Down on the Farm: Pollinator Conservation Helps Ecology and Economy

Mace Vaughan, Conservation Director
The Xerces Society for Invertebrate Conservation

The Xerces Society

An international non-profit that works to protect wildlife and biodiversity through the conservation of invertebrates.

Workshop Outline

- Pollinator basics

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- The current crisis facing honey bees

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- Biology and habitat needs
- Three-step approach to pollinator conservation
- Managing habitat for bees

Pollination

Pollinator facts

- 75% of all flowering plants
- 35% of crops worldwide
- One in three bites of the food we eat in the U.S.
- $20 billion in crops in the U.S.

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Wildlife

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

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Great diversity

Great diversity

Bees are the most important pollinators in temperate North America

Why bees?

- Provide for their young

Why bees?

- Provide for their young
- Vegetarians

Why bees?

- Provide for their young
- Vegetarians
- Many adaptations for collecting and moving pollen
  - Very hairy
  - Pollen baskets

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Why bees?

- Provide for their young
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- Many adaptations for collecting and moving pollen
  - Very hairy
  - Pollen baskets
- Forage out from a single nest
- Flower constancy

Bees and agriculture

Most crop pollination from the European honey bee.

Leaves us reliant on a single pollinator

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Importance of native bees:
Honey bees in decline

Fewer honey bees available

Diseases and pests

↓

50% decline in managed colonies since 1950;
70% decline in feral

Hybridization with aggressive African strain

↓

Expected future declines

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Importance of native bees:
Honey bees in decline

"Colony Collapse Disorder"

About 25% of beekeeping operations in the U.S. lost 45% of hives, on average

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Importance of native bees:
Honey bees in decline

"Colony Collapse Disorder" …we are on its trail

- Disease?
  - Israeli Acute Paralysis Virus
- Pests?
- Poor diet?
- Insecticides?
- Stress?

"Colony Collapse Disorder" …we are on its trail

- Disease?
  - Israeli Acute Paralysis Virus
- Pests?
- Poor diet?
- Insecticides?
- Stress?

- Not cell phones nor BT corn

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Importance of native bees:
Other important bees in decline

The Western Bumble Bee

One of the most common bumble bees in the West now nearly gone

Most likely from diseases introduced in 1996/97

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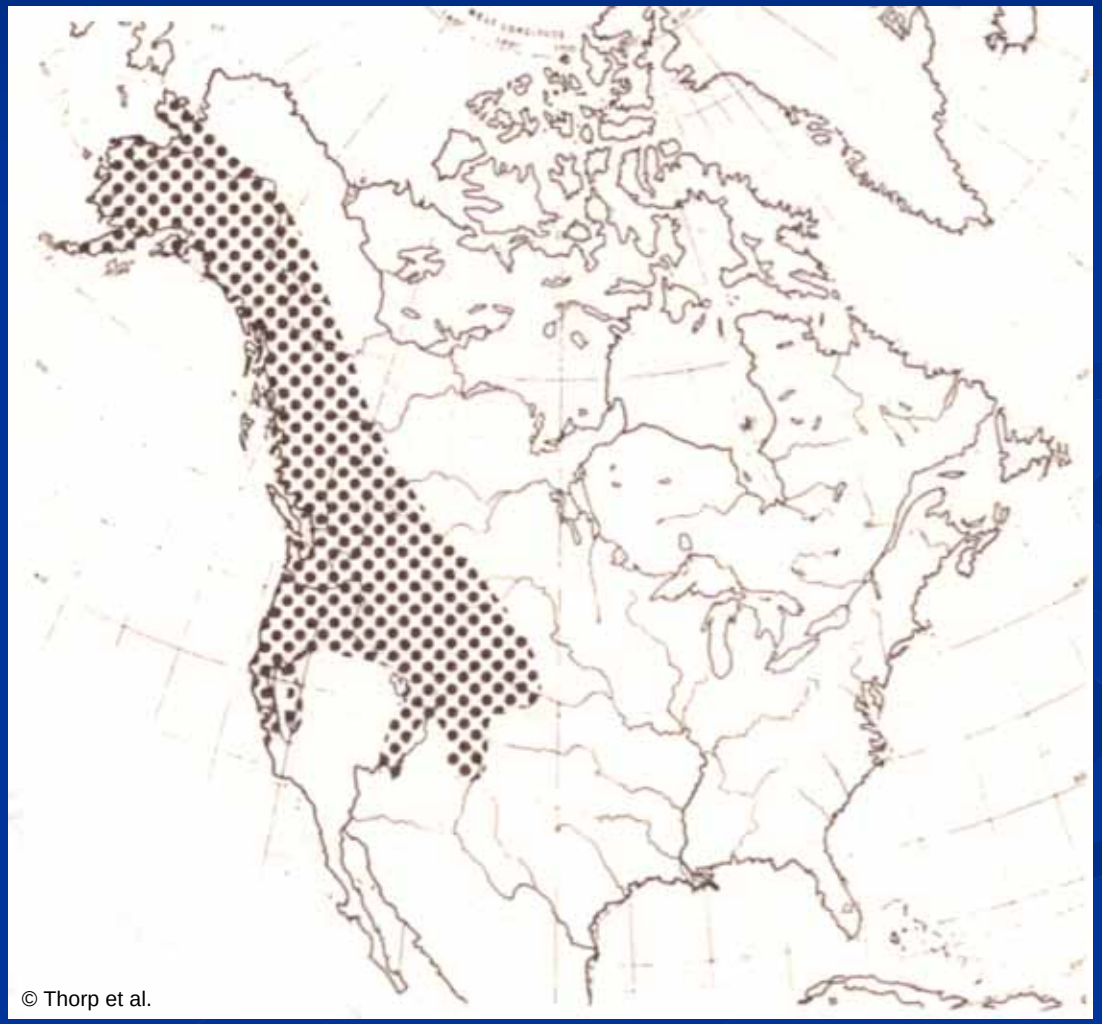
Importance of native bees: Other important bees in decline

