

# Promoting Agricultural Sustainability: Creating Habitat for Native Bees



Presented by Jessa Guisse  
Pollinator Habitat Restoration Specialist  
**The Xerces Society Pollinator Conservation Program**

Photo: Edward S. Ross



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FOR INVERTEBRATE CONSERVATION

## What is the Xerces Society

# The Xerces Society

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

Photo: © Edward Ross



# The Xerces Society Agricultural Pollinator Program





## Talk Outline

- Importance and diversity of pollinators
- Bee declines
- Native bee contributions to crop pollination
- Native bee biology and lifecycle
- Habitat for pollinators and beneficials



Photo: Bruce Newhouse

## Importance of Bees

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

- About 70% of the world's plants require a pollinator
- Fruit and nuts are food for wildlife
- 35% of crop species, worldwide
- One in three mouthfuls of food and drink we consume
- Value of crops in U.S.: \$18 to \$27 billion

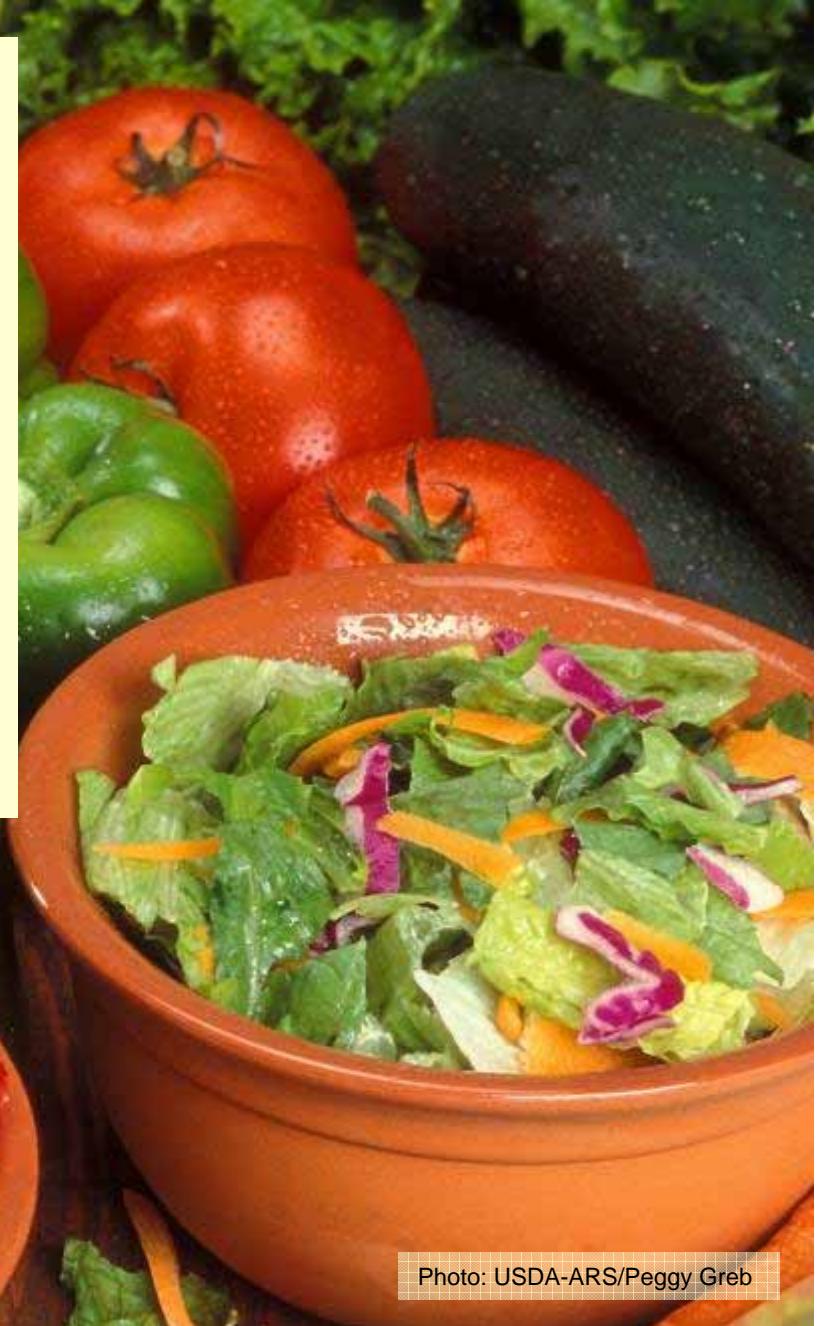
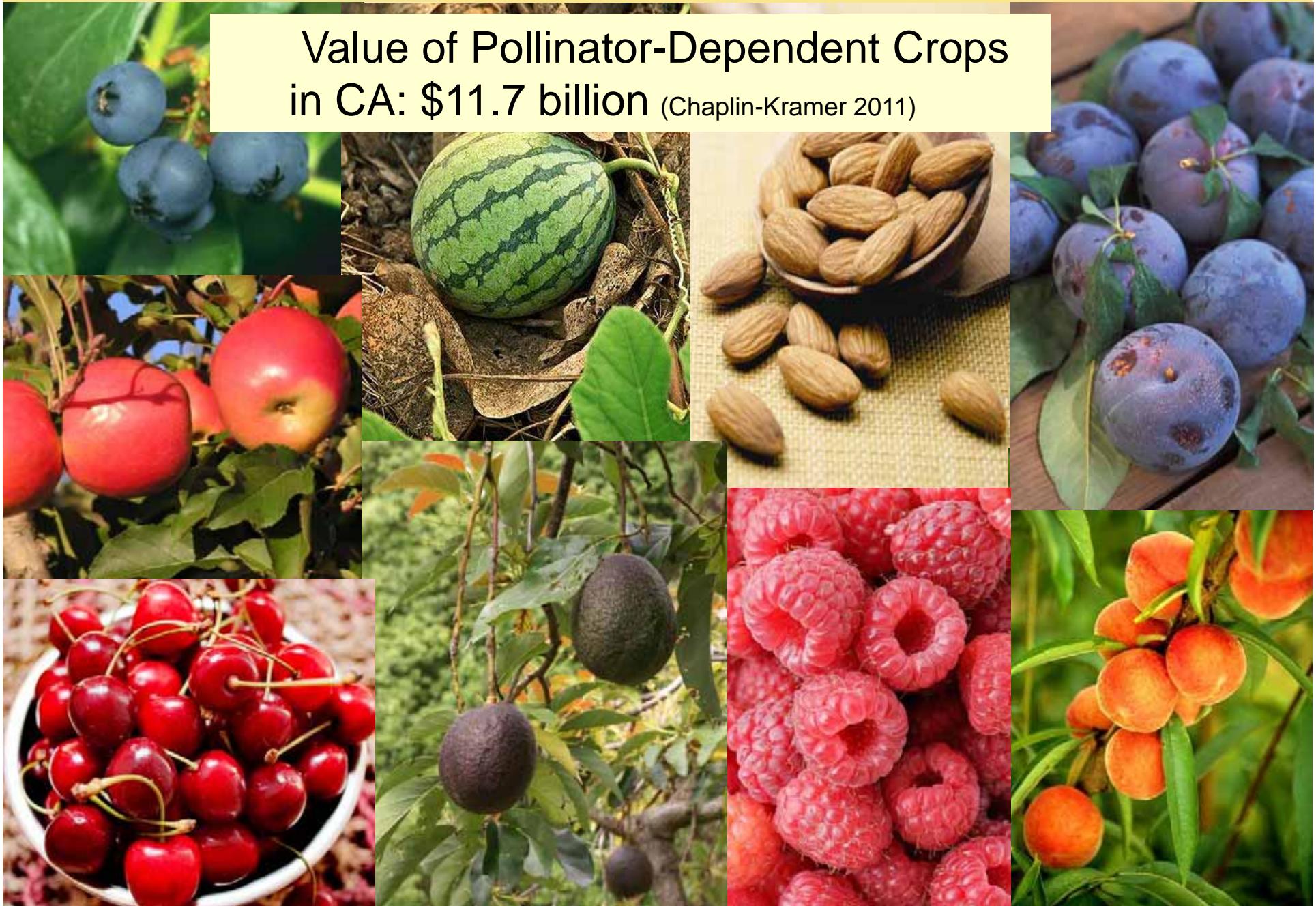


