# Green Gardening

## *Landscaping for Pollinators*

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Photo: Matthew Shepherd, Xerces

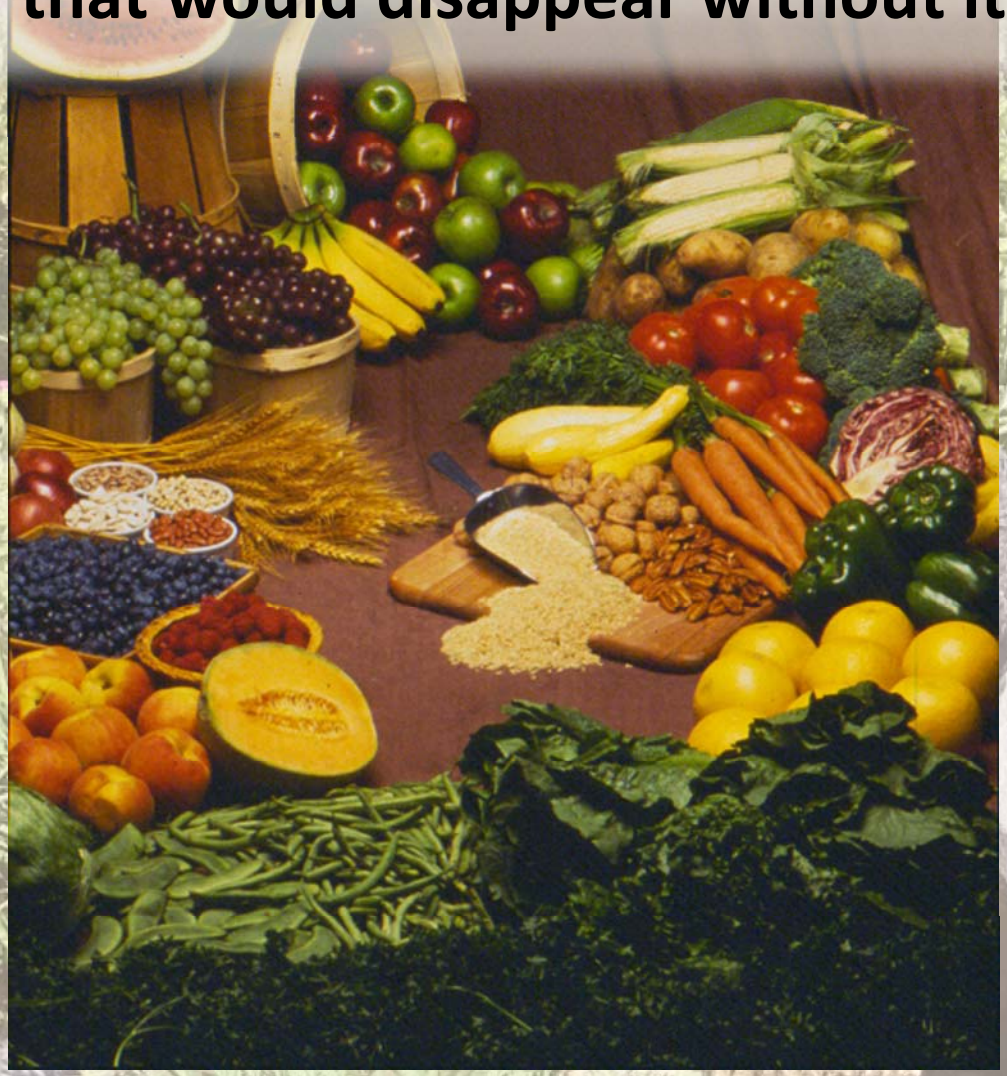

Photo: Matthew Shepherd, Xerces

**Pollination:**

**Value in USA: 10's of billions of dollars**

**Crops dependent on it: about 1/3**

**Food that would disappear without it: most**




The Big Picture: Earth’s vegetation. Most plant species depend on animal pollinators. We would not survive without them.

