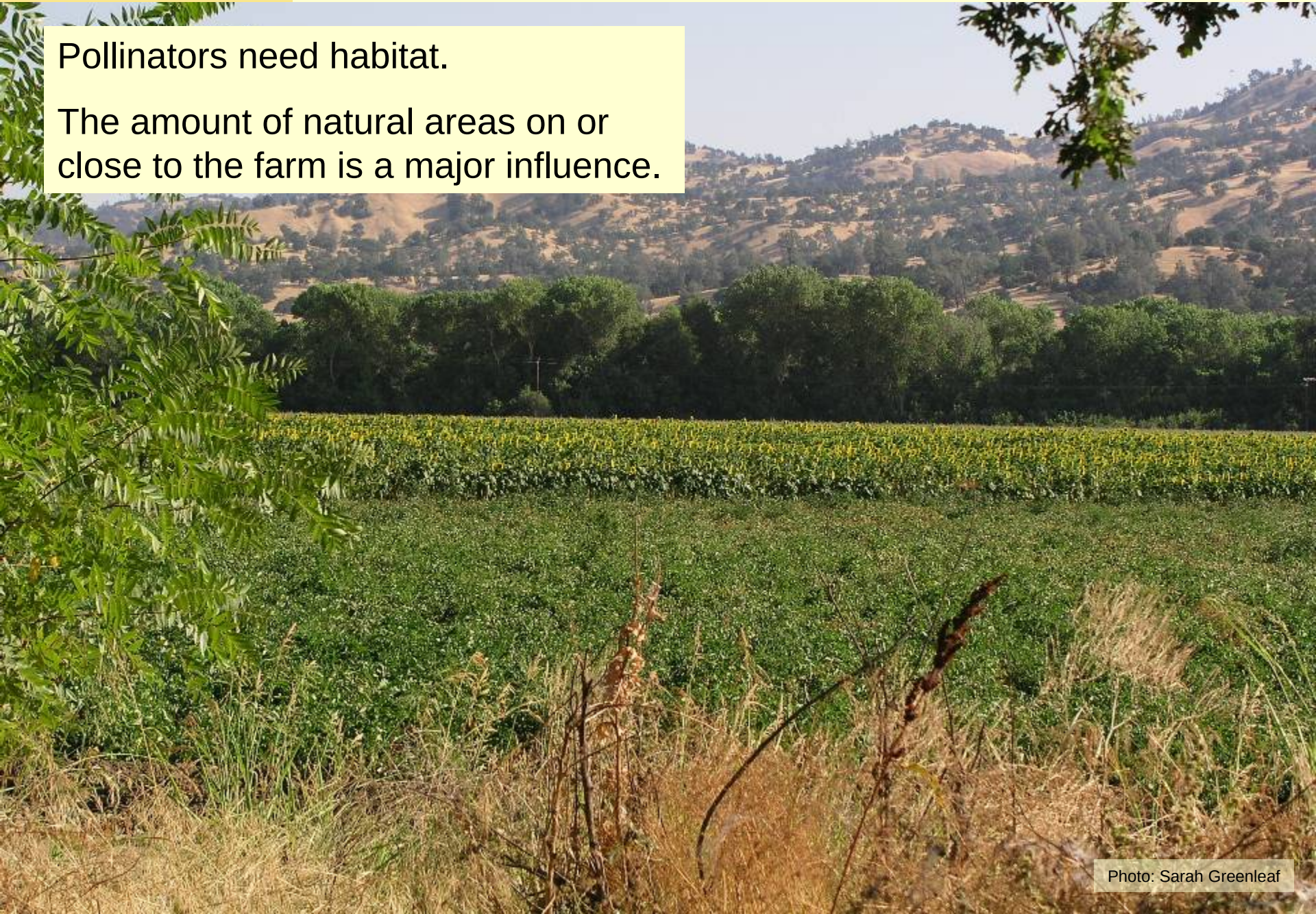

Photo: Sarah Greenleaf

Value of Natural Areas

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.

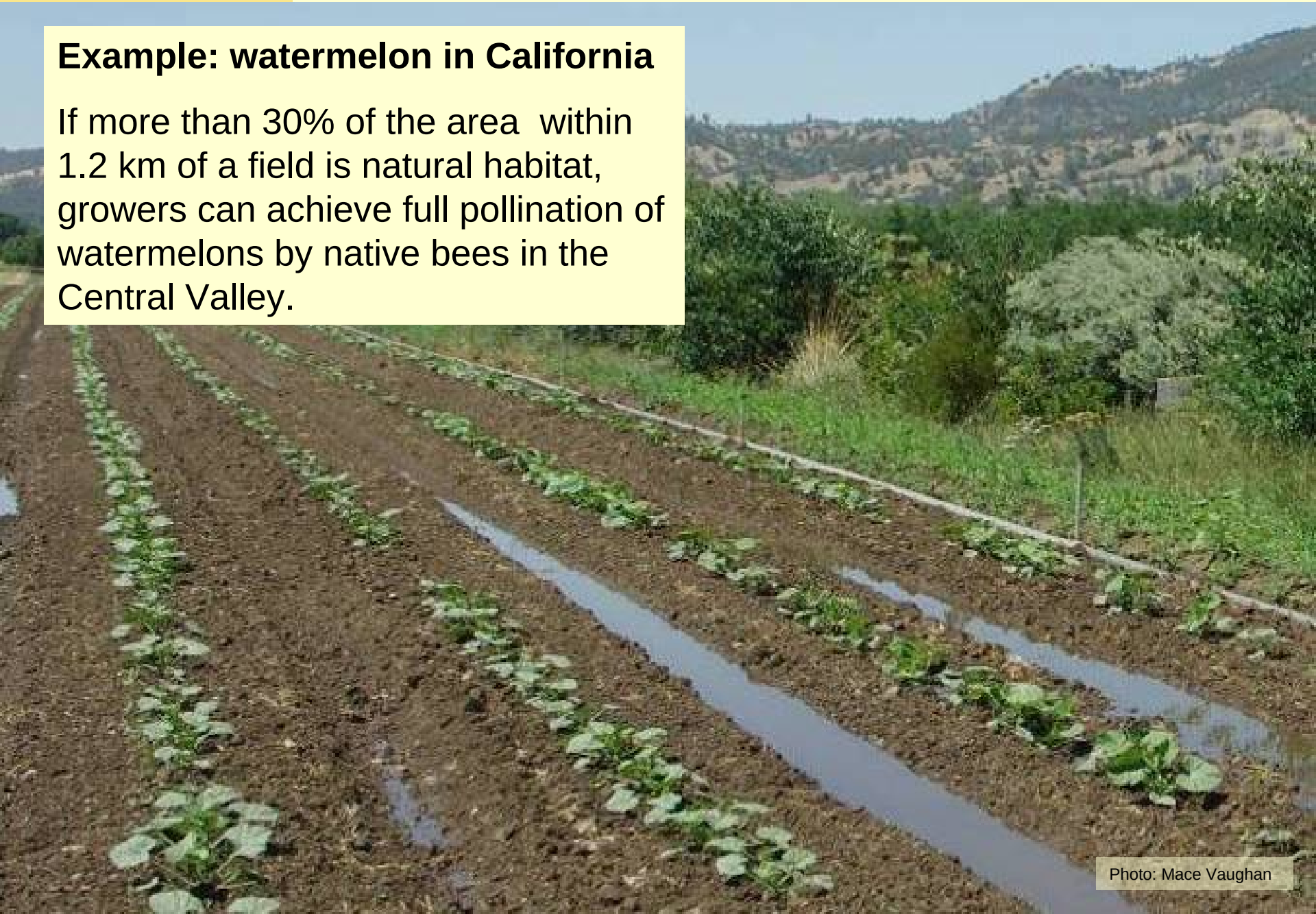

Photo: Mace Vaughan

Value of Natural Areas

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.