Photo: USDA-ARS/Peggy Greb



## Importance of Bees: California Agriculture

Value of Pollinator-Dependent Crops  
in CA: \$11.7 billion (Chaplin-Kramer 2011)



## The Value of Other Beneficial Insects

Wild natural enemies  
estimated to protect more  
than \$4.5 billion in crop  
production

(Losey and Vaughan 2006)



Photo: Mace Vaughan

## Diversity of Native Bees

**North America: 4,000+ species**

**California: 1,500 species**

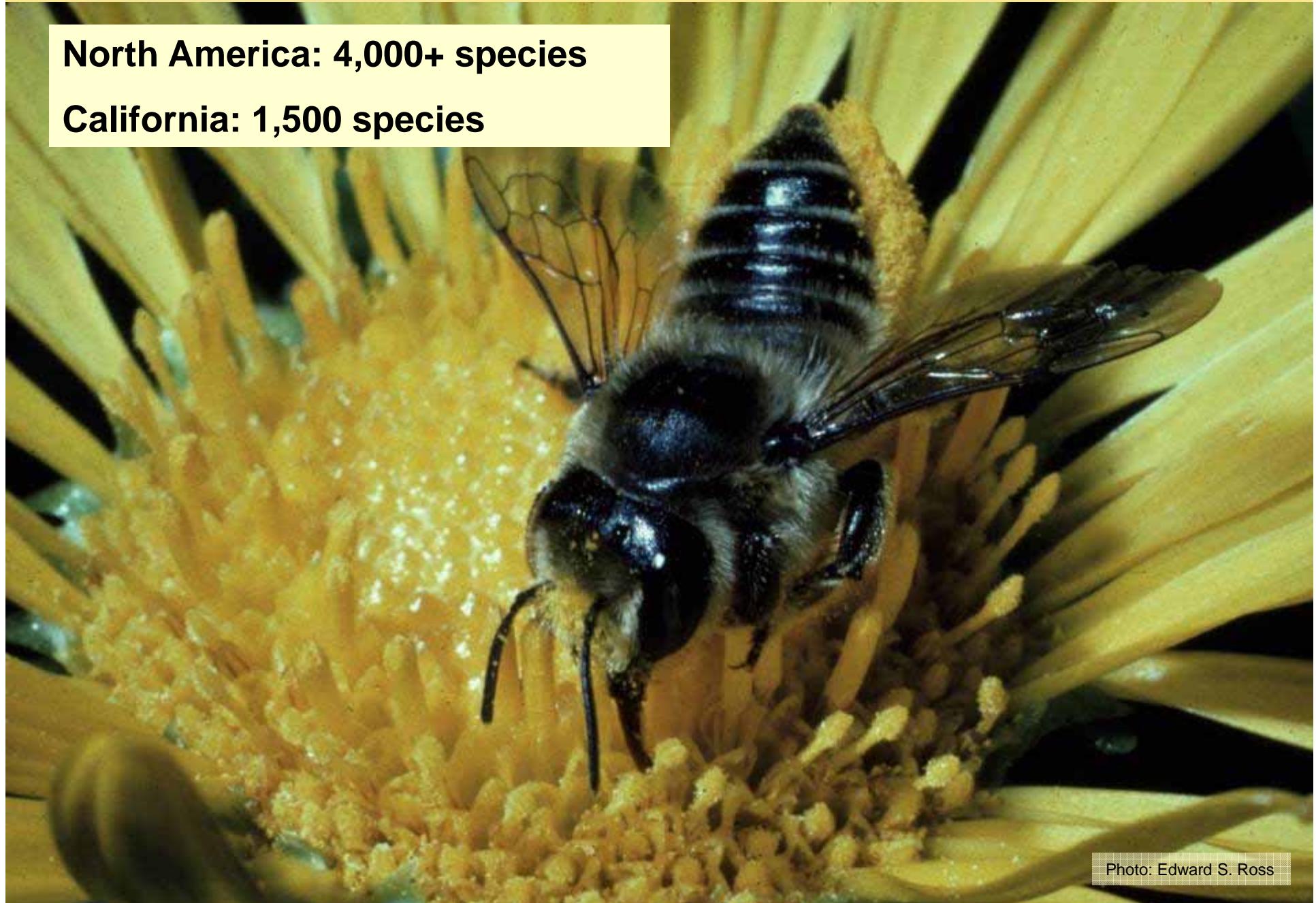


Photo: Edward S. Ross



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## Diversity of Native Bees

Honey bee (*Apis mellifera*)



Cactus bee (*Diadasia* sp.)