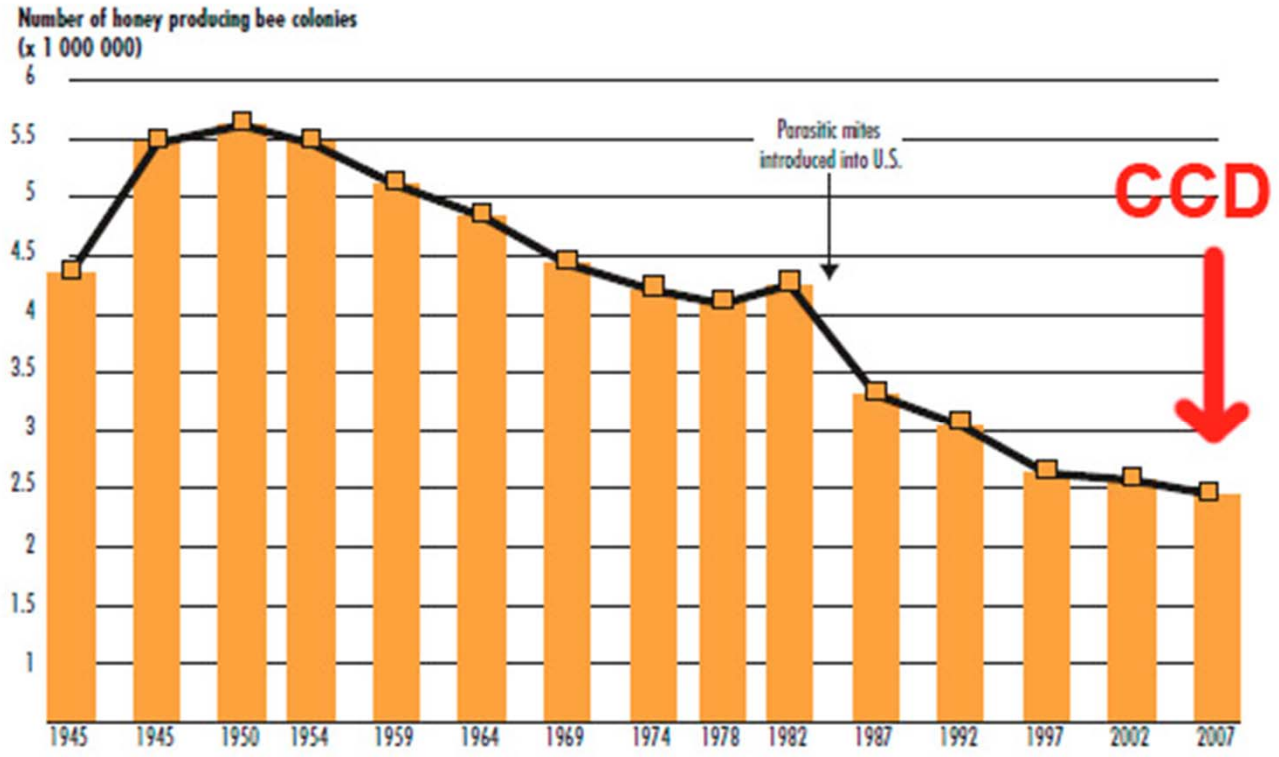
# Pollinator Decline

***Global response to environmental change and a planetary threat***

Examples

Honey bee hive decimation

**Figure 4:** US honey-producing colonies




*Data source: U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) NB: Data collected for producers with 5 or more colonies. Honey producing colonies are the maximum number of