Photo: Dr. James Altland, OSU

Value of Natural Areas

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.

Photo: Rachael Winfree

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Three Steps to Native Bee Conservation

Step 1 - Know what you have: recognize native bees and existing habitat.

Step 2 - Adapt current practices to reduce harm to pollinators.

Step 3 - Enhance habitat for bees.

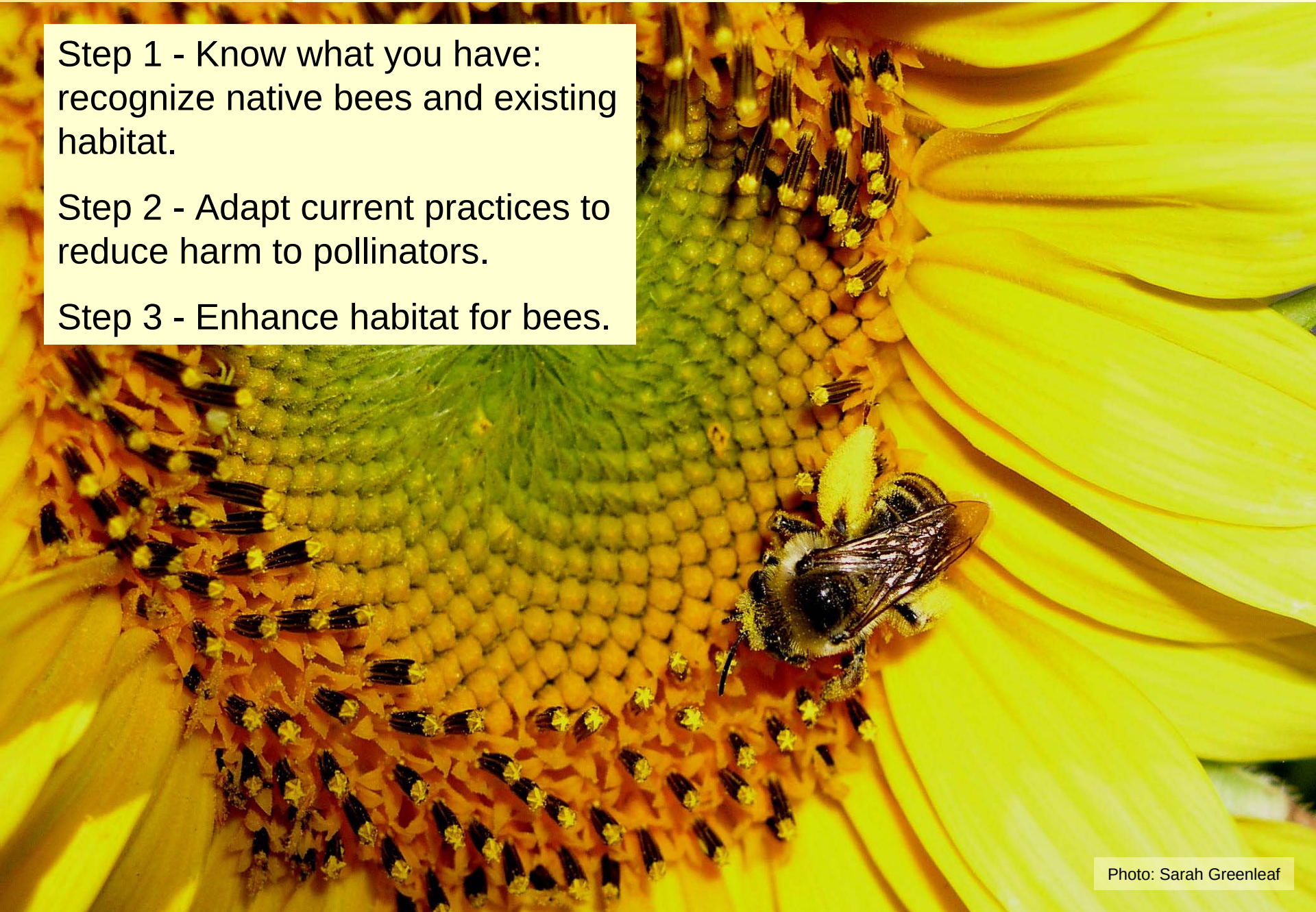

Photo: Sarah Greenleaf

Step 1 - Know What You Have: Native Bees

North America: 4,000 species

Oregon: 600-800 species?

Willamette Valley: 120-150 species?

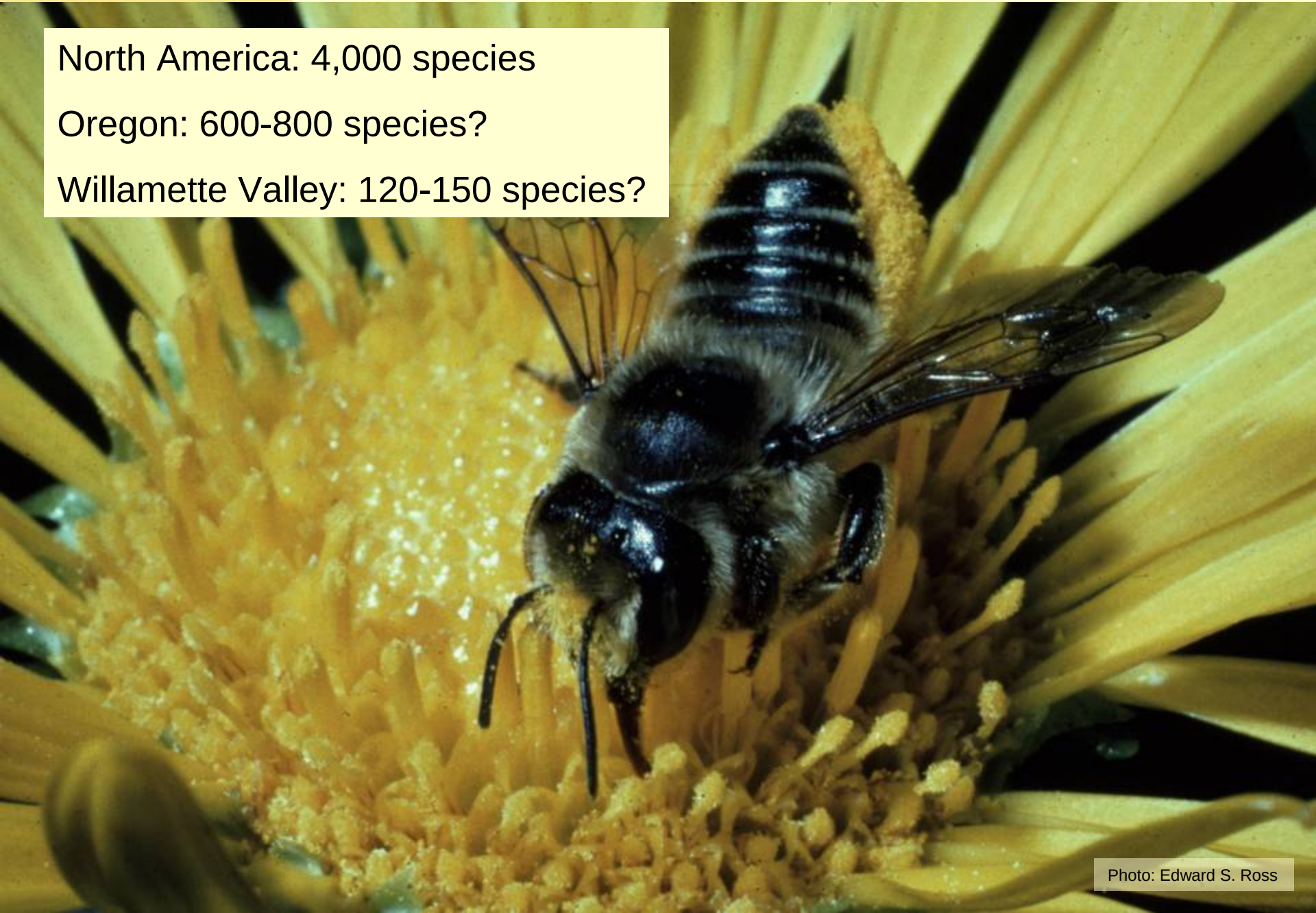

Photo: Edward S. Ross

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Step 1 - Know What You Have: Native Bees