The Western Bumble Bee



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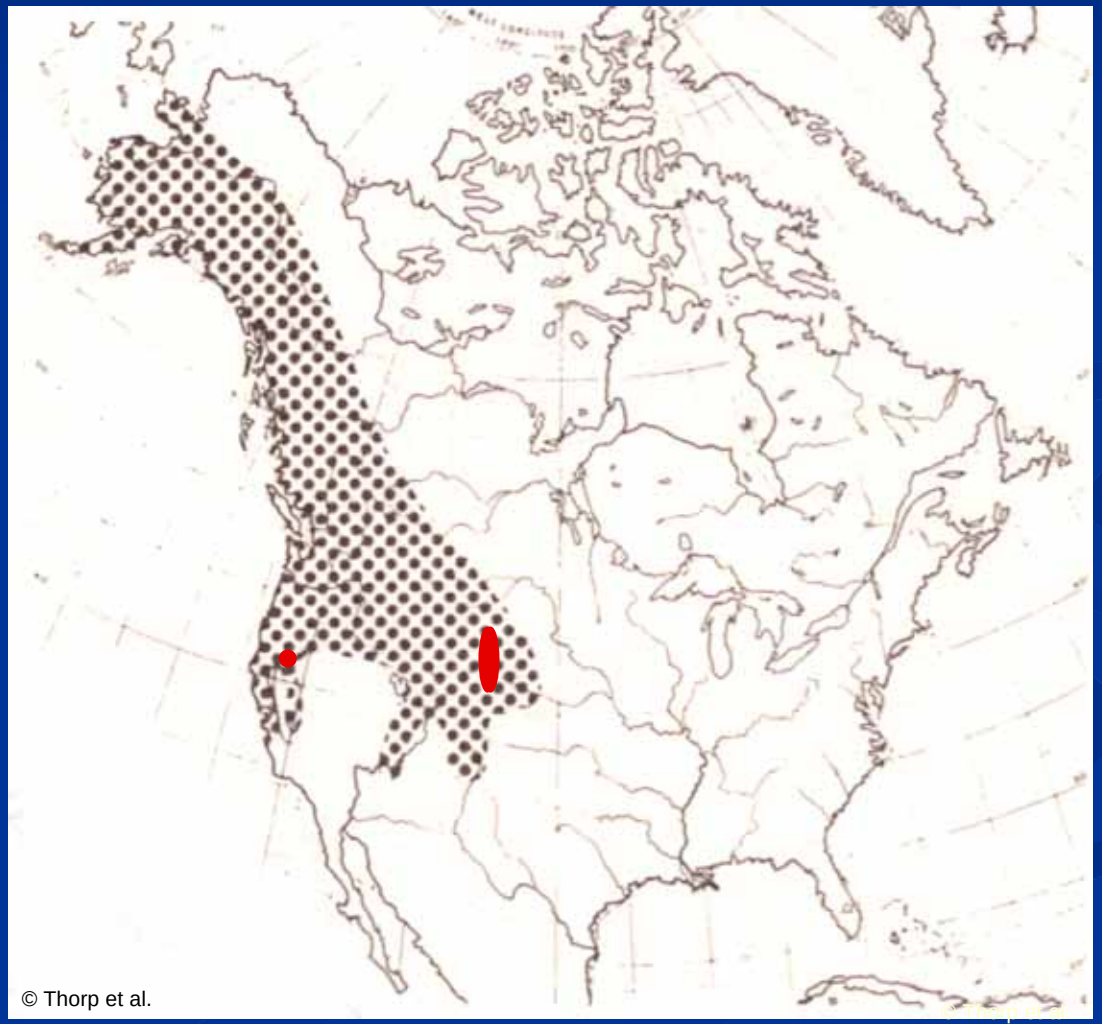
Importance of native bees: Other important bees in decline

The Western Bumble Bee



Native Pollinators and Crop Pollination

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Importance of native bees: Crop pollination

Remarkable diversity: 4,000 species in North America

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Importance of native bees:
Crop pollination

Native bees and agriculture

51 bee species recorded visiting watermelon, sunflower, or tomato in California

More than 80 bee species recorded visiting berry crops in ME, MA, and Nova Scotia

Sunflower example

When present, native bees:

- more than doubled seed set by honey bees in hybrid sunflower fields

Cherry tomato example

When present, native bees:

- almost tripled production of Sungold cherry tomatoes

Advantages of native bees

- Very efficient
  - Earlier, wetter, colder
  - Buzz pollination
  - Harass honey bees

  Example: 250 blue orchard bees per acre vs. 1 to 2.5 strong honey bee hives (10,000 to 25,000 foragers)
- No rental fees
- An insurance policy if honey bees are hard to acquire

Connecting Natural Areas to Crop Pollination

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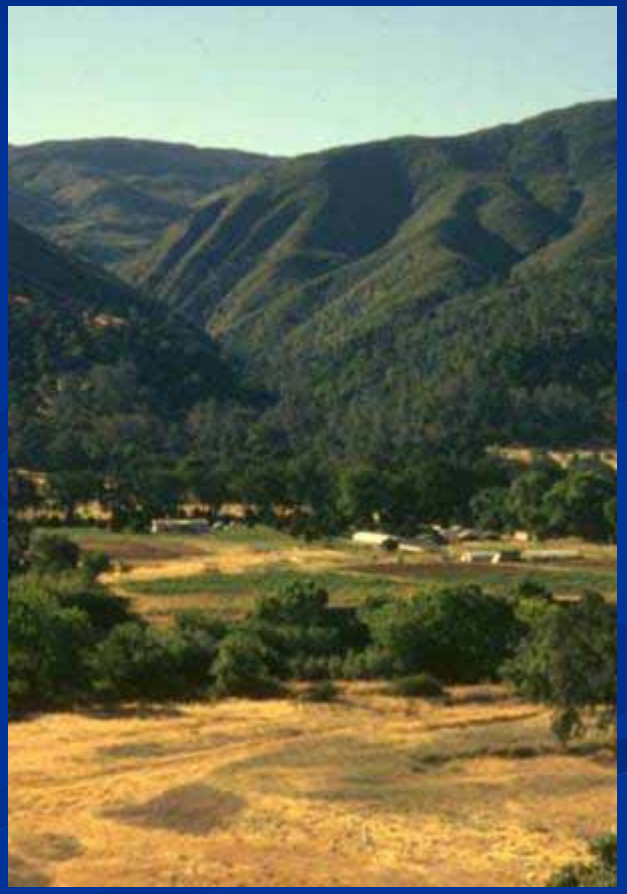
Value of Nearby Natural Habitat: Watermelon in California

Importance of natural areas

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, California



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

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Value of Nearby Natural Habitat: Watermelon in California

Importance of natural areas

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Value of Nearby Natural Habitat: Diverse crops in Oregon

Importance of natural areas

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Value of Nearby Natural Habitat: Canola in Alberta

Importance of natural areas

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 and Winston. 2006. Pollinators provide economic incentive to preserve natural land in agroecosystems. *Agriculture, Ecosystems, and the Environment.*