colonies from which honey was taken during the year. It is possible to take honey from colonies which did not survive the entire year.*

# Pollinator Decline

***Global response to environmental change and a planetary threat***

Examples

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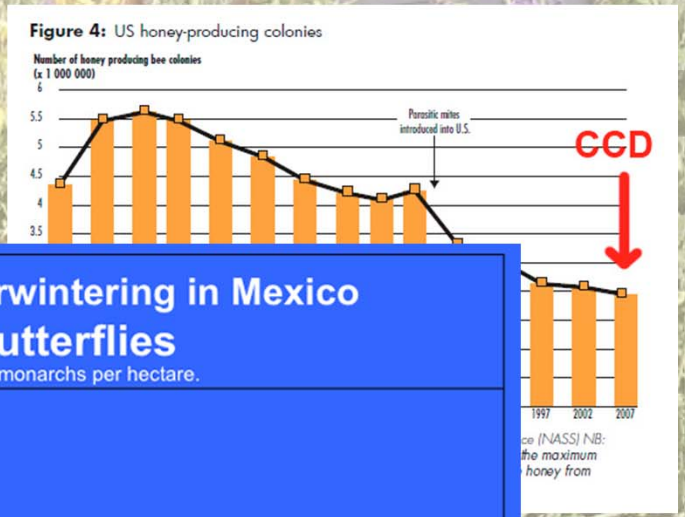
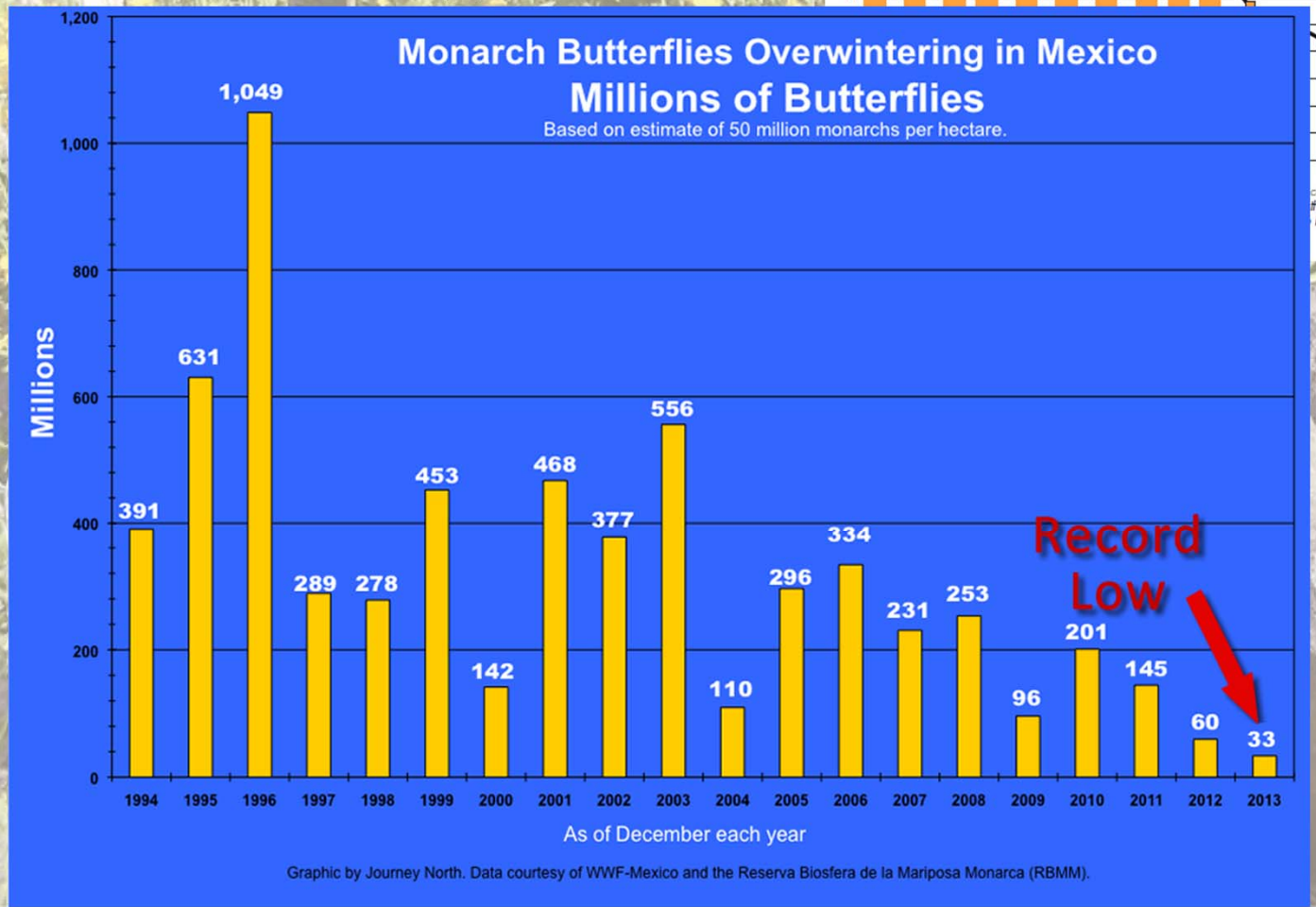
- Monarch disappearance