Photos: James Cane; Robert Parks; Edward S. Ross

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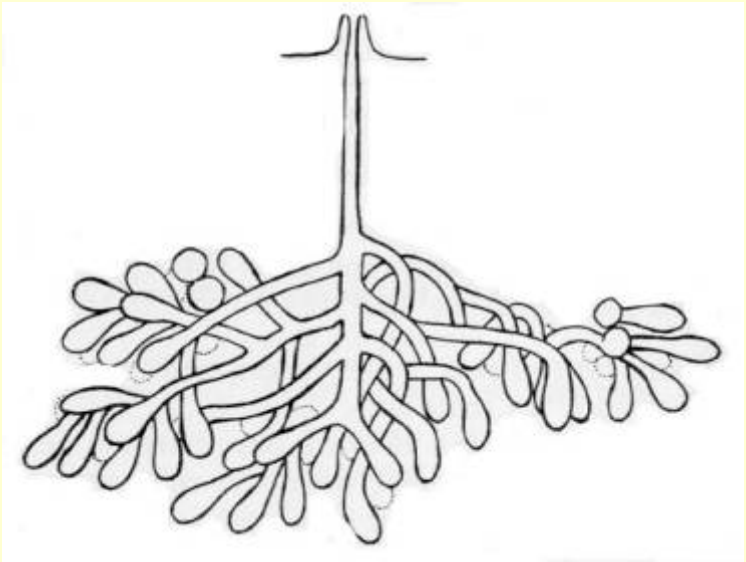
Step 1 - Know What You Have: Native Bees

Photos: Bruce Newhouse; Edward S. Ross; Mace Vaughan; USDA-ARS/Jack Dykinga

Step 1 - Know What You Have: Bee Nest Sites

Ground-nesting (~70%)

Photo: Matthew Shepherd

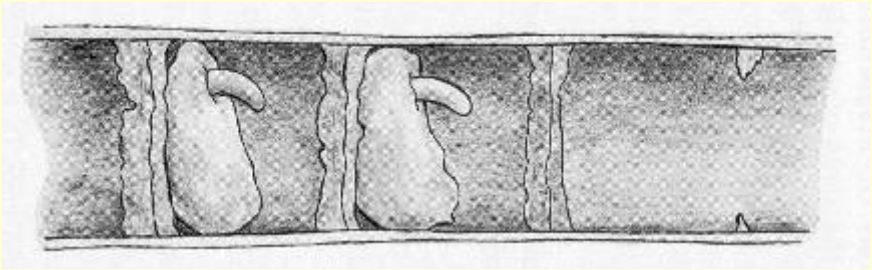


Source: Stephen, Bohart, and Torchio, 1967

Step 1 - Know What You Have: Bee Nest Sites

Tunnel-nesting (~30%)

Photo: Matthew Shepherd



Source: Stephen, Bohart, and Torchio, 1967

Bee Basics: Life Cycle of a Solitary Bee

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

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Step 1 - Know What You Have: Bumble Bee Nest Sites

Photos: Edward S. Ross, Mace Vaughan

Step 1 - Know What You Have: Forage Areas

Areas that support a diversity of native or naturalized plants.

Photos: Matthew Shepherd, Mace Vaughan

Bee Basics: Foraging

- Bees usually drink nectar from any accessible flower
- They may be more particular about where they collect pollen
- Some species collect leaf pieces, resin, soil, etc. for nest construction

Photo: Edward S. Ross

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Step 1 - Know What You Have: Habitat Patches

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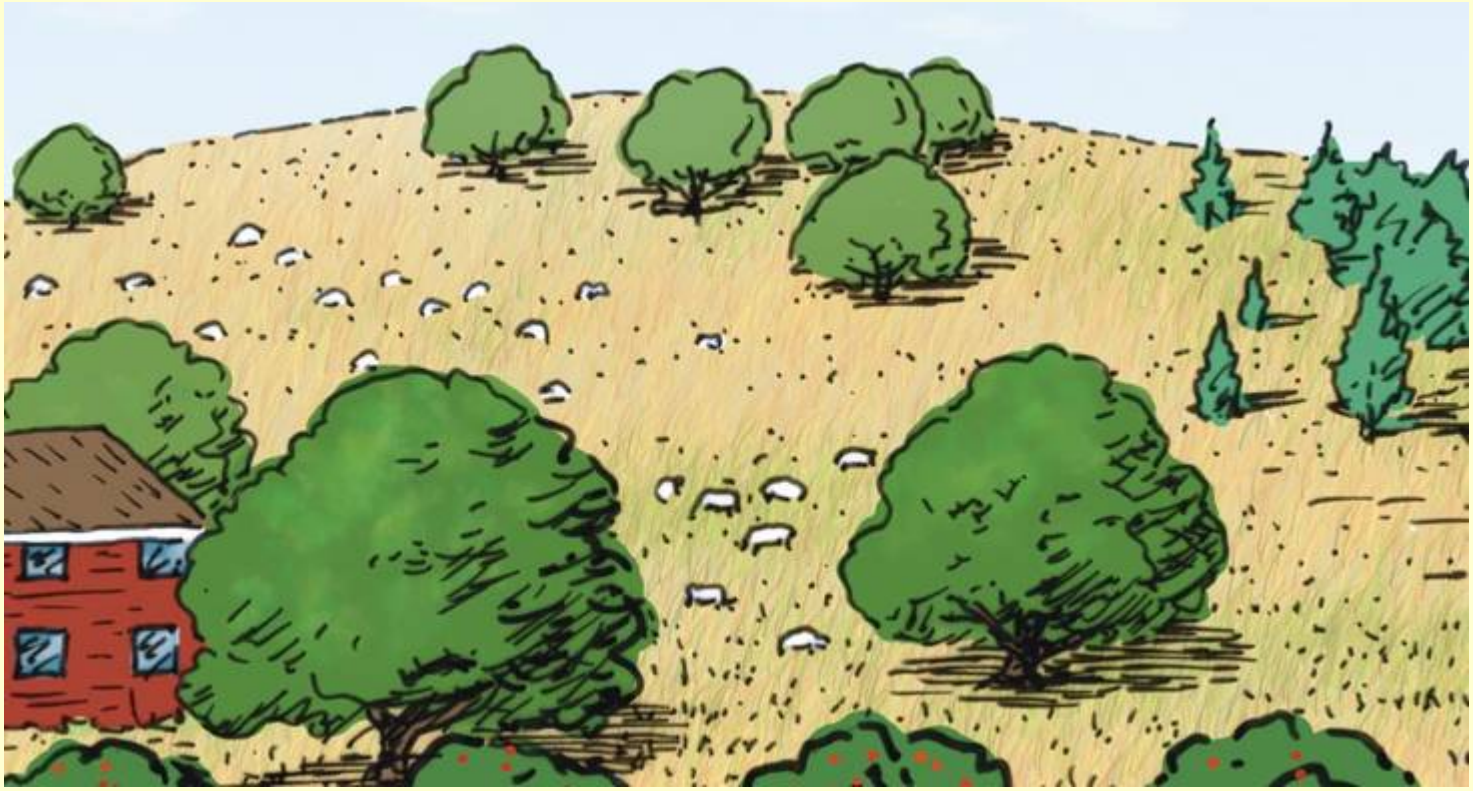
Natural or undeveloped areas