Bumble bee (*Bombus edwardsii*)



Leafcutter bee (*Megachile* sp.)



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



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## Diversity of Native Bees

Metallic sweat bee (*Agapostemon* sp.)



Yellow-faced bee (*Hylaeus* sp.)



Mason bee (*Osmia* sp.)



Sweat bee (*Halictus* sp.)



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



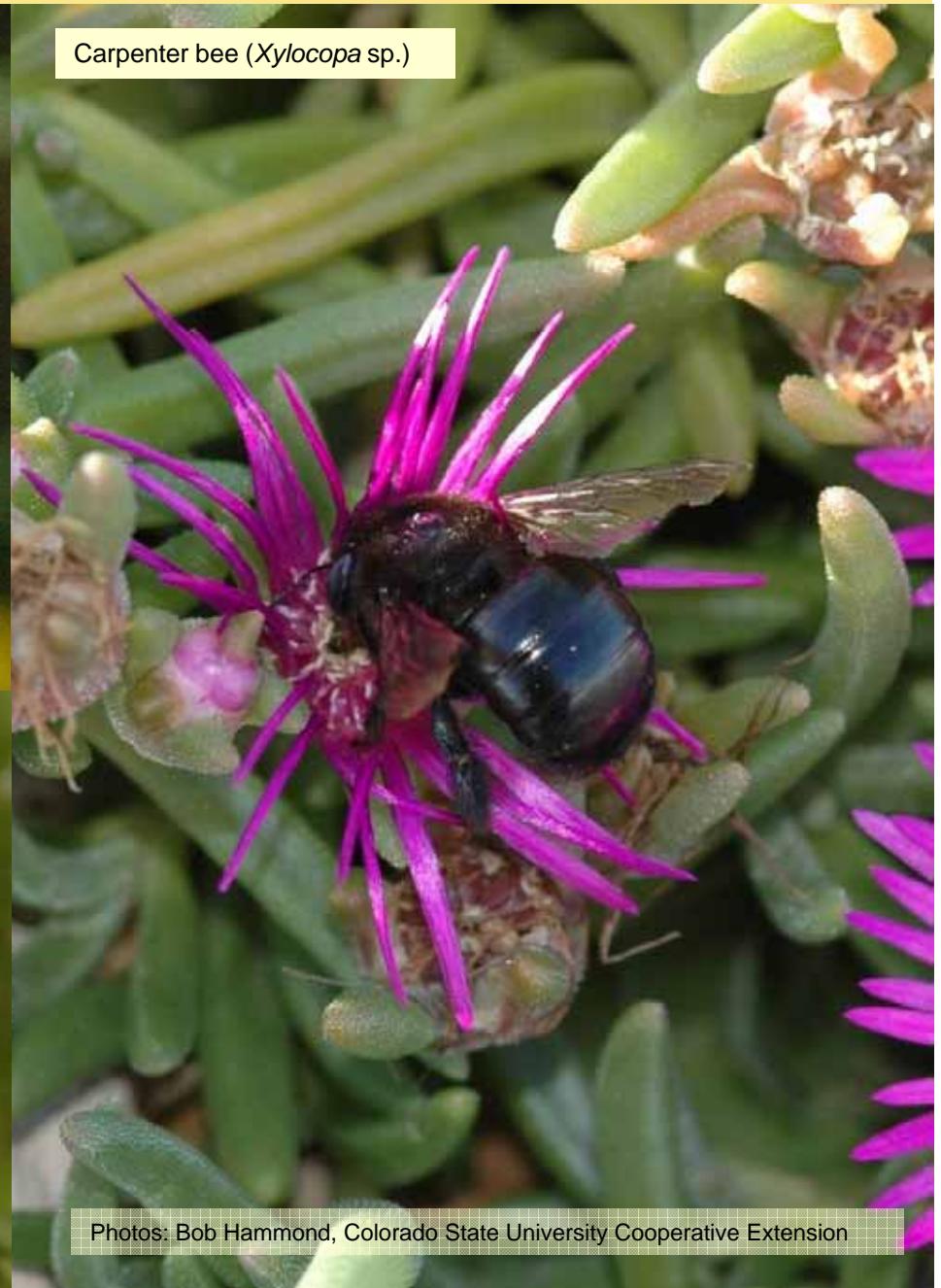
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## Diversity of Native Bees

Sunflower bee (*Svastra* sp.)



Carpenter bee (*Xylocopa* sp.)



Long-horned bee (*Mellisodes* sp.)



Photos: Bob Hammond, Colorado State University Cooperative Extension



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## Diversity of Native Bees



Photo: Stephen L. Buchmann



## Bee Declines

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



## Bee Declines

### Native bees also in decline:

Four sister species of  
bumble bees:  
96% decrease in  
population

(Cameron et al 2011)



## Native Bees and Crop Pollination

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



Photo: Mace Vaughan

## Fewer honey bees available

- Important to diversify pollinators for production agriculture
- Practices that support native bees also support honey bees and other beneficial insects



Photo: Bob Hammond, CO Coop Ext

## Native Bees Keep Honey Bees Moving: example of sunflower pollination

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

(Greenleaf and Kremen 2006)



## Native Bees and Crop Pollination

### Native Bees Buzz-Pollinate: example of cherry tomatoes

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

(Greenleaf and Kremen 2006)