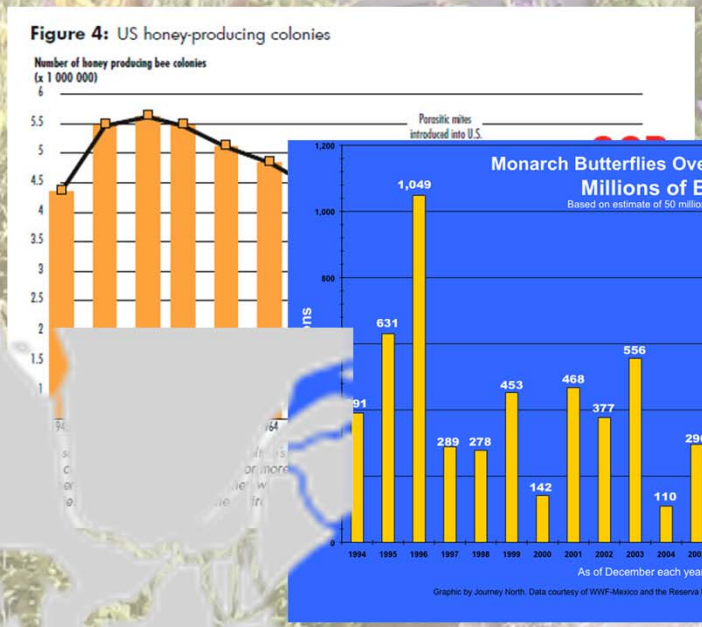



# Pollinator Decline

***Global response to environmental change and a planetary threat***

Examples

- Honey bee hive decimation
- Monarch disappearance
- Bumble bee extinction







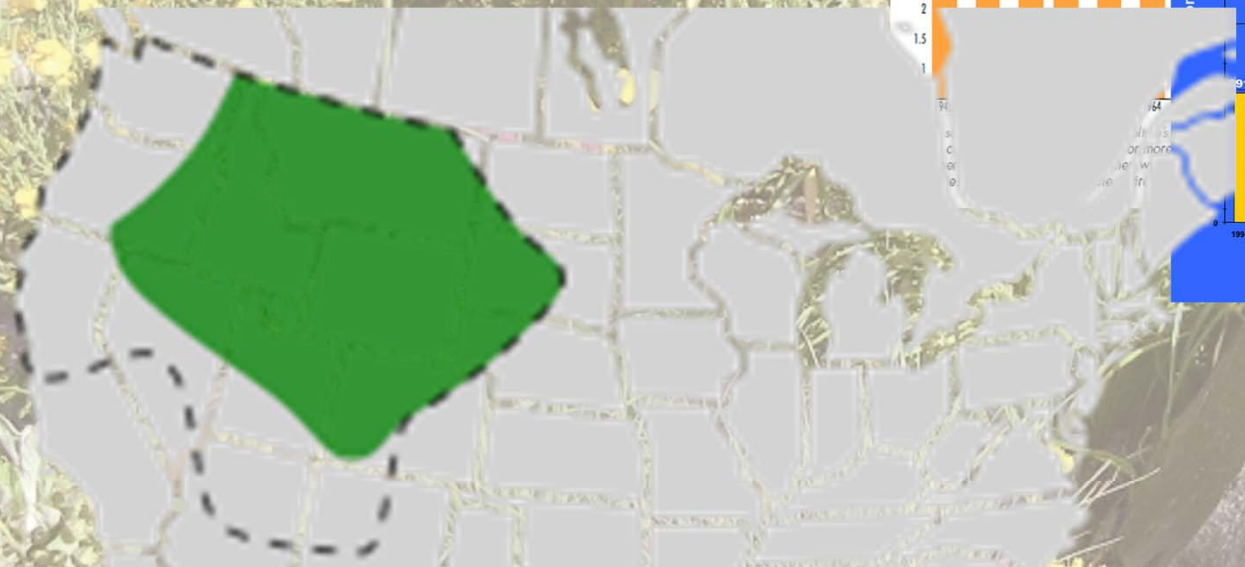


Photo: Matthew Sh

# Pollinator Decline

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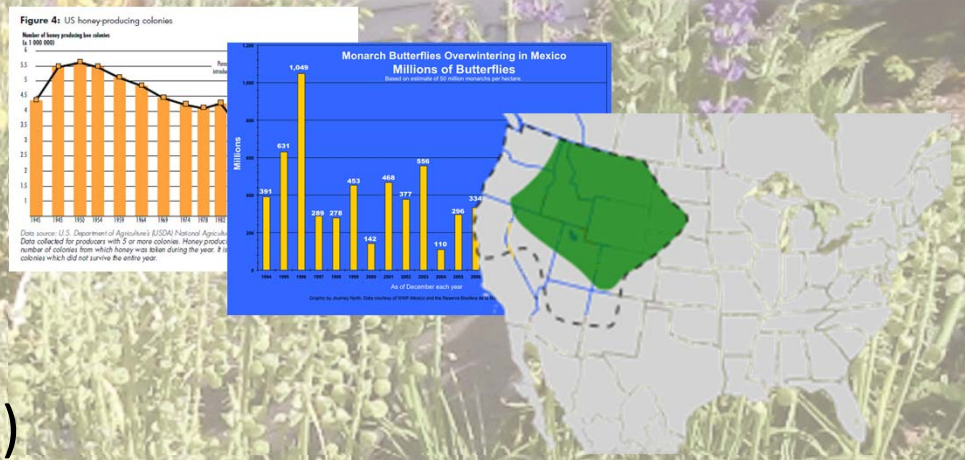



Examples

- Honey bee hive decimation
- Monarch disappearance
- Bumble bee extinction

Causes (in order of importance)

*Usually more than one; almost always difficult to prove per species*

- **Climate change** (many interacting effects)
- **Habitat Loss**, development & degredation
- **Toxins**, urban pollution, conventional & non-conventional pesticides, herbicides, fungicides & other farm chemicals
- **Exotic pests & diseases**
- **Loss of forage** (larval food plant &/or adult flower resources)

Photo: Matthew Shepherd, Xerces

# *Pollinator Diversity*


- Bats, other mammals
- Birds
- Odd Balls: e.g., slugs
- Insects: by far the most important

# Major Insect Pollinator Groups in Order of Importance:

- Beetles
- Flies
- Moths & Butterflies
- Wasps & ***Bees***

# Bees!


- Over 20,000 species; VERY DIVERSE!
- Feed only on flower nectar and pollen
- Many are tightly co-evolved as pollinators of individual plant species

# Bee categories of bees based on social life: **Solitary** vs. **Social**

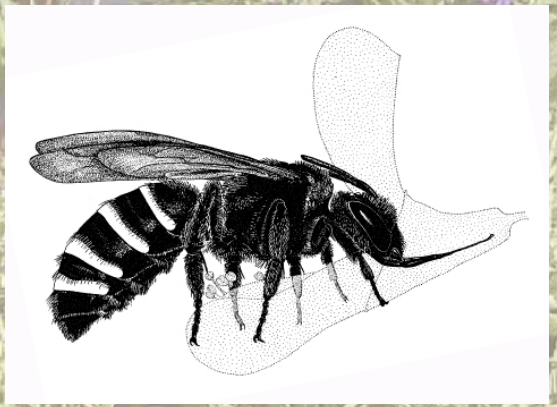
## Solitary Bees

- 90% of bees are solitary
- Lone female makes a burrow
- Offspring raised by lone mother
- Adult bees socialize only to mate
- Many solitary bees are small & inconspicuous, so often overlooked…
- …but they are important pollinators


Photo: Matthew Shepherd, Xerces

# “Useful” solitary bees & the main crops they pollinate

Alfalfa leafcutting bee (alfalfa)



Alkali Bee (alfalfa)

Blue Orchard Bee
(“mason bee”, fruit trees)