Step 1 - Know What You Have: Habitat Patches

Hedgerows, field edges, and road margins

Step 1 - Know What You Have: Habitat Patches

Cover crops

Step 1 - Know What You Have: Habitat Patches

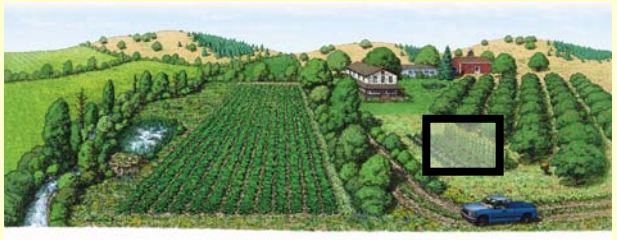
Snags

Step 1 - Know What You Have: Habitat Patches

Excavated soil

Step 1 - Know What You Have: Habitat Patches

Gardens



Step 1 - Know What You Have: Habitat Patches

Riparian buffers

Step 1 - Know What You Have: Habitat Patches

Fallow and unproductive land

Step 2 – Adapt Current Practices

Make simple changes. For example:

- Protect and value habitat
- Create pesticide buffers and adjust application methods to do least harm
- Do not overspray habitat
- Maximize untilled areas
- Allow crops to bolt
- Reconsider what is a weed

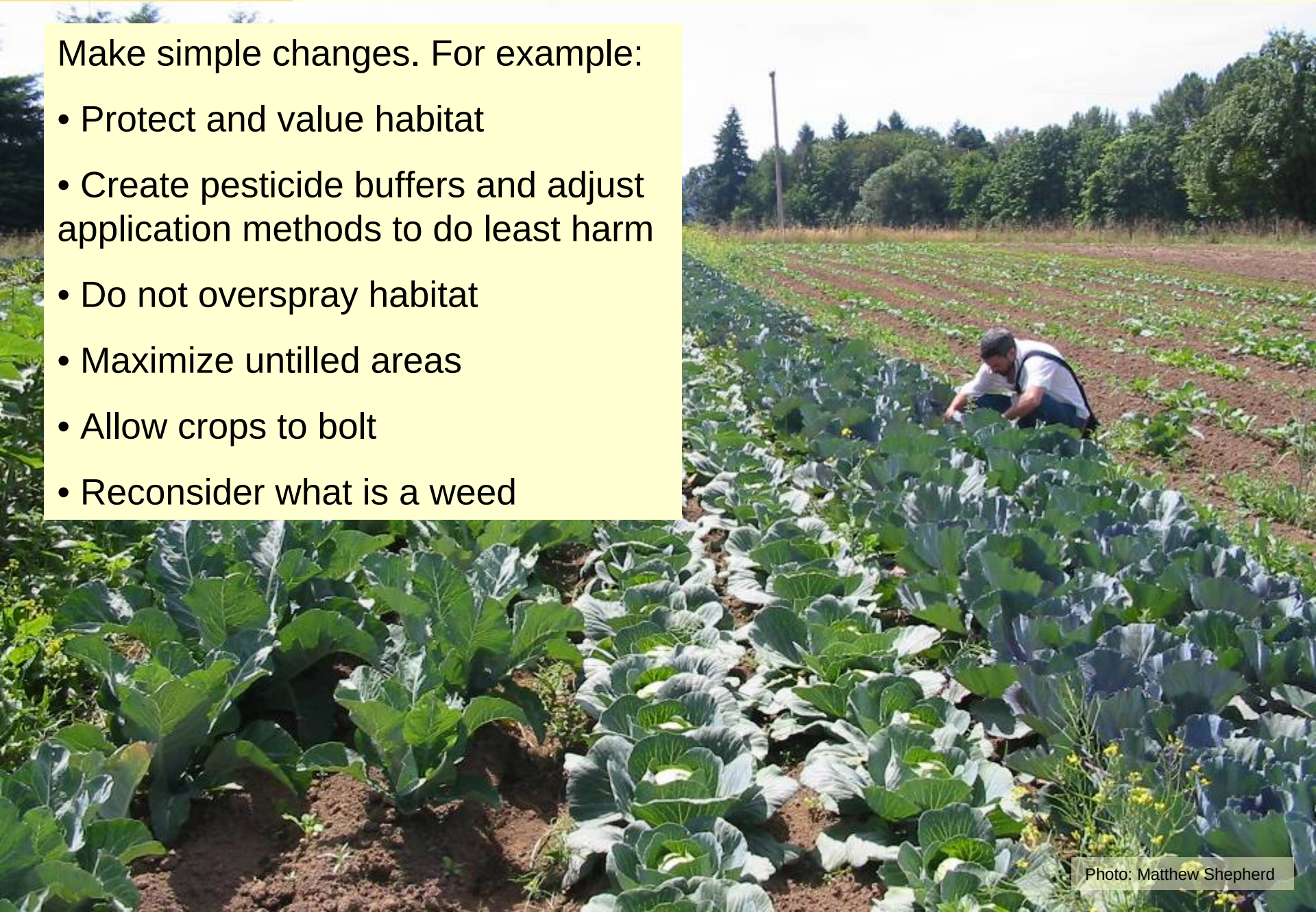


Photo: Matthew Shepherd

Step 3 – Enhance Habitat: Forage Patches

Choose a diversity of native or naturalized plants that:

- Provide abundant nectar & pollen
- Bloom throughout the year, especially early and late
- Can serve as a “bridge” between crops