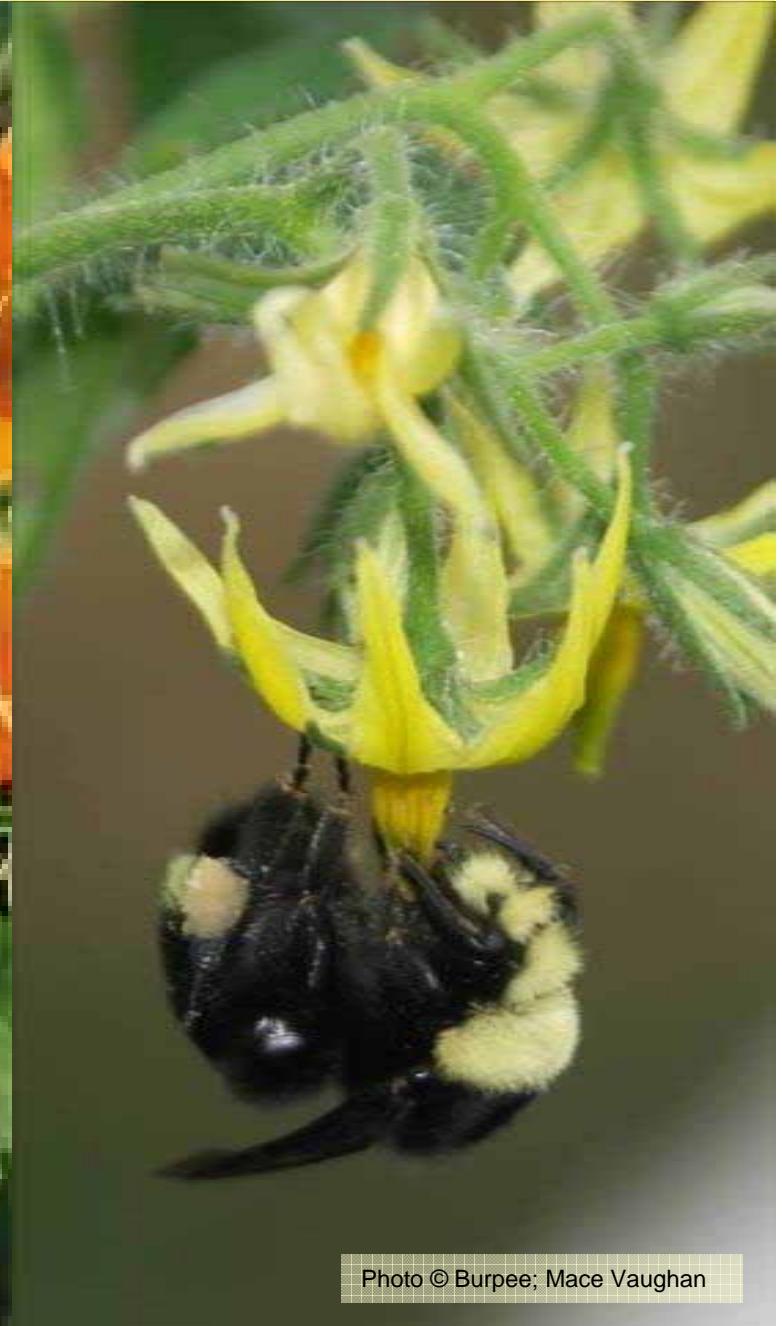
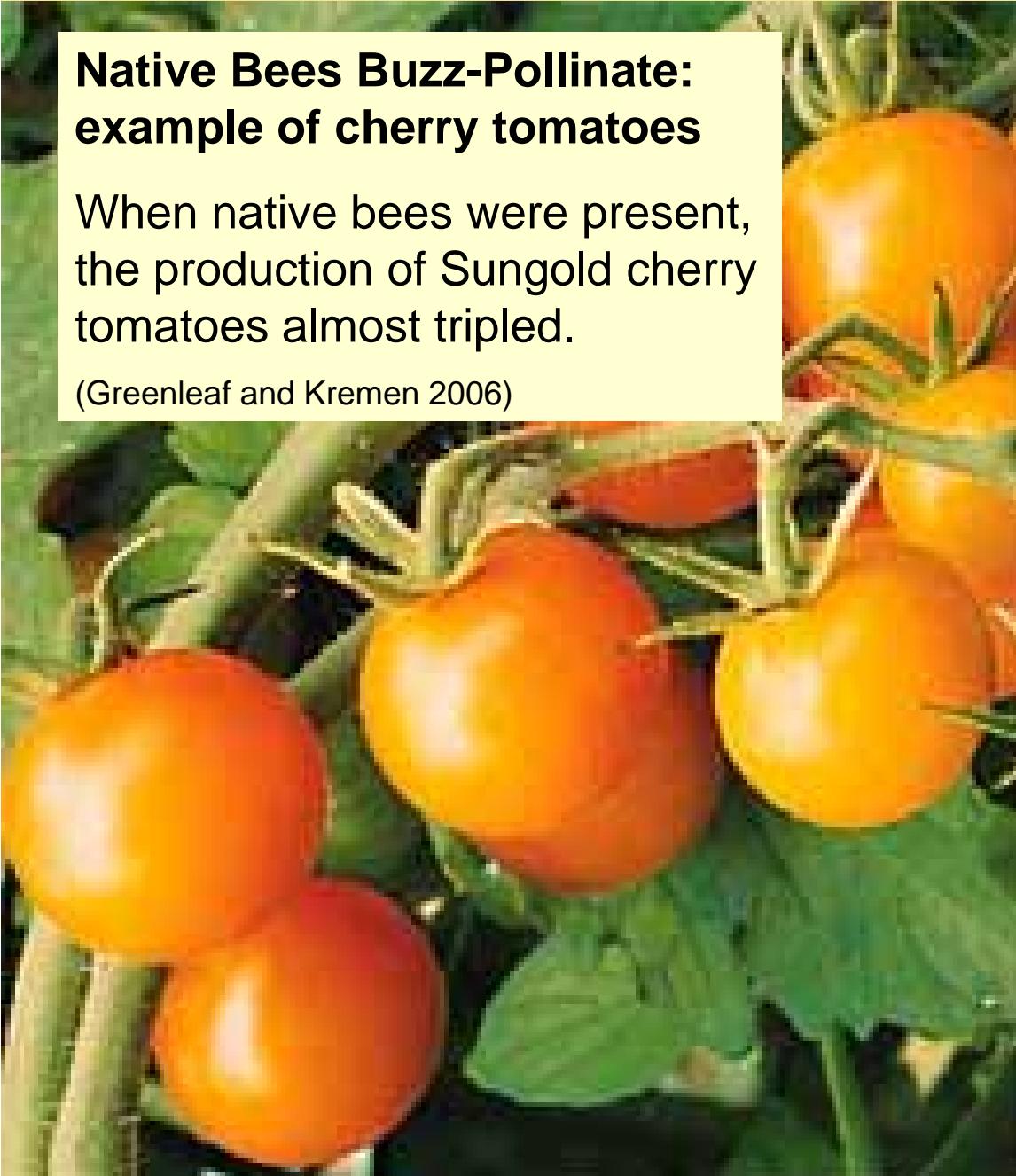


Photo © Burpee; Mace Vaughan

### Managed Native Bees: the blue orchard bee

- 300 individual females for an acre of almond orchard compared to 1 to 2.5 hives of honey bees (10,000 to 25,000 bees)
- Also pollinates apples and cherries
- Active at cool temperatures