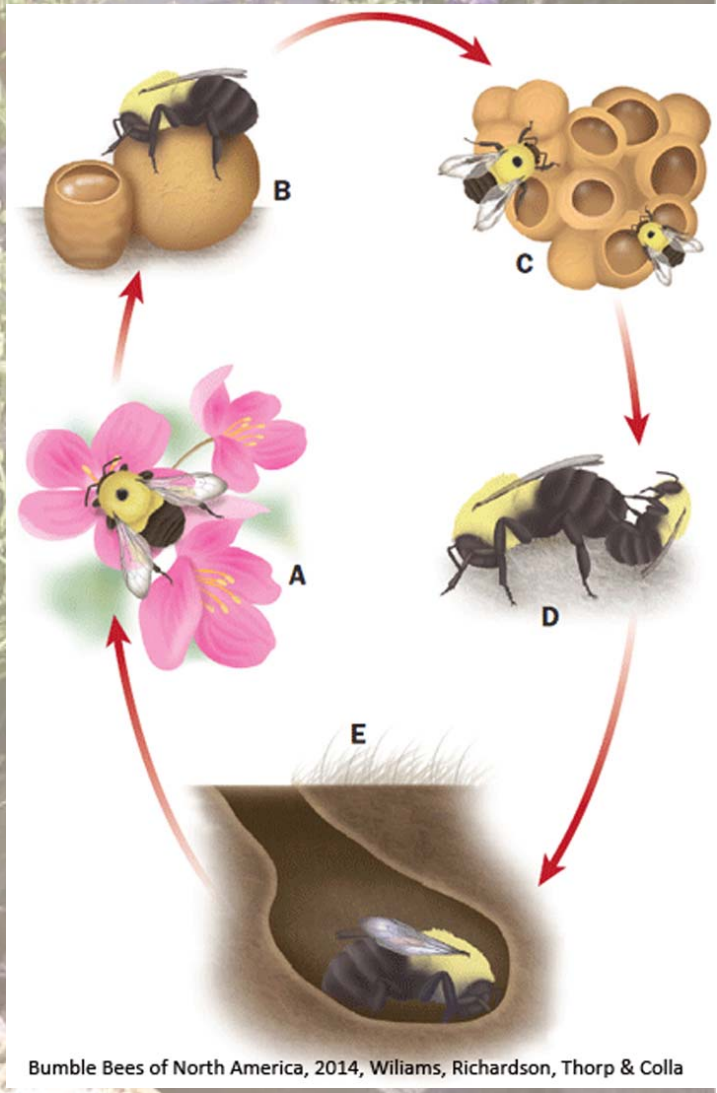

West Coast Green Berry Bee
(raspberries & blackberries)

# Social Bees

- Live in family groups (colonies)
- Reproduction limited to few or one adult ("queen")
- "Workers" rear offspring
- Colony survives for many months or perennially
- Better known because more conspicuous
- Include bumble bees & honey bees
- Are especially valuable as pollinators because:
  - They occur in large numbers
  - They visit many species of flowers

## Bumble Bees

- Our most valuable native pollinator (in PNW)
- 6-8 species in Puget Sound lowlands
- Queen begins in Spring as a solitary individual but soon has a growing colony.
- The nest is usually underground.
- Colonies grow to several hundred individuals, die out in late summer except next year's queens.
- Several species threatened or extinct, e.g. West Coast Bumble Bee.