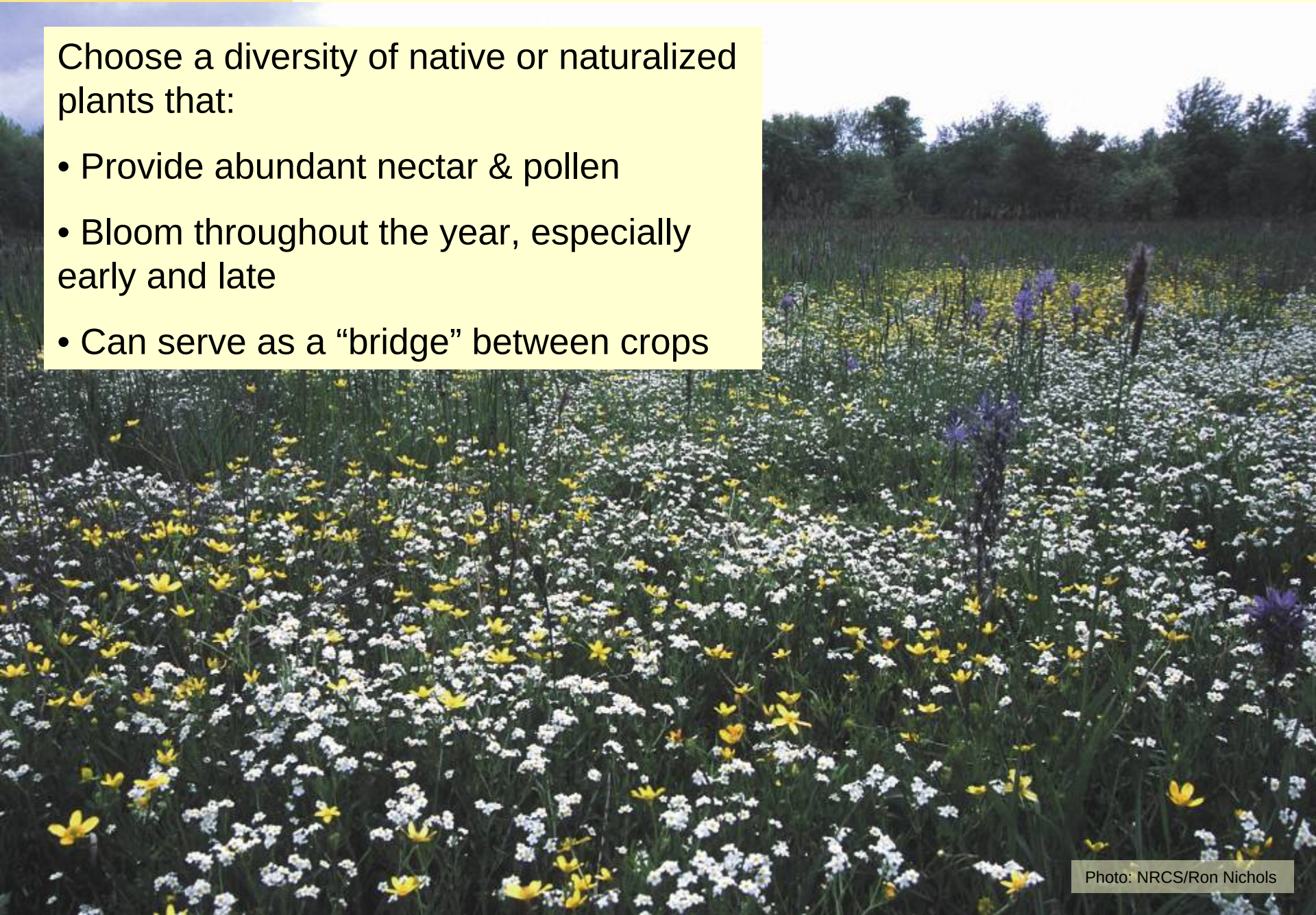
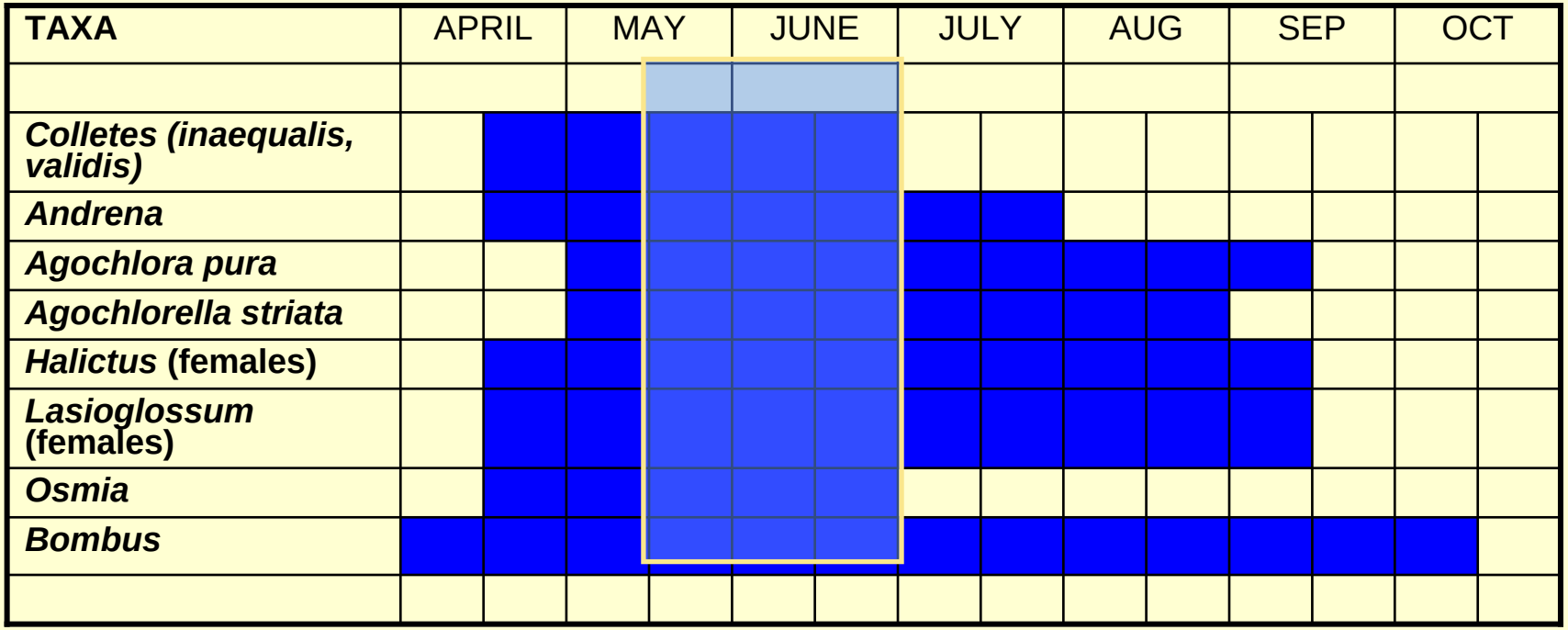


Photo: NRCS/Ron Nichols

Step 3 – Enhance Habitat: Forage Patches

Select plants that provide forage to support bees before and after crop bloom.