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## Three Broad Groups of Native Bees



**Ground-nesting bees  
(solitary)**



**Tunnel-nesting bees  
(solitary)**



**Bumble bees  
(social)**



Photos: Matthew Shepherd, Eric Mader, SA Cameron



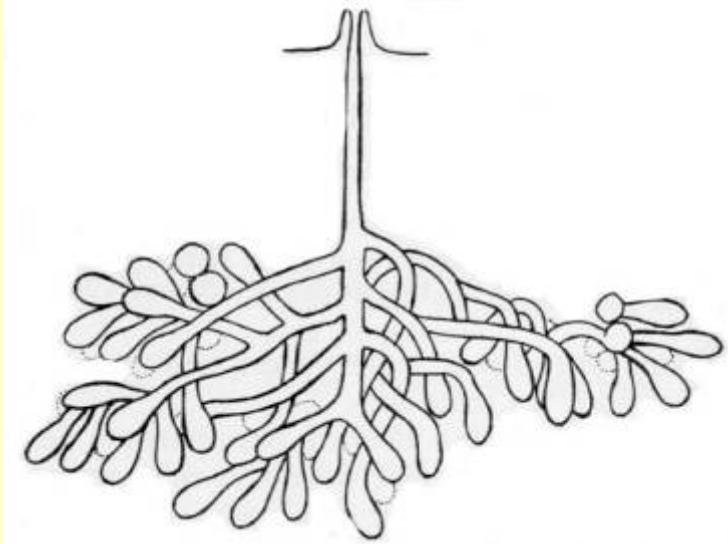
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## Solitary Bees

**Ground-nesting (~70%)**



Photo: Matthew Shepherd



Source: Stephen, Bohart, and Torchio, 1967



## Solitary Bees

### Tunnel-nesting bees:

- Approximately ~30% (or almost 1,000 species in North America)
- Hollow stems and beetle-borer holes