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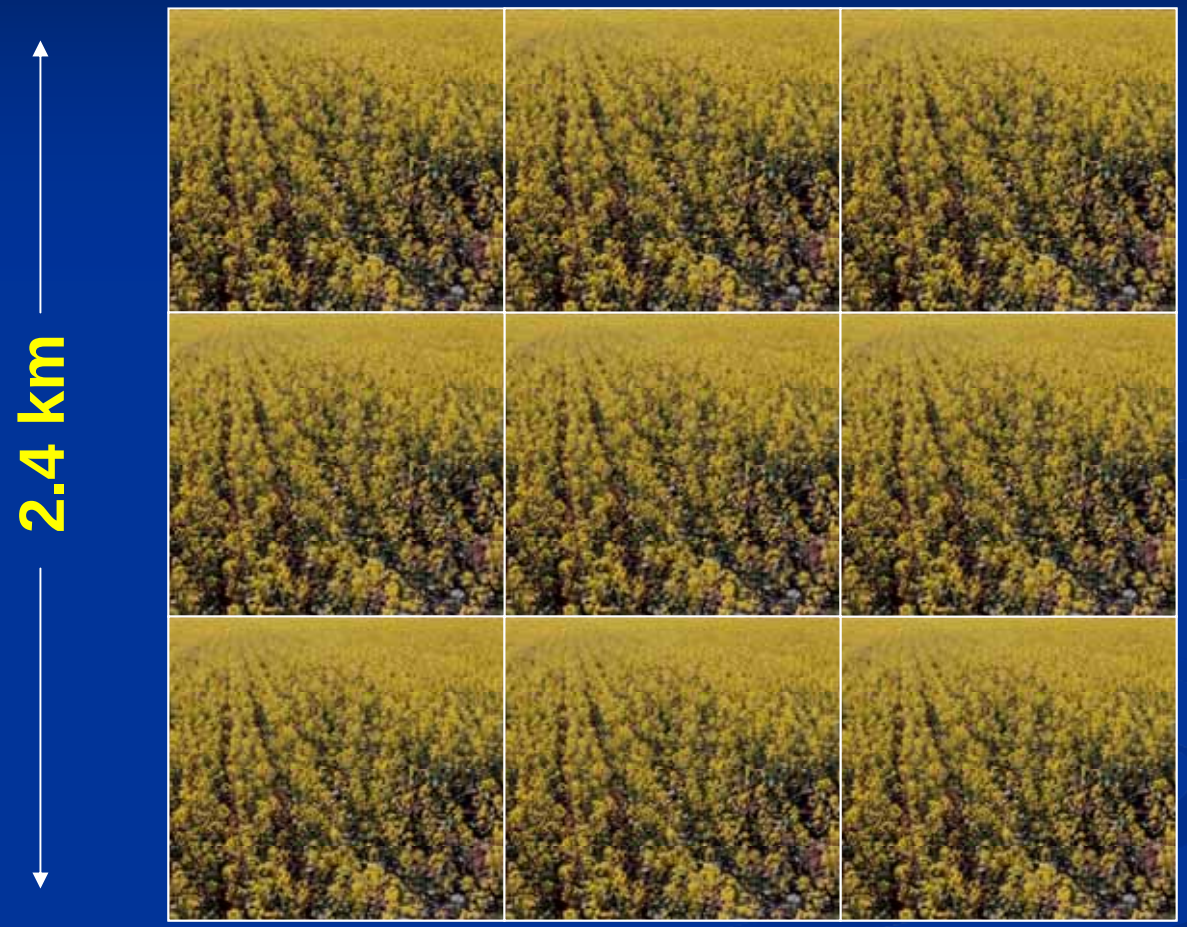
Value of Nearby Natural Habitat: Canola in Alberta



Slide courtesy of Lora Morandin

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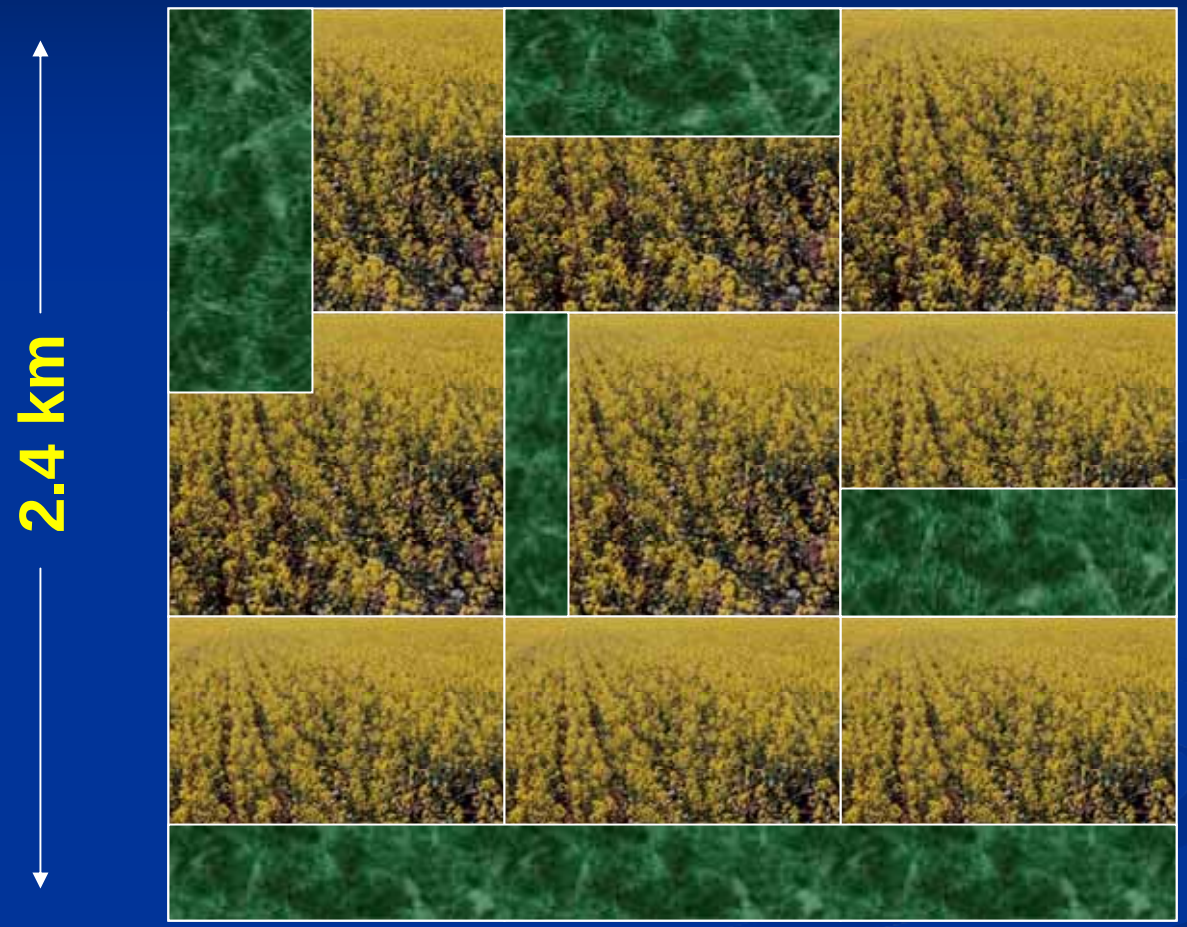

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Value of Nearby Habitat: Farms in the Eastern U.S.

Importance of natural areas

In 90% of farms studied in the east (NJ and PA), wild native bees provided all pollination needed for watermelon.

Winfree et al. 2007. Native bees provide insurance against ongoing honey bee losses. *Ecology Letters*. 10:xxx-xxx.

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Value of Nearby Habitat: Farms in the Eastern U.S.