Bumble Bees of North America, 2014, Wiliams, Richardson, Thorp & Colla

Photo: Matthew Shepherd, Xerces

# Bumble Bees

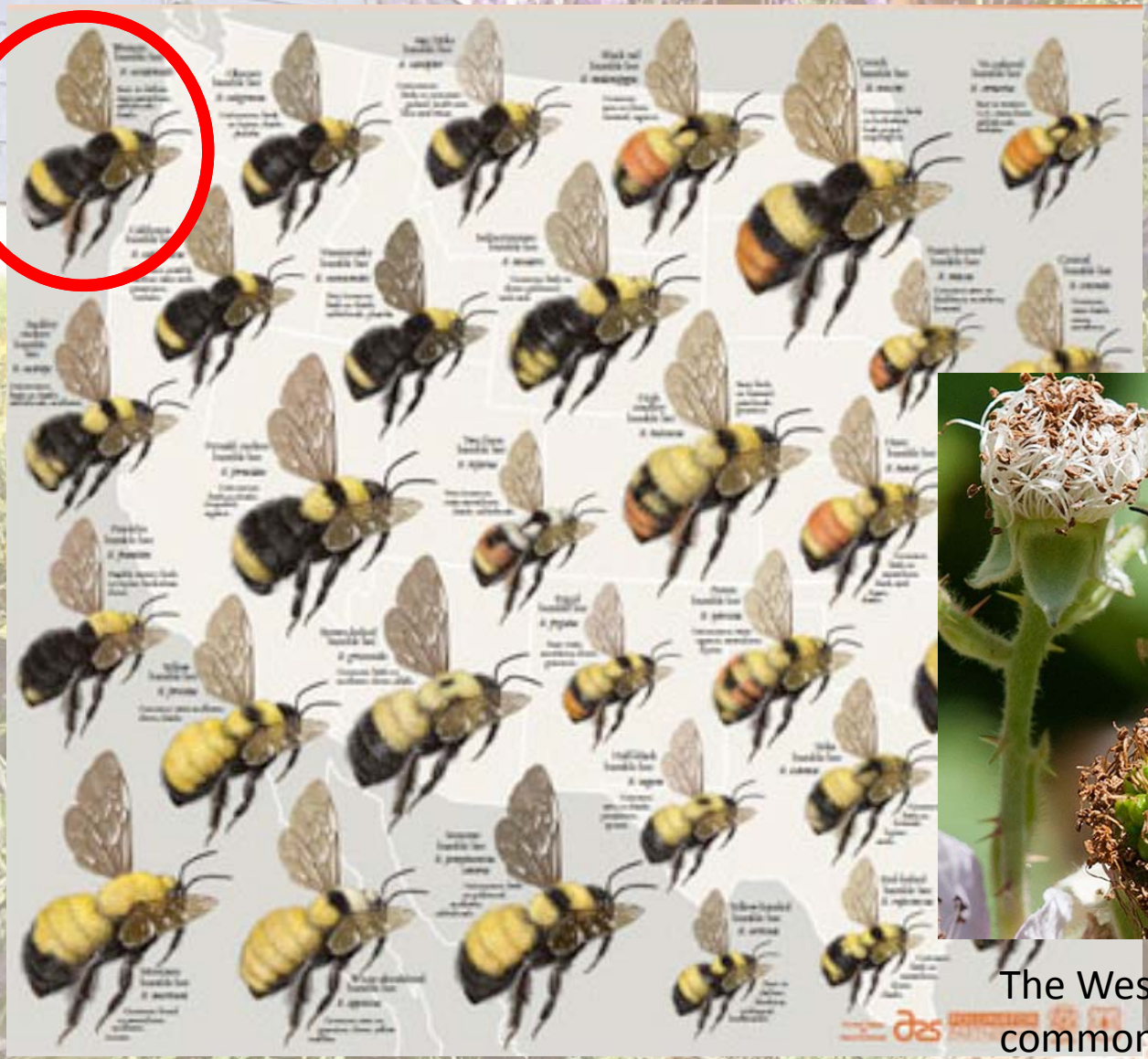


Photo: Matthew Shepherd, Xerces

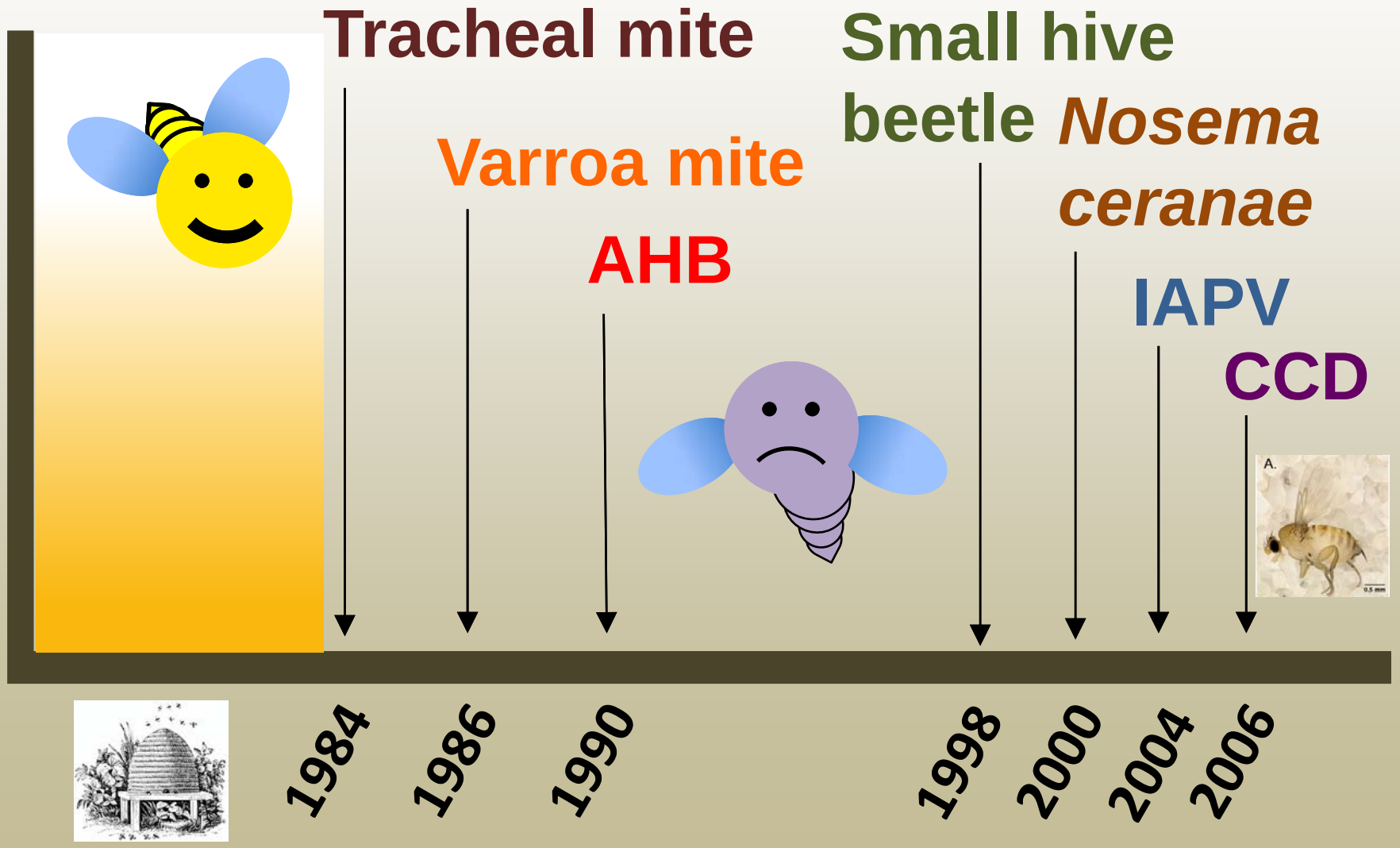
The Western Bumble Bee, once common, now rare. For more info.: **beesearch.org**

## Honey Bees

- Most highly social bee, colonies up to 60,000 individuals
- Single queen; active all year
- Make (store) honey as winter heating fuel
- Native to Africa, Europe, Middle East
- Now imported globally
- Most manipulable of all bees and most useful pollinator
- Industry worth $ millions in many countries.
- Some crops, e.g. almonds, utterly dependent on them.
- The pollinator “workhorse” and standard of comparison.
- Honey bees, in particular, have suffered the greatest number of new threats.