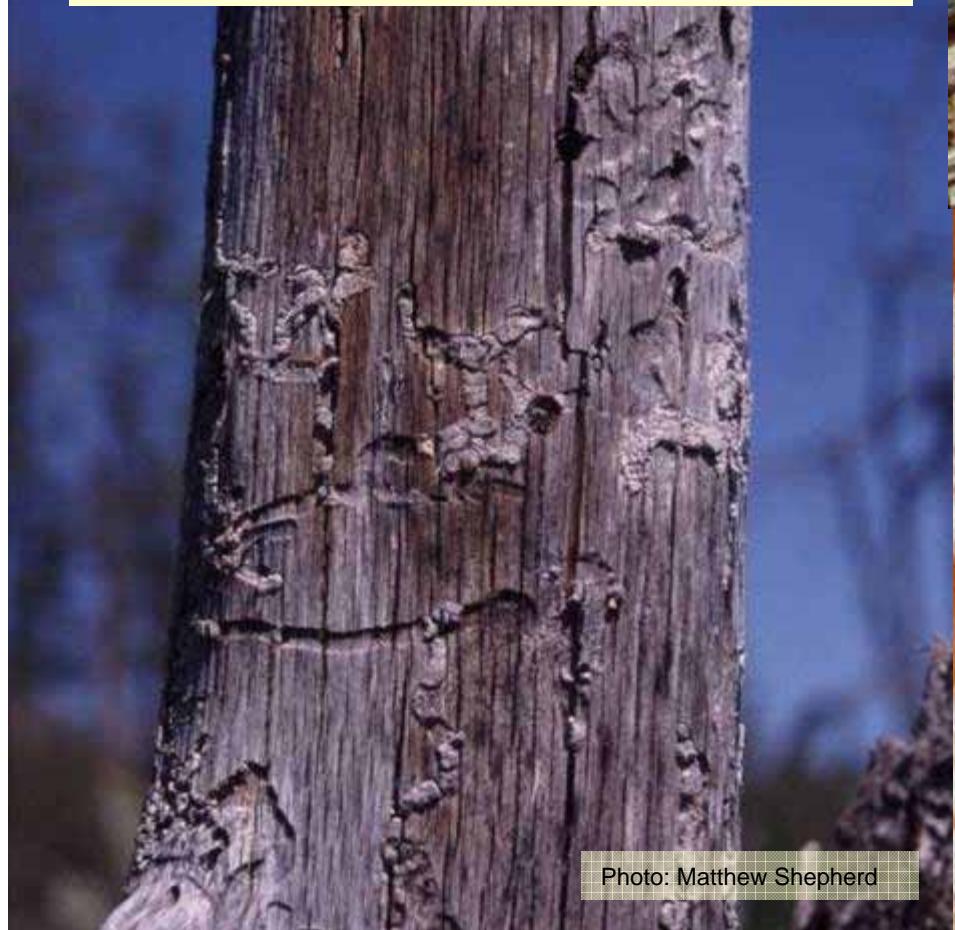


Photo: Matthew Shepherd



© Edward Ross



Photo: Mike Carter

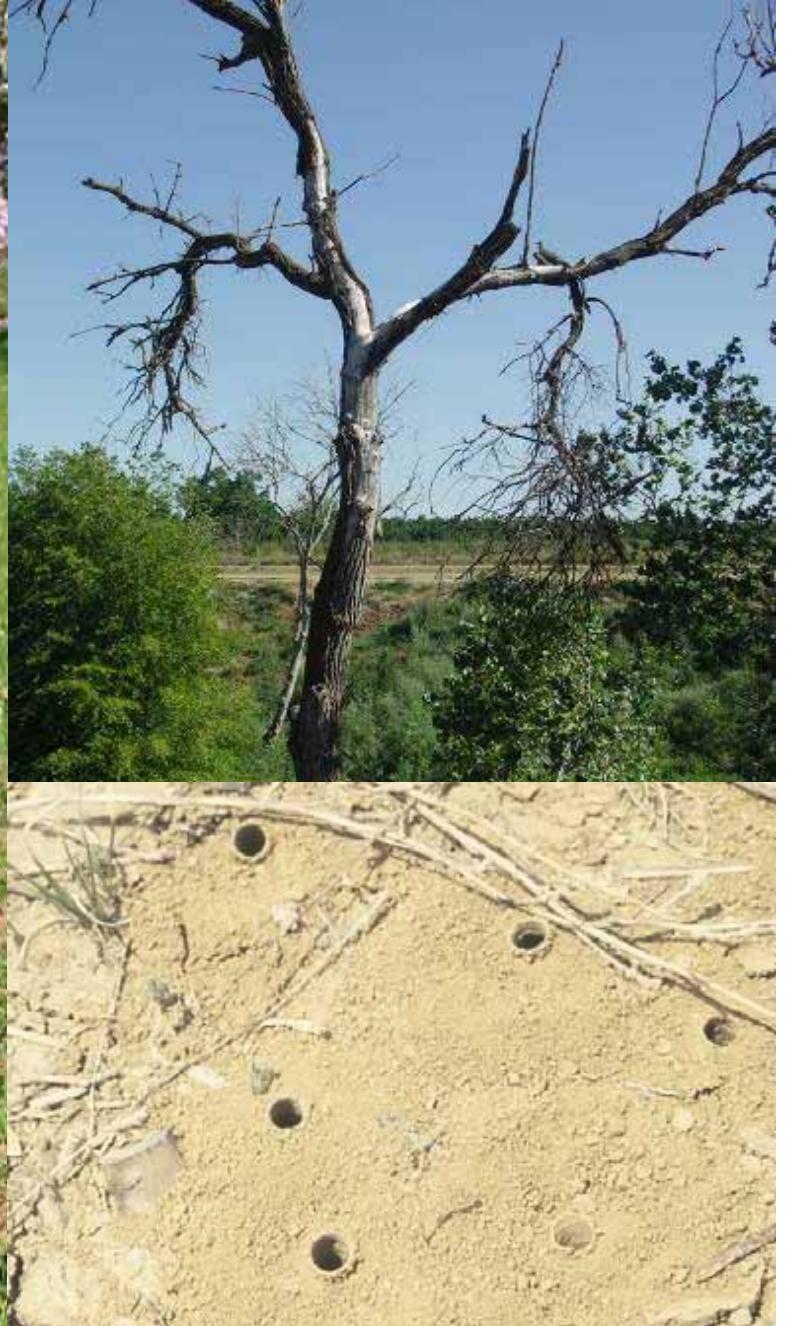


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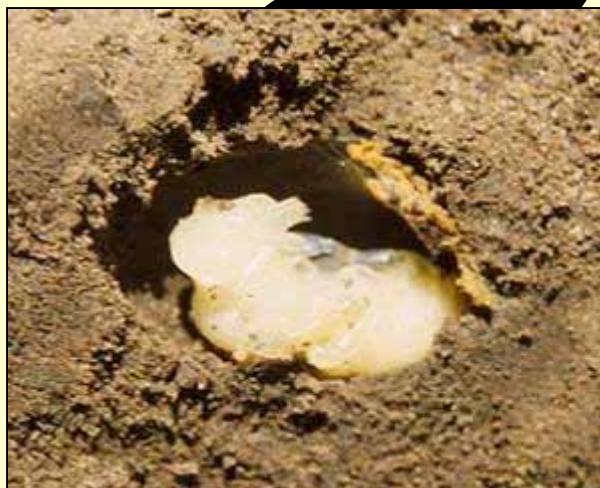
## Nest Sites for Solitary Bees



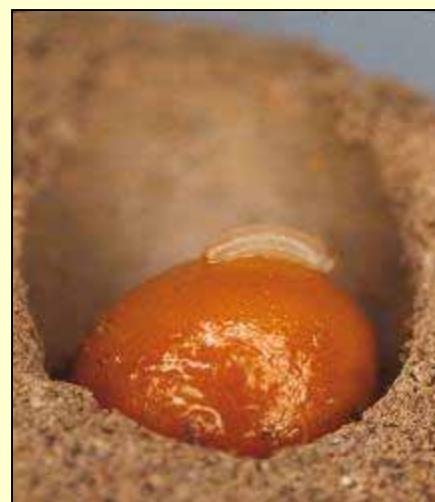
Photos: Matthew Shepherd, Mace Vaughan, Bob Hammond (CO Coop Ext.)



## 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



## Social Bees: Native Bumble Bees



Photo © Edward Ross



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## Nest Sites for Bumble Bees