Importance of natural areas

Native Bee Life Cycle and Habitat

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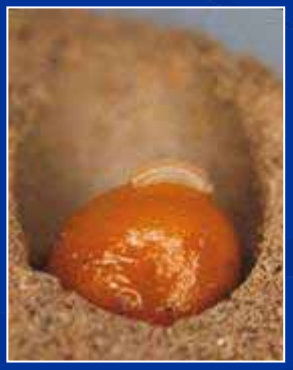
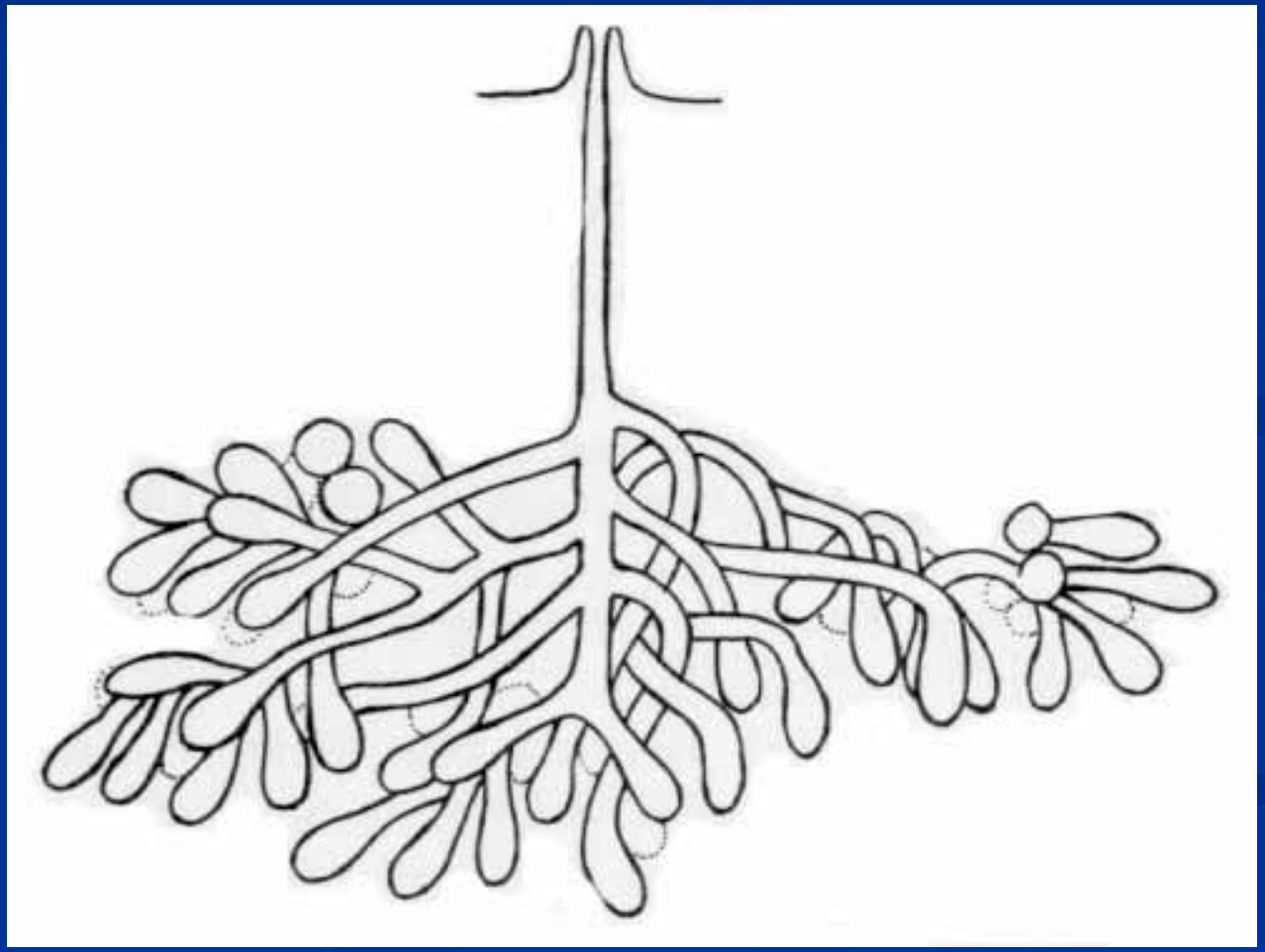
Life cycle: solitary bees



Mining bee (*Andrena* sp.) spends about eleven months in its underground nest before a few weeks as an adult.

(Photos: Dennis Briggs)

Ground Nests



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Life cycle and nest habitat: solitary bees
Ground nests

Ground Nests

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Life cycle and nest habitat: solitary bees
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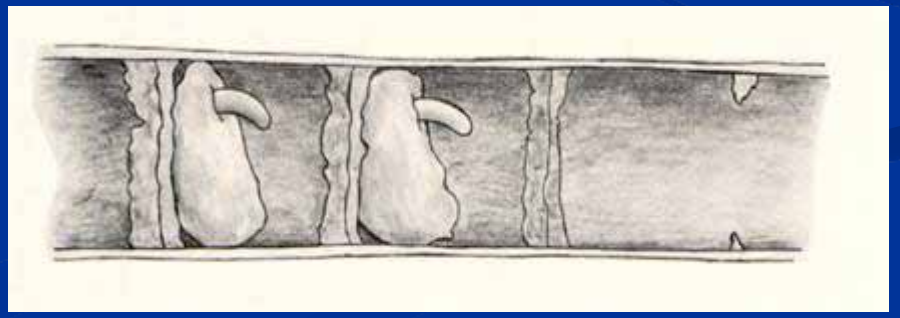
Life cycle and nest habitat: solitary bees
Tunnel nests

Tunnel Nests



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Life cycle and nest habitat: solitary bees
Tunnel nests

Tunnel Nests

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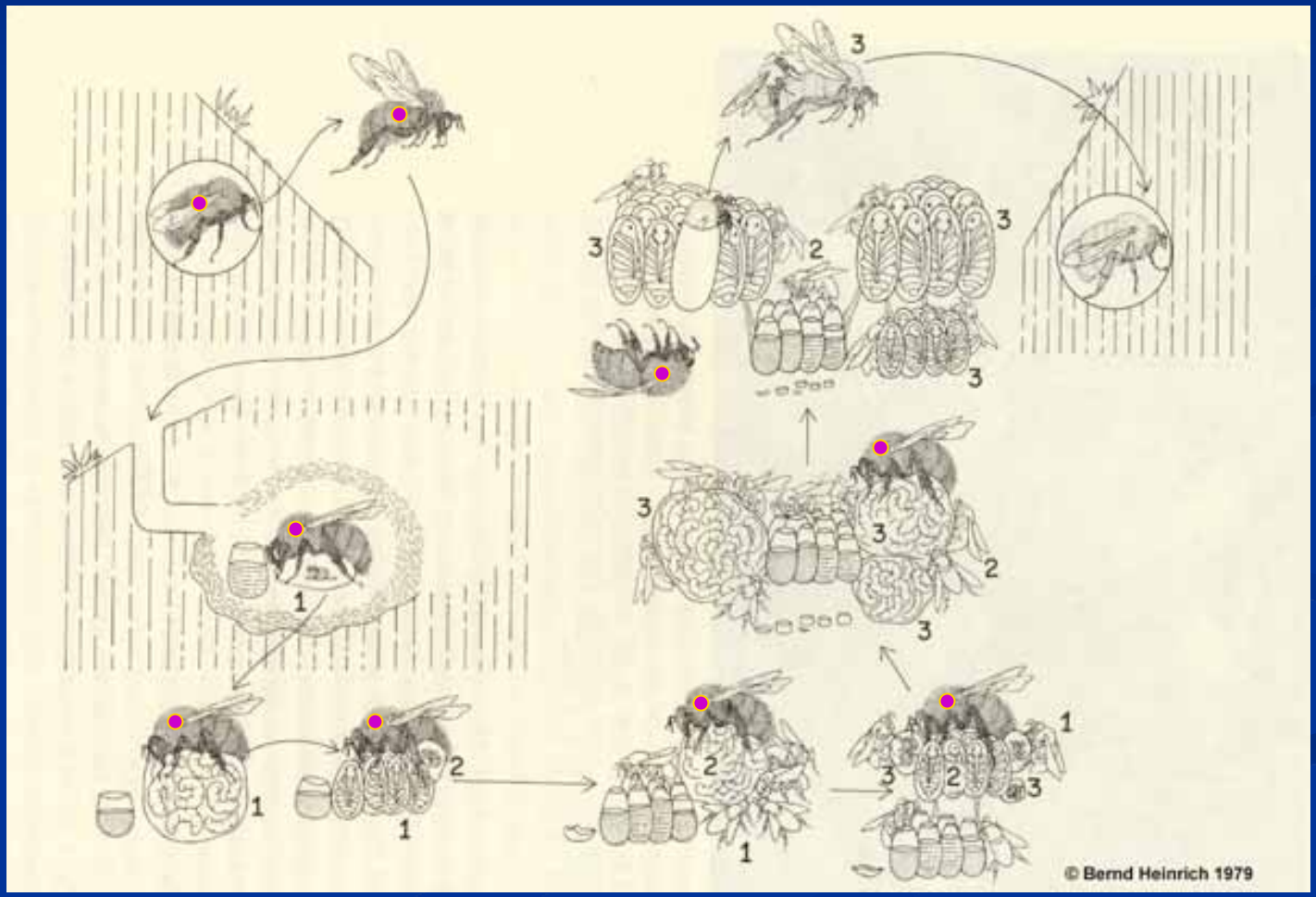
Life cycle and nest habitat: solitary bees
Tunnel nests