Photo: Matthew Shepherd, Xerces

# Beekeeping's Modern Era: *Multiple plagues*

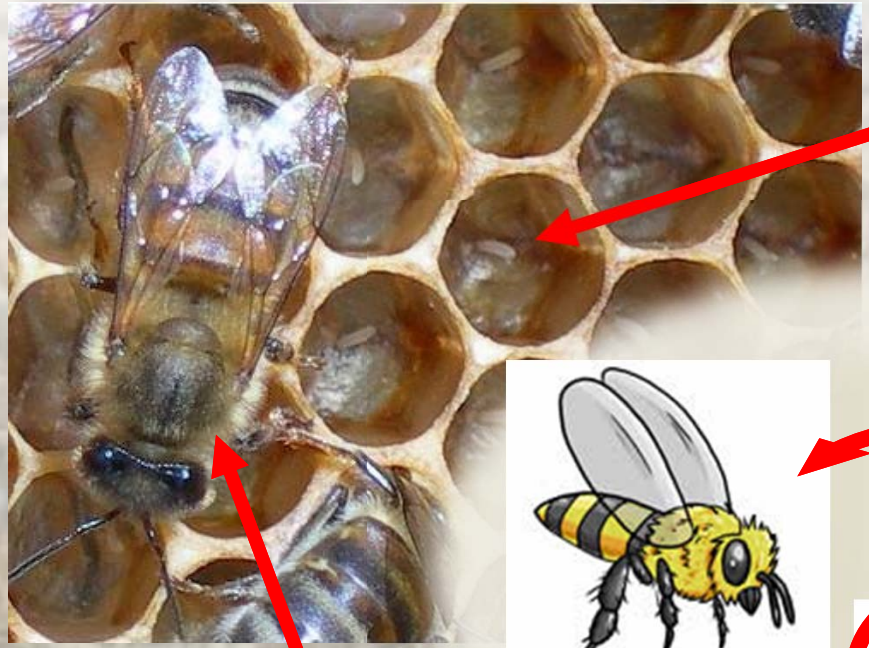


# Bee Biology Basics

***To understand the requirements of bees in landscapes, we must understand their basic biology.***

- Bees, unlike most other pollinating insects, live and rear their young in **nests**. They have distinct foraging territories and homing abilities.
- This means 1) bees forage back-&-forth from a central point (the nest), potentially pollinating many plants in the surrounding area, and 2) dependence on a nest can be used to cultivate bees.
- Bees, like most insects, have **complete development**: egg – larva - pupa – adult.
- **Larvae** are helpless except for their sisters and the nest to protect them. The larval stage is the most sensitive to disturbance and toxins.
- The function of the larval stage is **growth and development**.

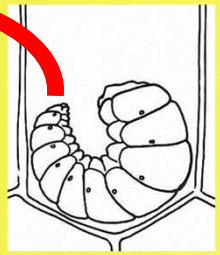
# Worker Developmental Stages



**Egg - 1st 3 days**
*Embryo Development to Hatching*

**Larva (3 molts) – days 4 – 9**
*Feeding & Growth*





**Adult – day 21**
*Hive duties to death; NO MORE GROWTH*

**Capped: Pre-pupa/Pupa – days 10 – 21**
*Metamorphosis*

# (Bee Biology Basics)

- The function of an adult bee is primarily **reproduction** – mating, collection of food for the next generation, and defense of young; social worker bees help their mother in the latter tasks.
- **Males only mate**, never collect pollen or carry nectar to the colony.
- **Short lives**. The lives of most adult bees are only 1-2 months; worker honey bees may live several months and queens may live several years.
- Most bees die in the field as foragers. **They work themselves to death.**

Bees and other pollinators have 3 basic requirements in human landscapes:

1) Nutrition
2) Nesting resources
3) Protection

# 1) Nutrition

Food: ***Flowers!***

Carbohydrate – Nectar (sugar solution, to attract pollinators); ENERGY for flight and, for honey bees, winter heating fuel.

Protein & Lipids – Pollen (plant reproductive granules); larval food for growth & development.

Landscaping solutions (more in afternoon sessions)

- Cultivate nectar and pollen plants
- Allow nearby native flowering growth
- Consider pollinator needs when trimming, etc.

Photo: Matthew Shepherd

# 2) Nesting Resources

*Usually overlooked but essential*

<u>Natural Materials</u>

Bare soil (ground-nesters)

Wood & branches (cavity & twig-nesters)

Resin (honey bees, nest caulking and antibacterial;
mostly incidental)

Water (honey bees, nest cooling; mason bees, mud; mostly incidental in our area)

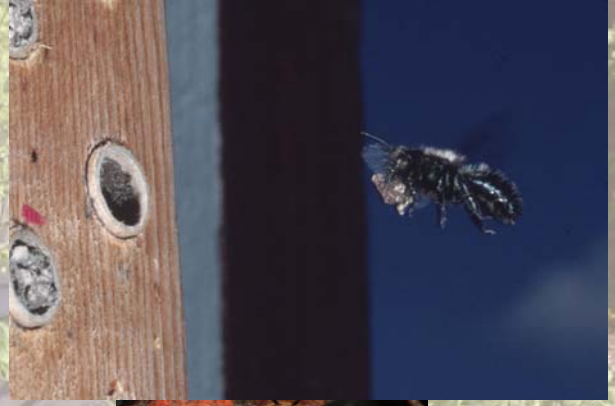
<u>Provided Materials</u>

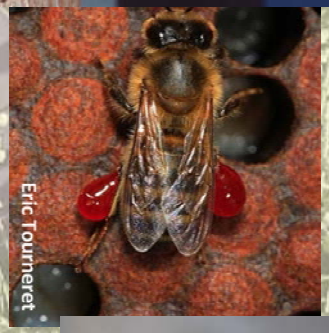
Modified natural materials (e.g., drilled holes)

Artificial materials (nest boxes, etc.)