© Mace Vaughan



© NRCS Lynn Betts



## The Value of Natural Areas and Biodiversity

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



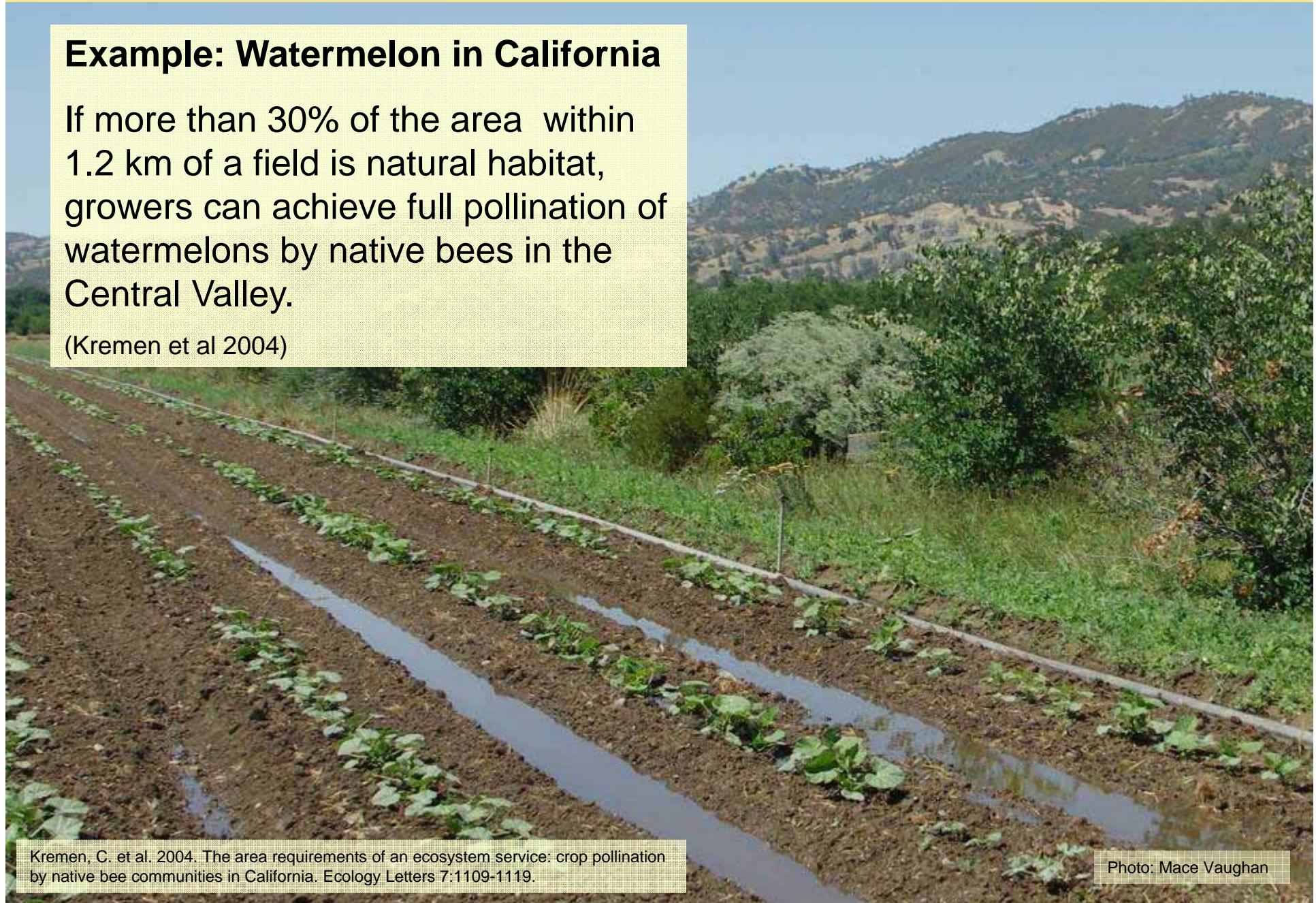
Photo: Edward S. Ross



### 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 et al 2004)



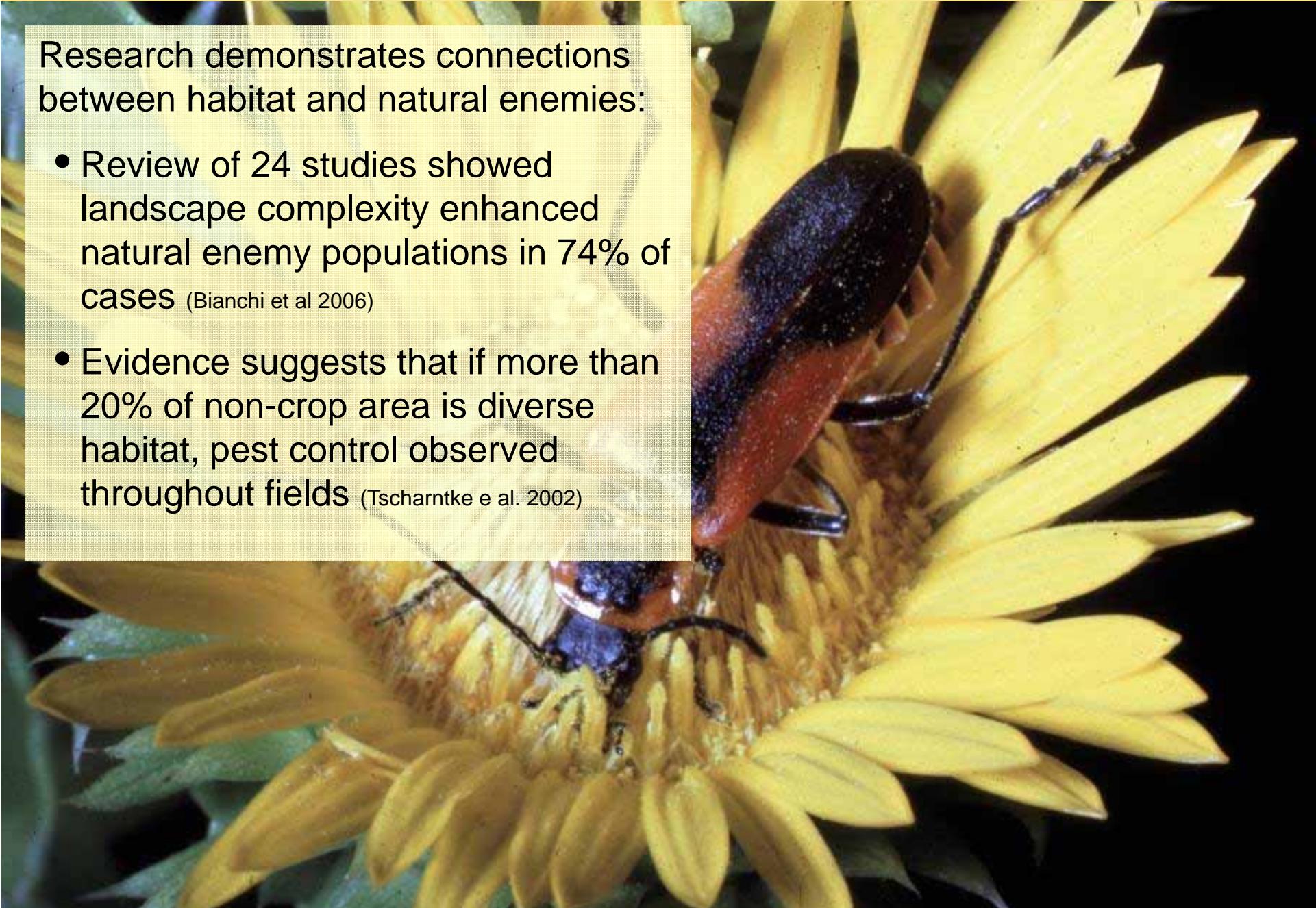
Kremen, C. et al. 2004. The area requirements of an ecosystem service: crop pollination by native bee communities in California. *Ecology Letters* 7:1109-1119.