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



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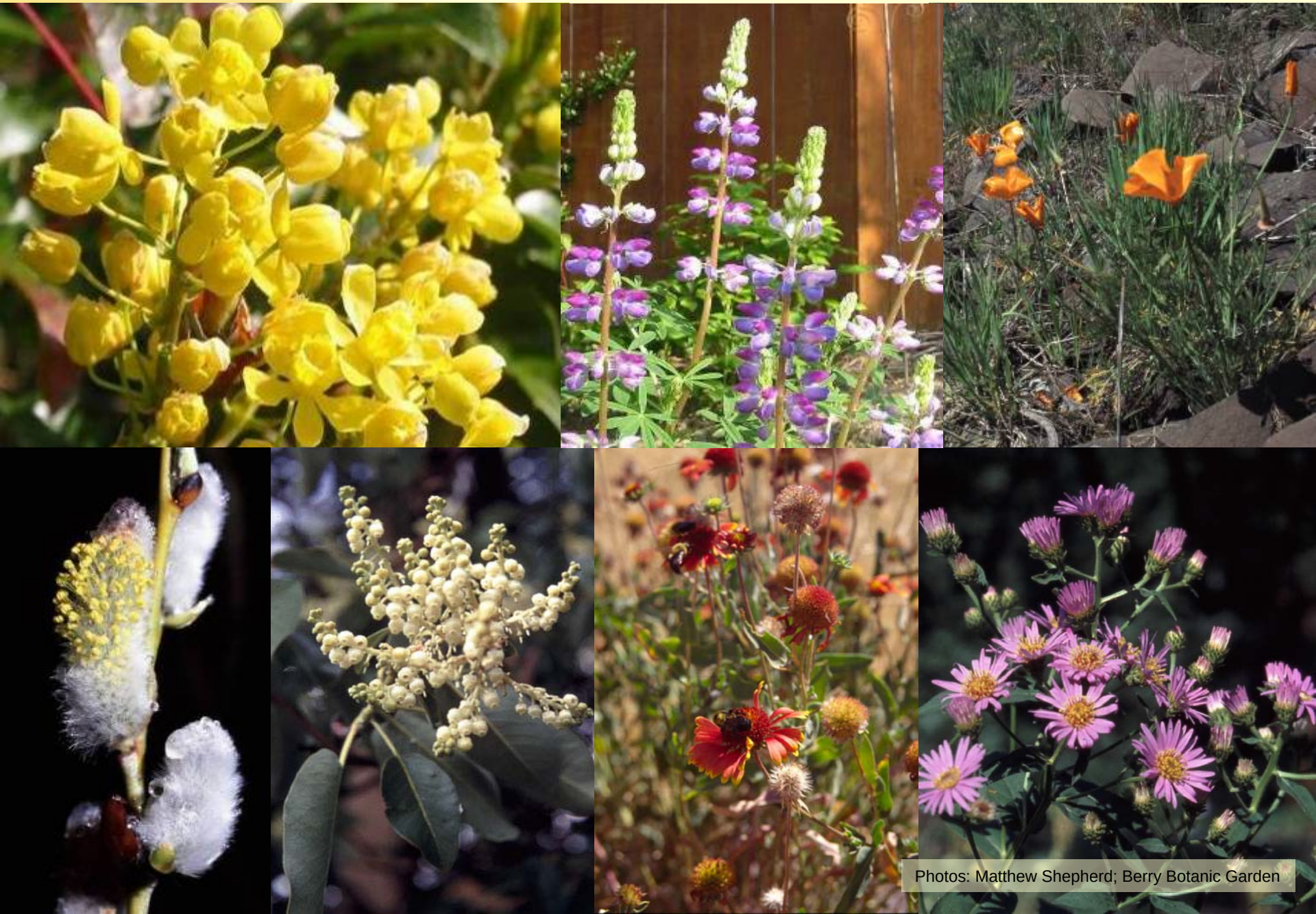
Step 3 – Enhance Habitat: Forage Patches



Photos: Matthew Shepherd; Berry Botanic Garden

Step 3 – Enhance Habitat: Ground Nests

Retain or create bare soil.

- Keep bare ground
- Maximize untilled areas
- Clear away some plants from well drained slopes
- Piles of soil
- Experiment with no-till farming techniques
- Plant native bunch grasses

Photos: Matthew Shepherd

Step 3 – Enhance Habitat: Tunnel Nests

Retain or create tunnels.

- Protect snags wherever possible
- Provide artificial nests

Photos: Mace Vaughan; Katharina Ullman

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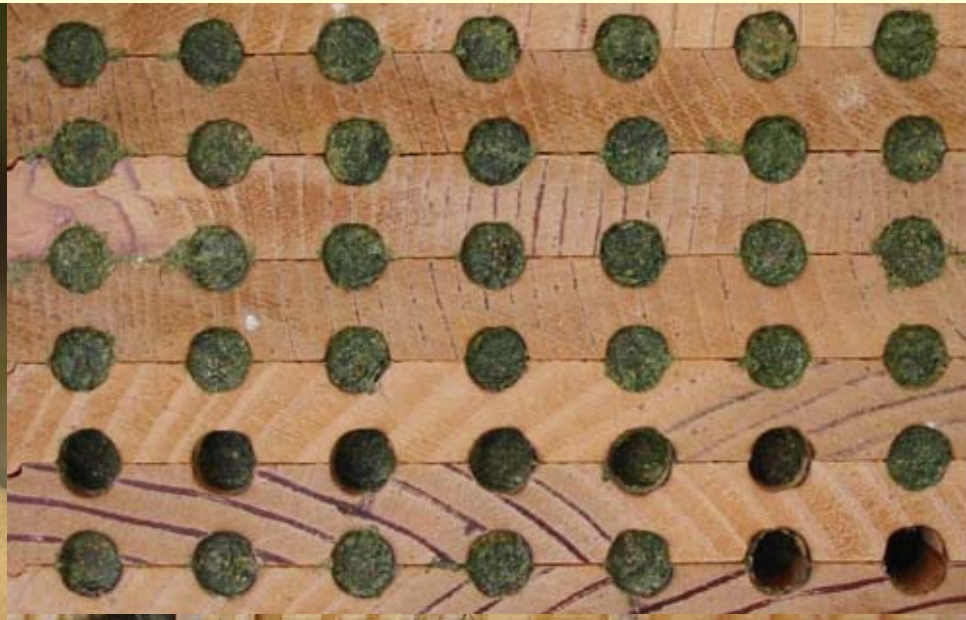
Step 3 – Enhance Habitat: Wood Nests



Photos: Jeff Adams; Matthew Shepherd; Mace Vaughan

Step 3 – Enhance Habitat: Bumble Bee Nests

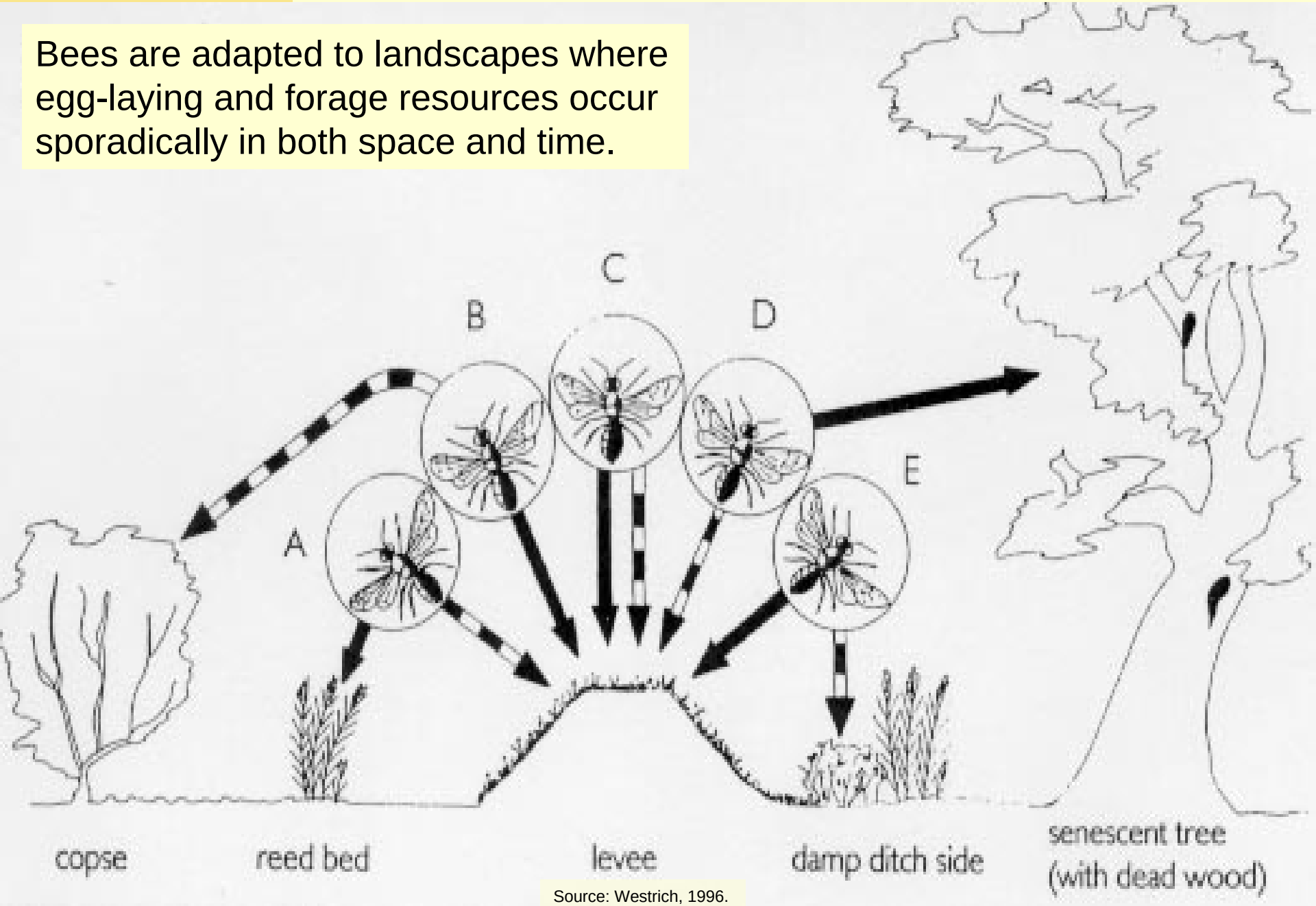
Retain or create nest sites.