Landscaping solutions

- Leave some bare soil
- Allow some brush piles, downed wood
- Trim high - leave some dry, pithy stems







# 3) Protection

*An outgrowth of human-associated threats*

- Habitat stability
- Non-toxic zones

Major threats to protective efforts:

- Urban/pollinator-unfriendly development
- Agricultural land clearing
- Toxins
  - Traditional Pesticides
  - New pesticides, e.g. neonicotinoids, GMOs
  - Fungicides (newly realized dangers)
  - Herbicides
  - Misc. chemical contamination


**Landscaping solutions**

- **Set aside safe zones for pollinators**
- **Have a pollinator-conscious land management plan**
- **Inform neighbors, all stakeholders, & the public**

# Recent pollinator conservation findings & initiatives

## Toxins

- Research has found that bees are far more susceptible to chemical toxins than once thought.
- Larval stages are extremely sensitive.
- Many chemicals once thought benign, are now recognized as dangerous to pollinators.
- Foraging bees, which must return to their nest, can bring contaminating toxins to their larvae from far away.
- Toxins can accumulate in long-lived honey bee colonies by building up in stored pollen (delayed effect on larvae) and in the structural wax.

# (Recent pollinator conservation findings & initiatives)

Historical perspective

- The Pesticide Treadmill of the 1950s-'60s was replaced by the era of Integrated Pest Management (IPM) in the 1970s – 1990's.
- Overall, most pesticides are now safer for mammals.
- But toxicity to insects has been continually refined, often with inadequate regard for build up of resistance.
- New pesticides, such as the neonicotinoid class, are not only extremely toxic to bees but can impact a wide variety of beneficial organisms, from biocontrol agents to earthworms.
- Neonics are applied to seeds and systemically, increasing the exposure risk to bees and potentially making nectar toxic.
- Typical application procedures, goals, and outcomes are often outside of the norm of IPM.
- Are we going back to the Treadmill?

THE XERCES SOCIETY
FOR INVERTEBRATE CONSERVATION

about programs publications news invertebrates

# Pesticide Causes Largest Mass Bumble Bee Death on Record

FOR IMMEDIATE RELEASE: June 21, 2013

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## Pesticide Causes Largest Mass Bumble Bee Death on Record

**Oregon Department of Agriculture confirms deaths due to application of insecticide known as Safari**

**Wilsonville OR.** — Scientists investigating the mass death of bumble bees in Wilsonville, Oregon say that pesticides are the most likely cause. The incident first came to light on Saturday when shoppers at a Target store reported finding tens of thousands of dead bees in the store's parking lot. News quickly spread to the Portland-based Xerces Society for Invertebrate Conservation, a group known for their international bee conservation work, who launched an investigation.

Photo: Matthew Shepherd, Xerces

(Recent pollinator conservation findings & initiatives)

*Other recent findings*

- Competition. Honey bees (large numbers of hives) may threaten food reserves of some native pollinators under certain conditions.
- Augmentation. Many species of native bees can be managed commercially to substitute or augment honey bee pollination.
- Natural Pollination. Can occur naturally, without management, where native bee populations are healthy.
- Management. Better management can help increase survival of honey bees.
- **Enhanced pollinator habitat can be integrated into farm- & landscapes** (more on this later.)

## Attitudes

- Changing
  - Education turning toward pollinators
    - Giving rise to new policies

## Initiatives

### World

European moratorium on certain neonics

Growth of organic farming sector

### Federal

Farm Bill provisions

Federal pollinator protection initiative 2012

Presidential Memo

*Effects will depend on implementation & enforcement*

### Local

Seattle neonics ban

European Commission

HEALTH AND CONSUMERS

Animals

ARCHIVED ON
03/04/14
Visit new website!

OPA > European Commission > DG Health and Consumers > Overview > Animal Health and Welfare

Animals | Semen, Ova & Embryos | Products of Animal Origin | Animal Diseases | Identification | Animal Welfare | Zootechnics | Strategy (2007-2013)

Bees/Neonicotinoids

Bees & Pesticides: Commission goes ahead with plan to better protect bees

Topics
Introduction
Bee health
EU reference laboratory for bee health
Veterinary Medicines
Residues in honey
Pollination and

EU) No 485/2013

onicotinoids family

House of Commons

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BIODIVERSITY, FOOD AGRICULTURE

# House Adds Honey Bee and Pollinator Protections to Farm Bill

lberlekamp | June 21, 2013 4:54 pm | Comments

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Center for Food Saf

The Center for Food Safety
Wednesday that was offere
considered by the U.S. Hou
National Pollinator Week.

For Immediate Release

June 20, 2014

# Presidential Memorandum -- Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators

MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

SUBJECT: Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators

USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

National Plant Data Center

The Xerces Society for Invertebrate Conservation

San Francisco State University

August 2008

Technical Note No. 78

## Using Farm Bill Programs for Pollinator Conservation

SEATTLE WEEKLY News


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# Seattle Sticks Up For Bees, Bans Neonicotinoids. But Will It Help?

By Matt Driscoll Fri., Sep 26 2014 at 04:19PM

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Seattle just got a little more bee-friendly. At least on the municipal level. Maybe.

As the Associated Press dedicated five sentences to this afternoon, the Seattle City Council has moved to ban the municipal use of neonicotinoids, a class of pesticides that's been linked to negative impacts on bee populations. As Texas A&M details in this blog post, neonicotinoids are pesticides related to nicotine,


~ end ~
Photo: Matthew Shepherd, Xerces Society