Tunnel Nests

Life cycle of bumble bees



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Life cycle and nest habitat: bumble bees (social)

Cavity Nests

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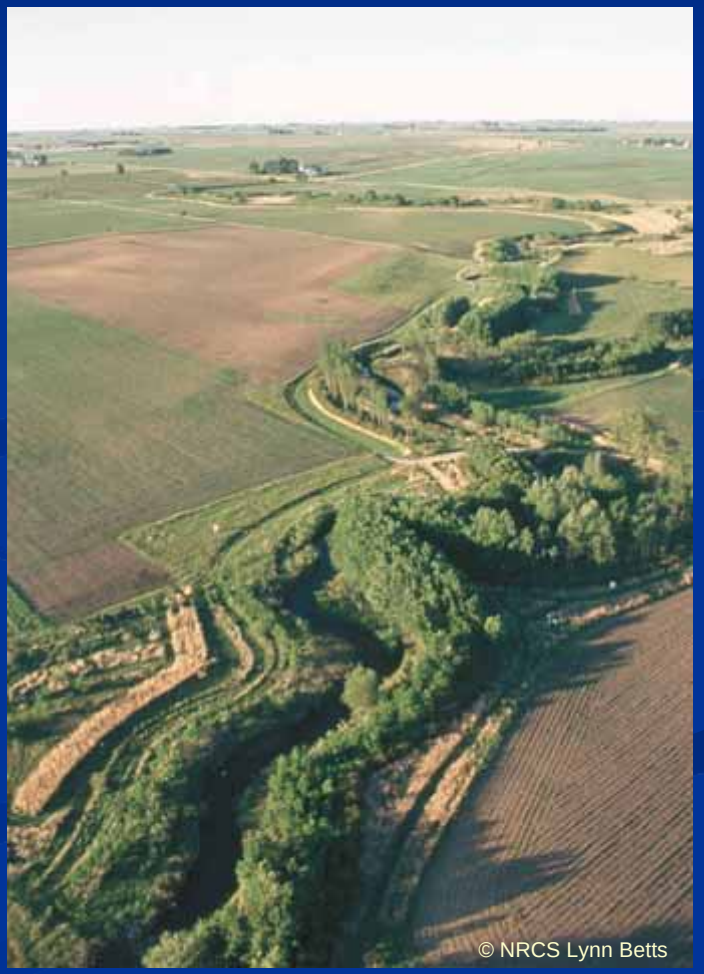
Life cycle and nest habitat: bumble bees (social)

Cavity Nests



Three steps to native bee conservation

Three-step approach to conservation of native bees

1. Recognize native bees and bee habitat

Three-step approach to conservation of native bees

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2. Adapt existing management practices to avoid causing undue harm

Three-step approach to conservation of native bees

1. Recognize native bees and bee habitat
2. Adapt existing management practices to avoid causing undue harm
3. Enhance and manage habitat for native bees

Native bee habitat

Nest sites

- Stable, untilled semi-bare ground
- Narrow tunnels
- Cavities

Forage

- Diversity of native plants

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Native bee conservation:
Step 1 – Recognize habitat

Areas that support pollinators

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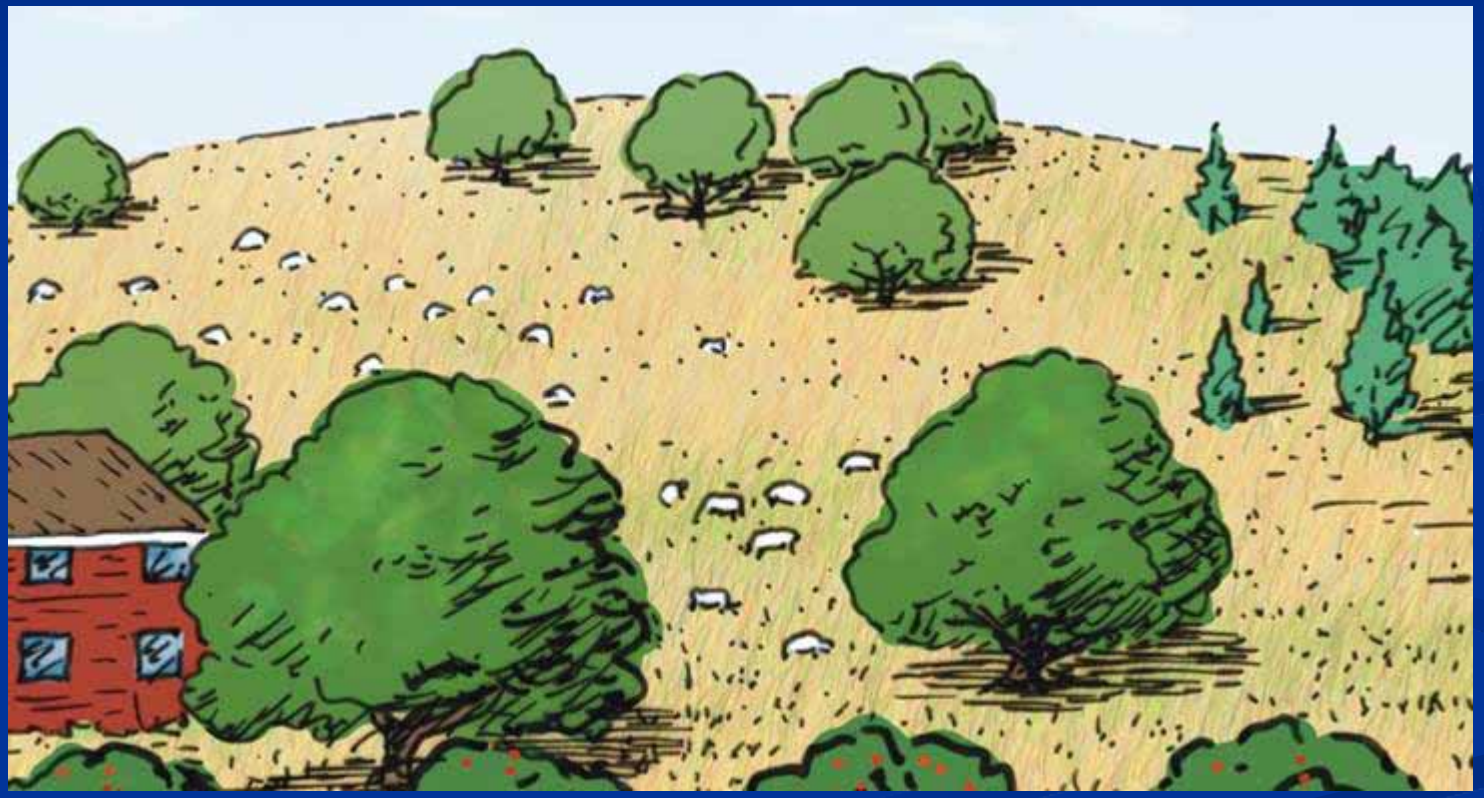
Native bee conservation:
Step 1 – Recognize habitat