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

Photos: Matthew Shepherd; NRCS/Lynn Betts

Step 3 – Enhance Habitat: Partial Habitats

Bees are adapted to landscapes where egg-laying and forage resources occur sporadically in both space and time.

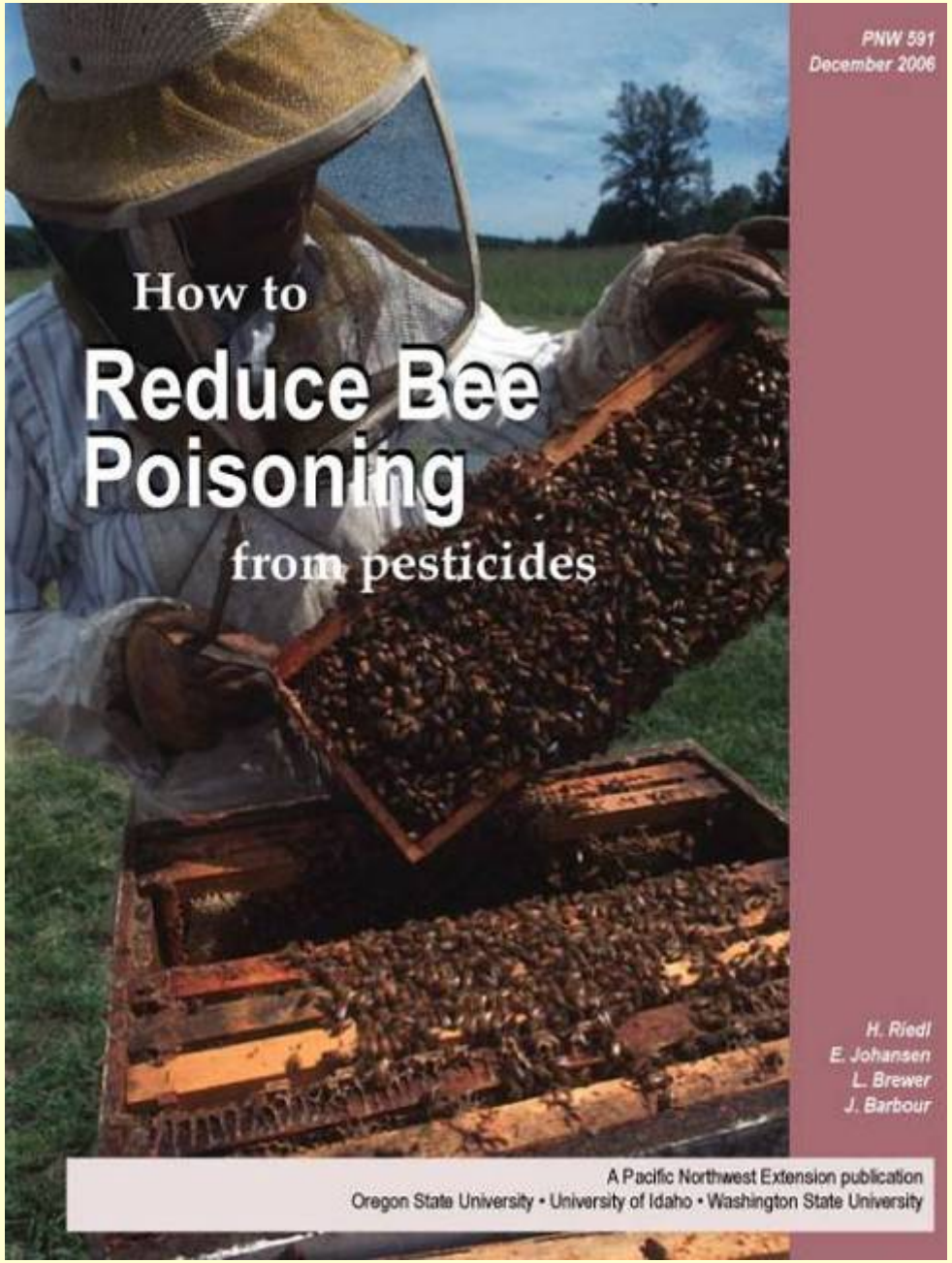


Source: Westrich, 1996.

Step 3 – Enhance Habitat: Reduce Risk From Pesticides

Pesticides cause significant damage to pollinator insect populations.

- Prevent overspray or drift onto adjacent habitat
- Use most targeted application
- Use active ingredients with least impact on bees
- Don’t spray on plants in bloom
- Spray at night and when dry
- Consider alternatives
  - Pheromone traps and baits
  - Pest-resistant crops



Tools Available to Support Growers

Farm Bill conservation programs

- EQIP, WHIP, CSP, CRP, GRP, WRP, etc

Many NRCS conservation practices can include habitat for pollinators.

Photo: USDA-ARS

NRCS Conservation Programs

Case Study: Howell hedgerow

WHIP: 422 Hedgerow Planting

- Tree/shrub – container: $3/plant, with 75% cost share
- Geotextile fabric: $1/sq. ft., with 50% cost share