Natural or undeveloped areas



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Native bee conservation:
Step 1 – Recognize habitat

Hedgerows, road edges and field margins

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Native bee conservation:
Step 1 – Recognize habitat

Cover crops

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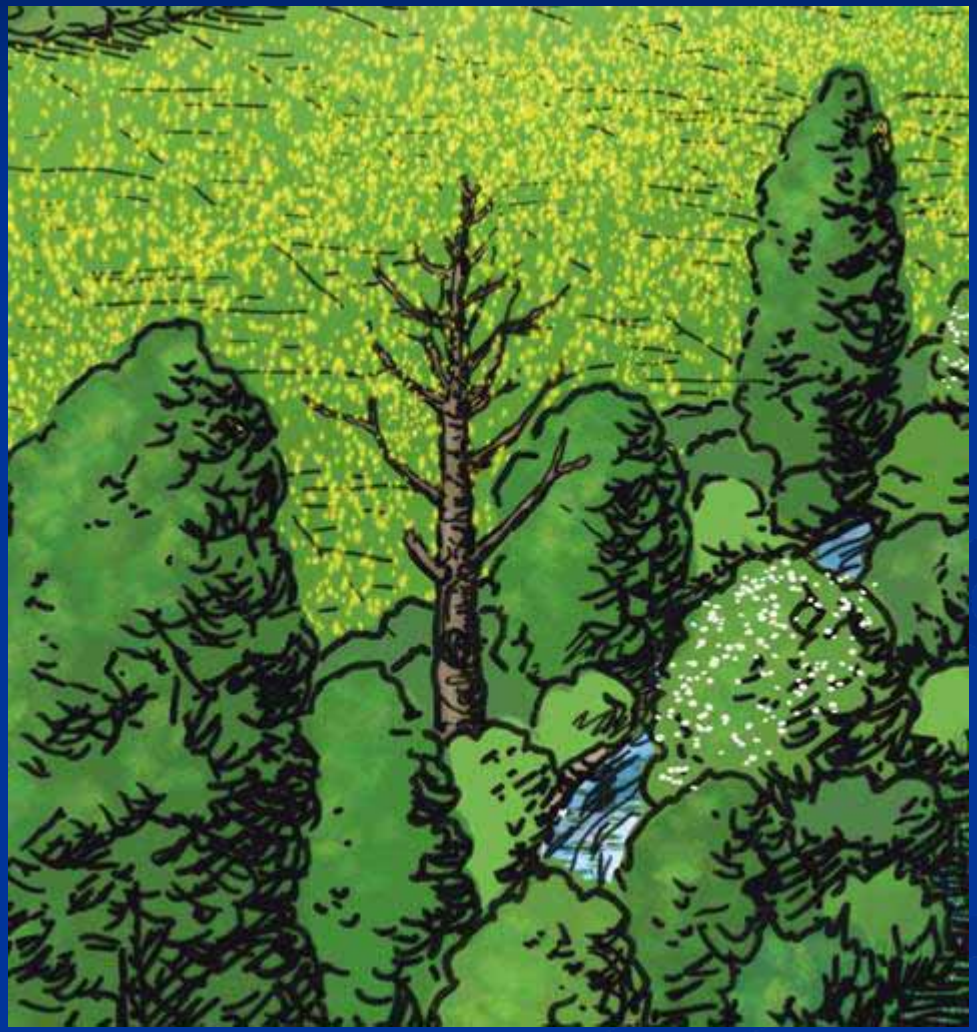
Native bee conservation:
Step 1 – Recognize habitat



Snags

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Native bee conservation:
Step 1 – Recognize habitat

Excavated soil

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Native bee conservation:
Step 1 – Recognize habitat

Gardens

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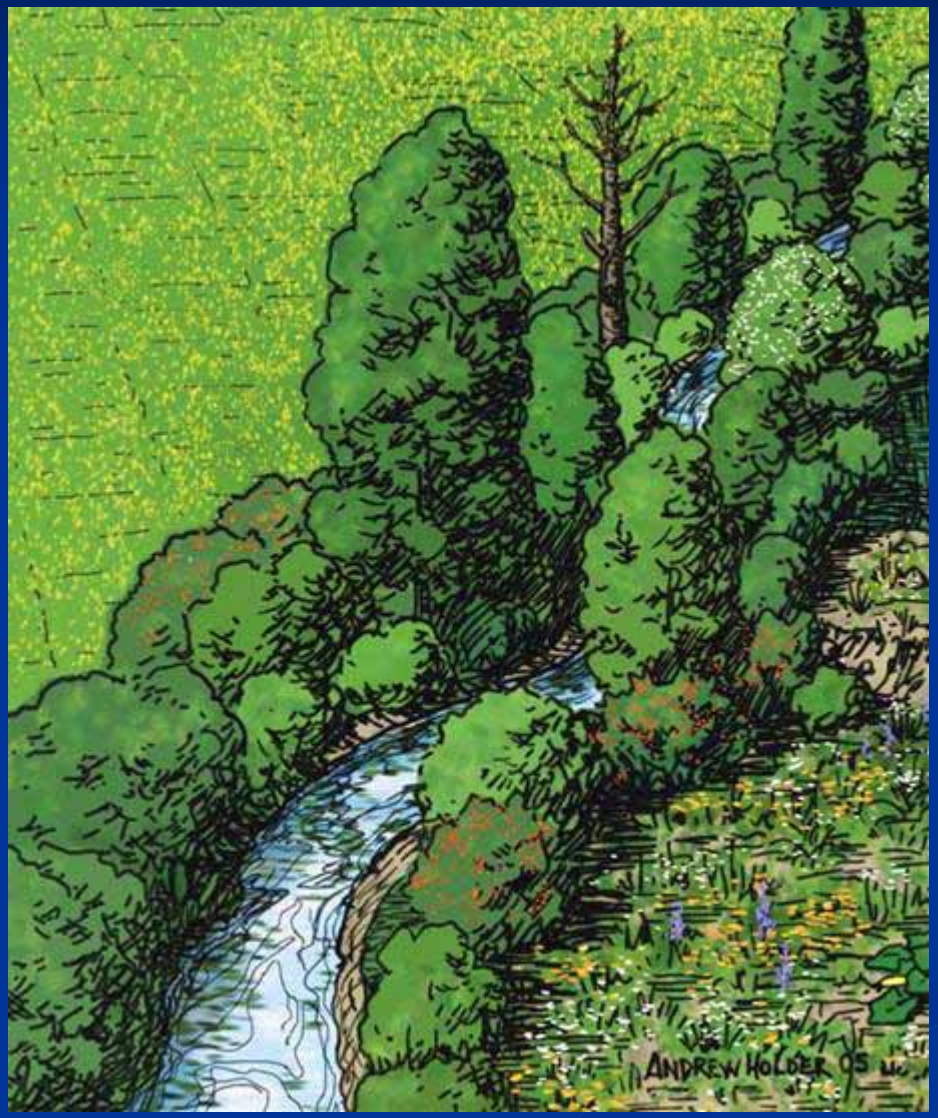
Native bee conservation:
Step 1 – Recognize habitat



Riparian buffers

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Native bee conservation:
Step 1 – Recognize habitat

Fallow fields and unproductive land

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Native bee conservation:
Step 1 – Recognize habitat

Areas that support pollinators

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Native bee conservation:
Step 2 – Adapt farming practices

Make simple changes

© USDA ARS

For example:

- 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

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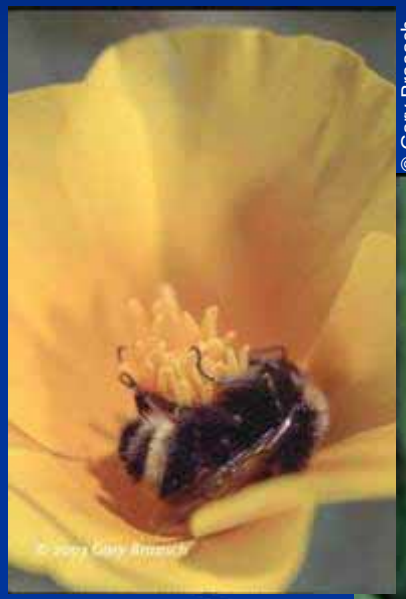
Native bee conservation:
Step 3 – Enhance habitat: forage

Supplement forage

Choose <u>diversity</u> of native or naturalized plants that:

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



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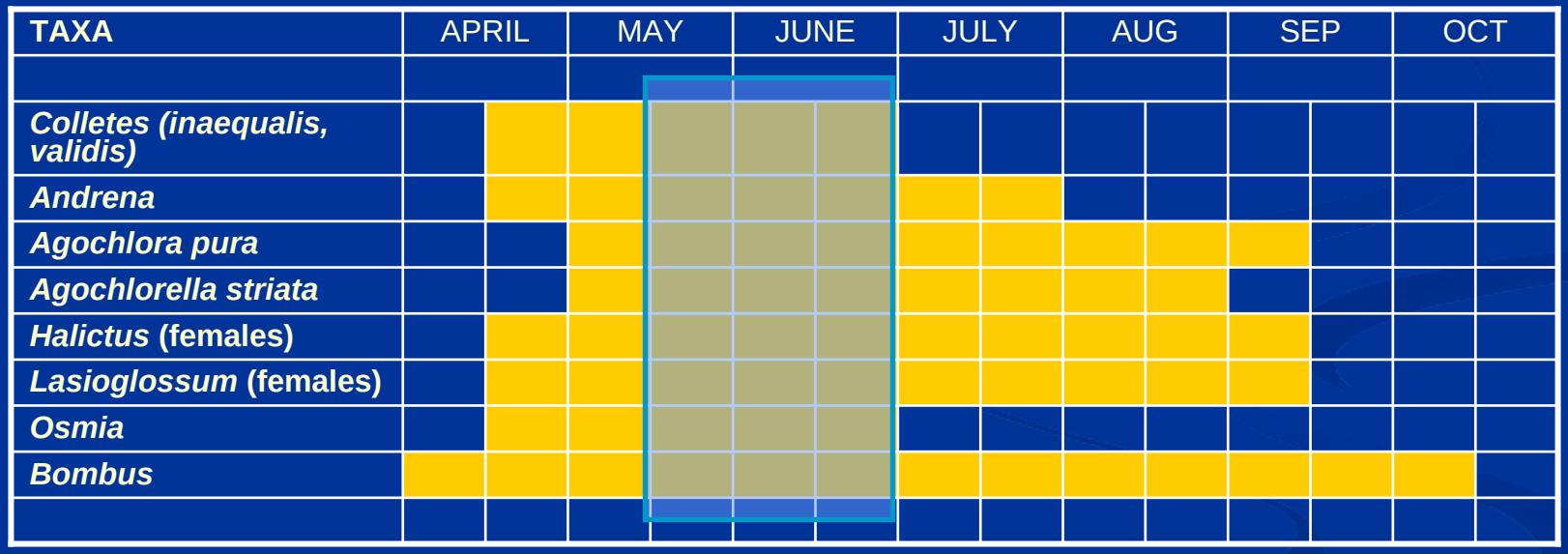
Native bee conservation:
Step 3 – Enhance habitat: forage

Native bee flight periods in relation to blueberry bloom



© Data from Steve Javorek, Agriculture Canada

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
Canada

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Native bee conservation:
Step 3 – Enhance habitat: forage

Supplement forage

Ground nest sites

Need to see the soil

Some ideas:

- Native bunch grasses
- Clear away some plants from well-drained slopes
- Maximize untilled areas
- Piles of soil
- Experiment with no-till farming techniques

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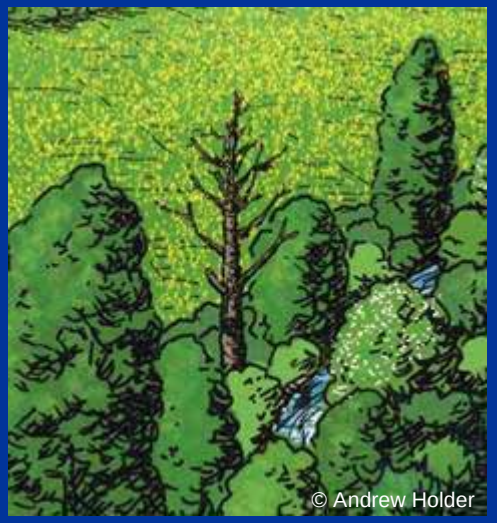
Native bee conservation:
Step 3 – Enhance habitat: nest sites

Tunnel nest sites

- Protect snags whenever possible
- Provide trap nests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Cavity nest sites

- Grassy borders
- Maximize “wild” areas
- Send out the raptors

Managing habitat for native bees

Traditional habitat management goals

Natural areas are often managed for a plant community or for a particular wildlife species or group.

Traditional habitat management goals

Only recently have we begun to pay attention to ensuring or maximizing invertebrates to provide ecosystem services, such as pollination or wildlife food.

Habitat management tools

- Insecticides
- Grazing
- Fire
- Herbicides

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Managing habitat:
Insecticides

Protect bees from insecticides

Value: pest control

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Managing habitat:
Insecticides

Protect bees from insecticides

Value: pest control

Potential problems: poisoning pollinators

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Managing habitat:
Insecticides