Photo: Mace Vaughan

NRCS Conservation Programs

Case Study: berry farm

EQIP cost share

340 Cover Crop: planted annually between berry rows; $78.24/acre.

327 Conservation Cover: permanent cover planted on the edges of the fields; $74.41/acre

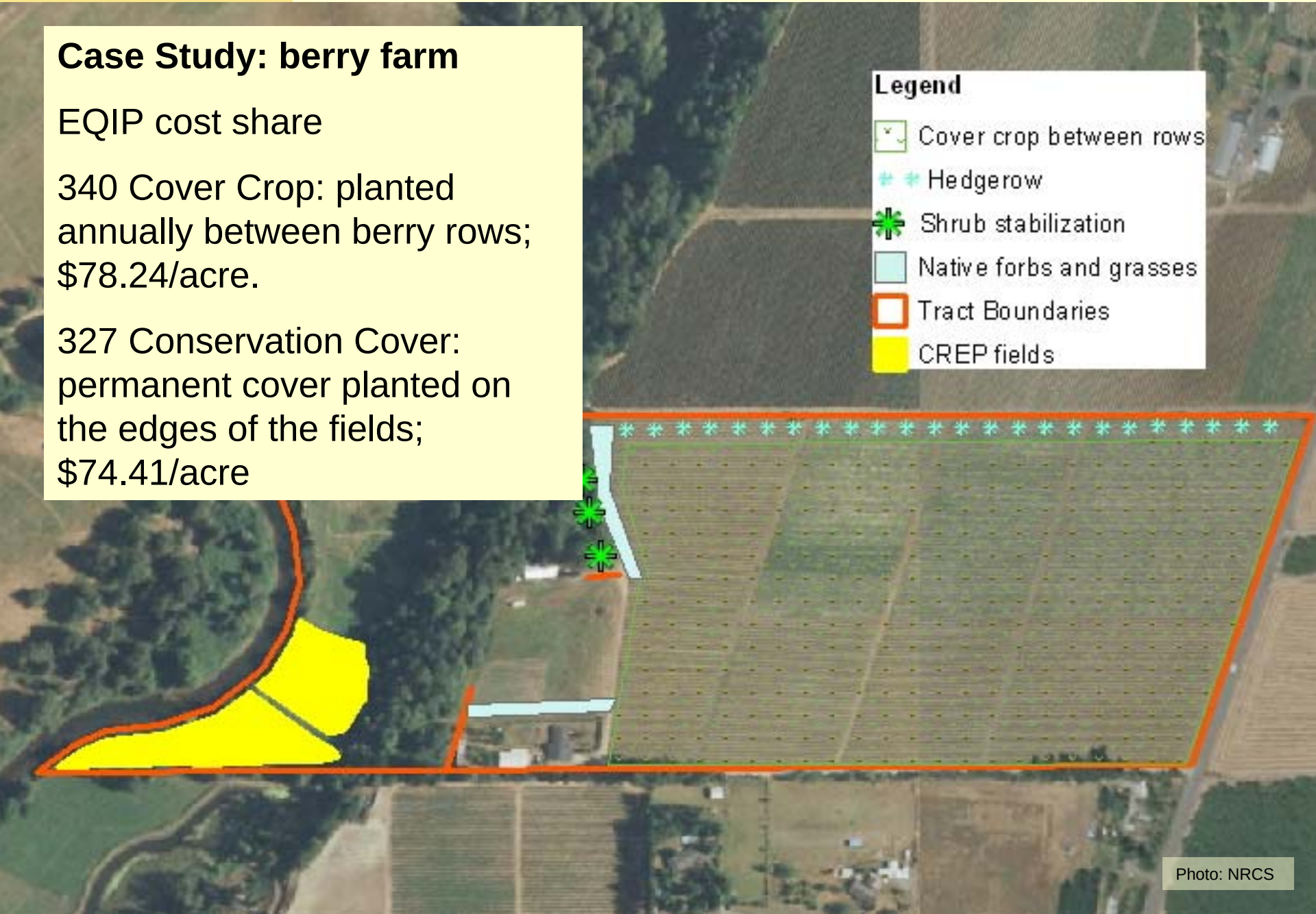


Photo: NRCS

NRCS Conservation Programs

Case Study: berry farm

Owner will pay for windbreak and shrub planting. Could have used:

380 Windbreak/Shelterbelt Establishment

612 Tree/Shrub Establishment

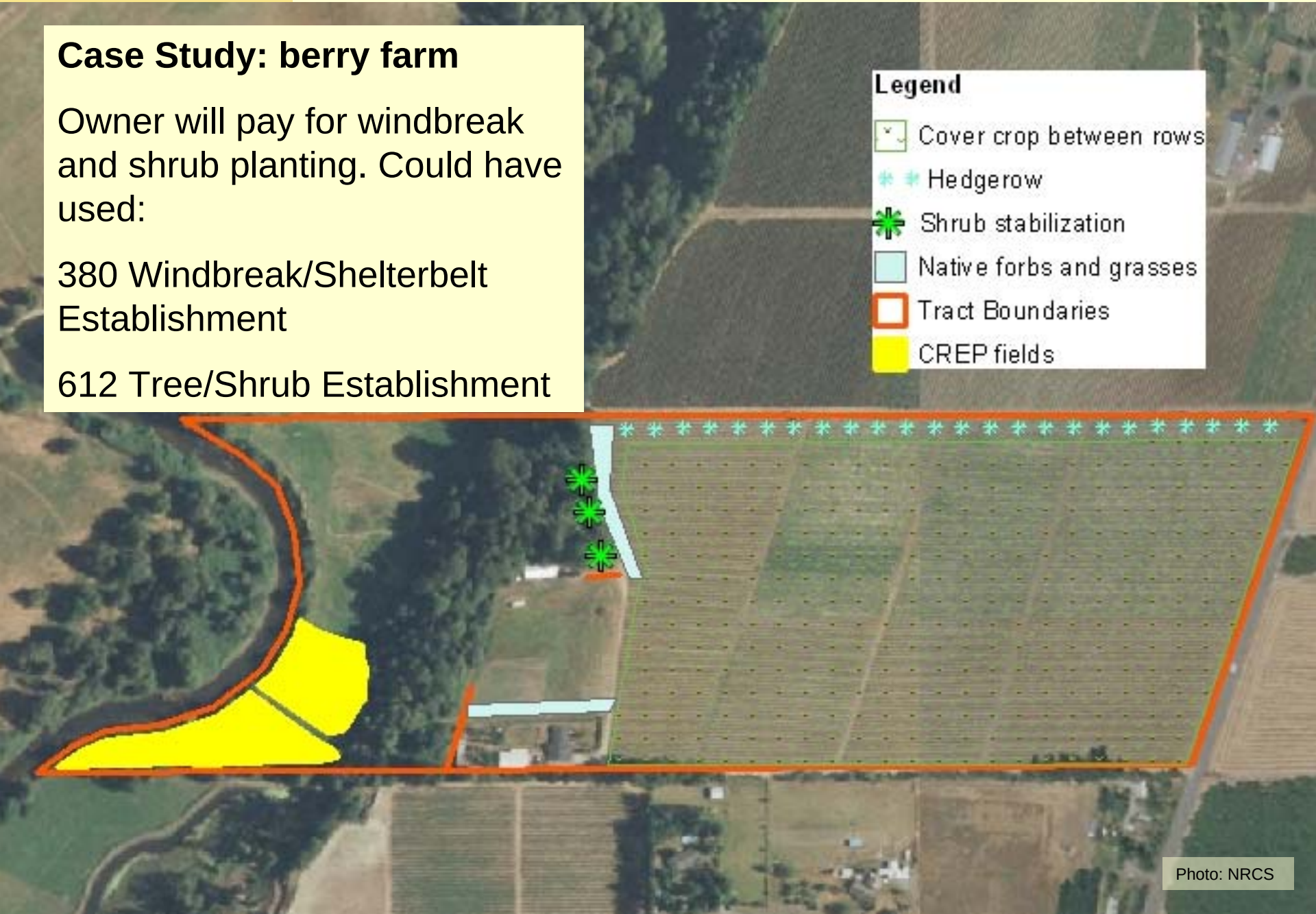


Photo: NRCS

Further Information: NRCS

- Tech Notes: *Plants for Pollinators in Oregon*

ftp://ftp-fc.sc.egov.usda.gov/OR/Technical_Notes/Plant%20Materials/PMC13.pdf

- *Farming for Pollinators* brochure
- Agroforestry Notes
- PLANTS database

Further Information: Xerces Society

- Xerces Society publications
- www.xerces.org
- 503-232 6639
- mdshepherd@xerces.org

Take Home Message

A diverse community of wild native bees can provide significant pollination for many crops.

Habitat on and around farms can support wild pollinators as well as managed native and honey bees:
- plant forage patches
- create nest sites
- minimize pesticide risk

Current Farm Bill conservation programs can be used to create change on the ground for pollinators.

www.xerces.org

Photo: Mace Vaughan