Protect bees from insecticides

Value: pest control

Potential problems: poisoning pollinators

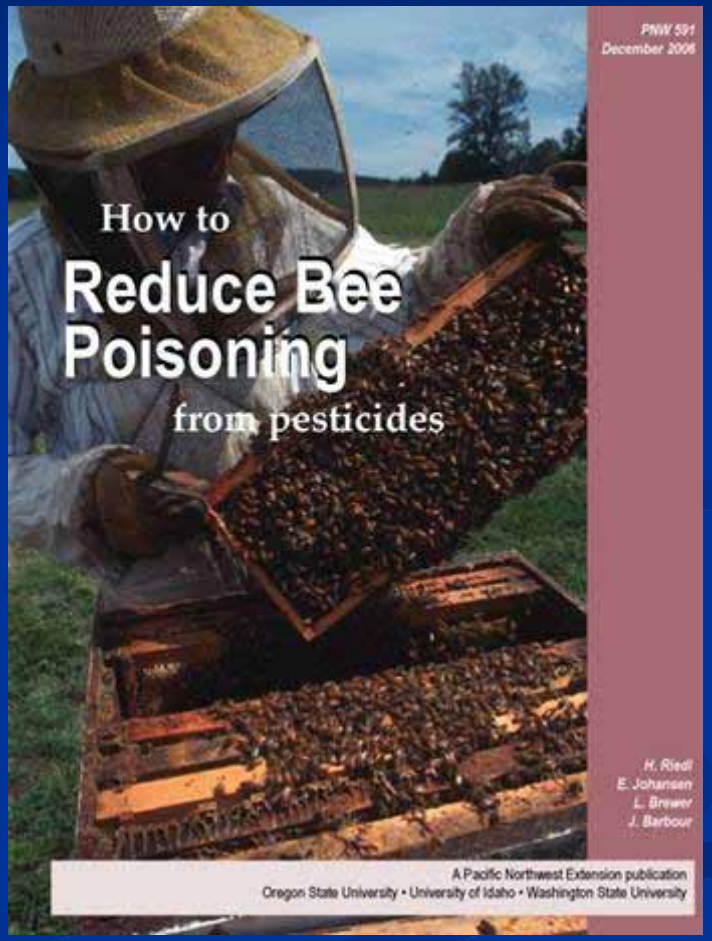
Mitigating impacts:

- No overspray or drift onto adjacent habitat
- Most targeted application
- No spray on plants in bloom

Protect bees from insecticides

<u>Mitigating impacts (con't):</u>

- Use active ingredients with least impact on bees
- Spray at night, when dry
- Consider alternatives
  - Pheromone traps and baits
  - Pest-resistant crops



http://extension.oregonstate.edu/catalog/pdf/pnw/pnw591.pdf

Grazing

Value: weed control and encouraging forbs

Grazing

Value: weed control and encouraging forbs

Potential problems: loss of forage for pollinators, site compaction

Grazing

Value: weed control and encouraging forbs

Potential problems: loss of forage for pollinators, site compaction

Mitigating problems:

- rotational grazing
- long recovery periods
- exclusion from sensitive areas
- on the ground when few plants are in bloom

Fire

Value: often part of natural cycles and native plants are adapted

Fire

Value: often part of natural cycles and native plants are adapted

Potential problems: burning at too large of a scale or wrong time of year

Fire

Value: often part of natural cycles and native plants are adapted

Potential problems: burning at too large of a scale or wrong time of year

Mitigating problems:

- burn only small percentage of a site each year
- when pollinators are least vulnerable

Herbicides

Value: inexpensive and effective tool for control of invasive spp.

Herbicides

Value: inexpensive and effective tool for control of invasive spp.

Potential problems: can quickly remove forage

Herbicides

Value: inexpensive and effective tool for control of invasive spp.

Potential problems: can quickly remove forage

Mitigating problems:

- minimize and carefully target applications
- choose most targeted active ingredient

Technical or Financial Help

Natural Resource Conservation Service: a New Ally in Pollinator Conservation

- Farm Bill conservation programs:
  - EQIP, WHIP, CSP, CRP, GRP, WRP, etc.
- Most “conservation practices” can include habitat for pollinators

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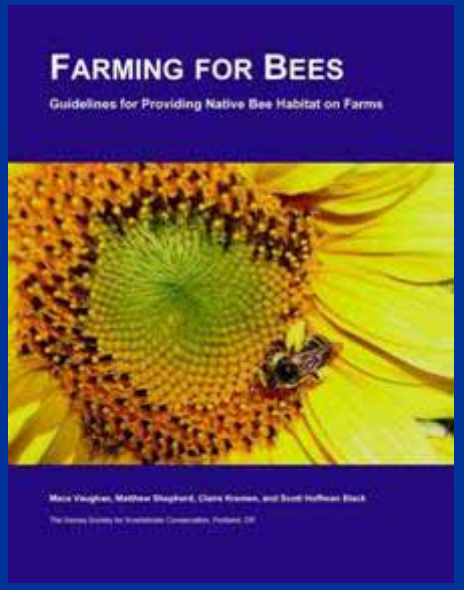
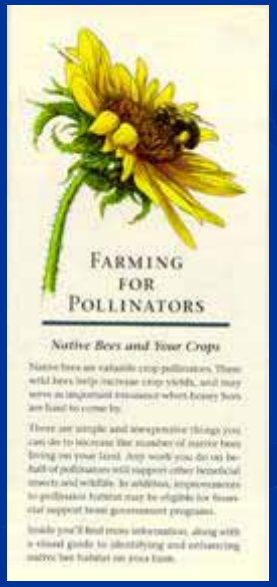
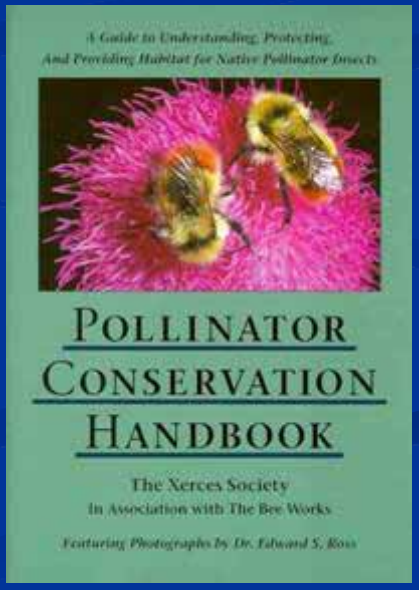
More information from the Xerces Society

For more information

- Farm guidelines
- Brochure
- *Pollinator Conservation Handbook*
- NEW: Wildland guide
- Fact sheets
- Plant lists
- www.xerces.org







Take Home Messages

- Pollinators are a diverse, interesting, important, and often overlooked component of wildlife
- A diverse community of native bees can provide significant crop pollination

Take Home Messages

- Habitat on and around working lands can support these pollinators
  - Flowers
  - Nest sites
  - Pesticide protection

- Typical management strategies can be fine-tuned to take these habitat needs into account

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Thanks

Heather Rorer (Defenders of Wildlife) and Patty Tipson (Land Trust Alliance)

A host of bee researchers

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- Xerces Society Members
- CS Fund
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- NRCS
- Disney Wildlife Conservation Fund
- Richard and Rhoda Goldman Foundation
- Gaia Fund
- National Fish and Wildlife Foundation
- Wallace Genetic Foundation

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

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Questions

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

Butterfly and Moth Habitat Needs

Butterfly and moth habitat needs

- Host plants for caterpillars
- Nectar and pollen sources for adults
- Overwintering refugia
- Sources of water and/or minerals

Fly, Wasp and Beetle Habitat Needs

Fly habitat needs

Flies are particularly important pollinators in arctic and alpine (especially the muscoid flies)

Very wide ranging habitat needs.

- Food for maggots: aphids, solitary bee brood, other immature insects, carrion, decaying plants
- Food for adults: some feed on pollen, most on nectar

Wasp habitat needs

Typically not great pollinators, but can still play a roll.

Wide ranging habitat needs:

- Food for young: meat (carrion, spiders, aphids, caterpillars, etc.)
- Food for adults: nectar or other sugar products
- Nest sites: very diverse

Beetle habitat needs

Worldwide, beetles are the most speciose group of pollinators.

Wide ranging habitat needs:

- Food for grubs: trees, solitary bee nests, other insects, and much more…
- Adults: visit flowers for food or mating, they may feed upon nectar or pollen.