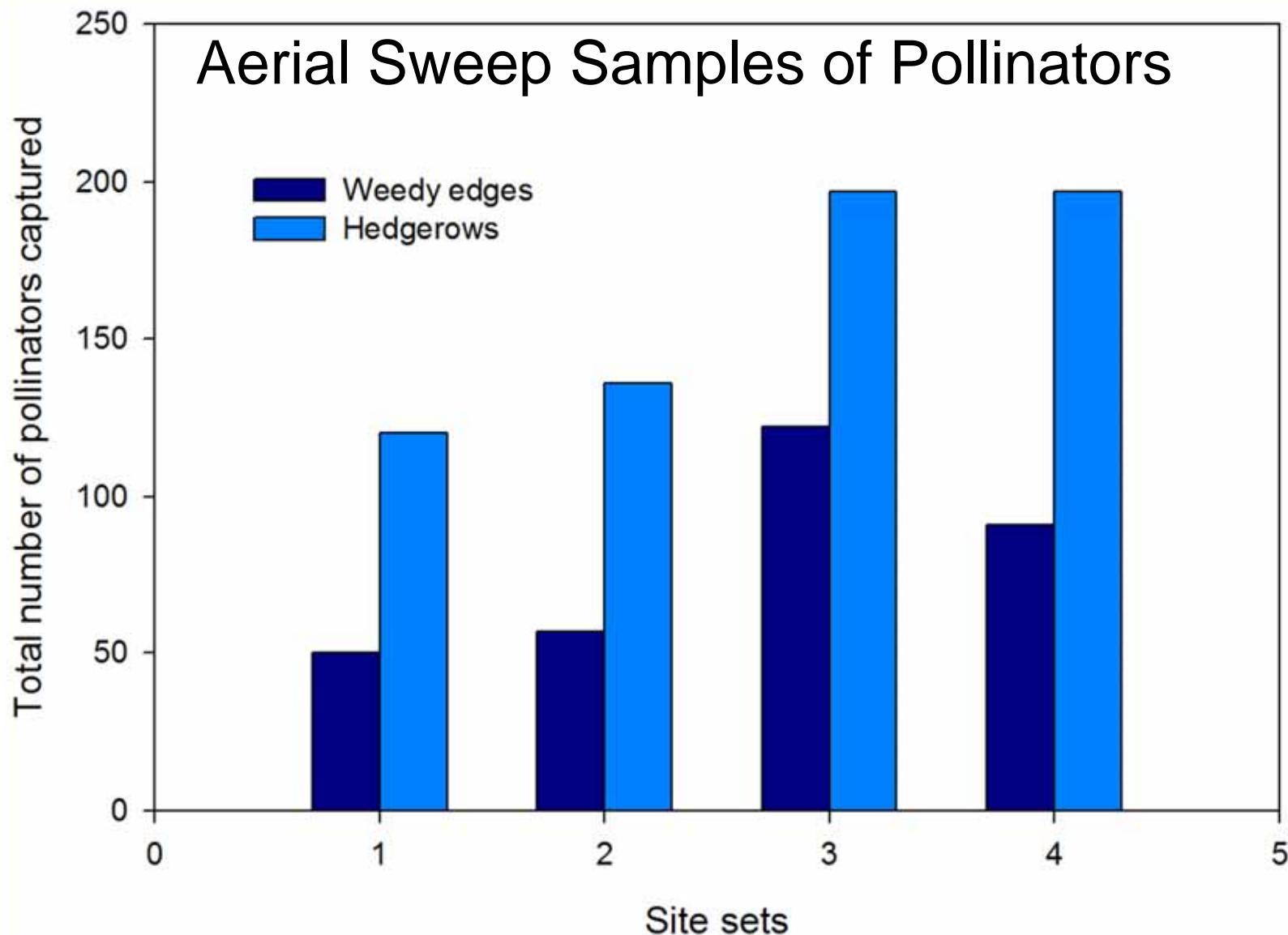
Photo: Mace Vaughan

## The Value of Habitat

Research demonstrates connections between habitat and natural enemies:

- Review of 24 studies showed landscape complexity enhanced natural enemy populations in 74% of cases (Bianchi et al 2006)
- Evidence suggests that if more than 20% of non-crop area is diverse habitat, pest control observed throughout fields (Tscharntke et al. 2002)

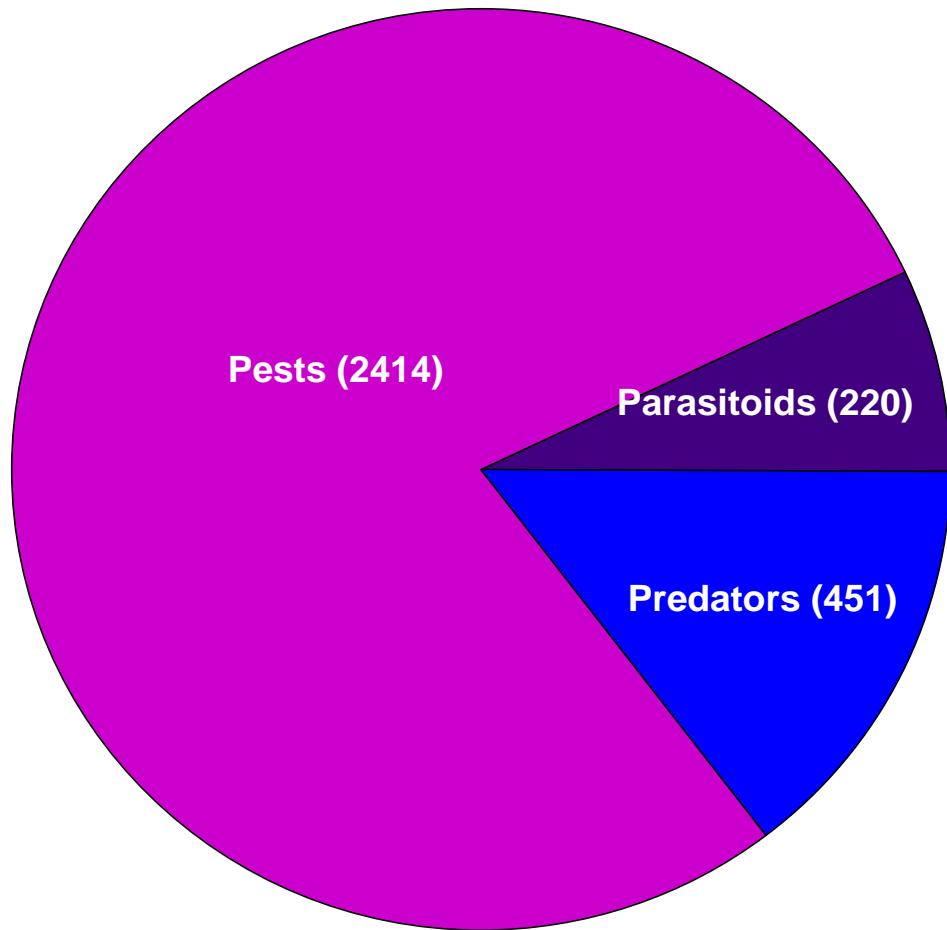




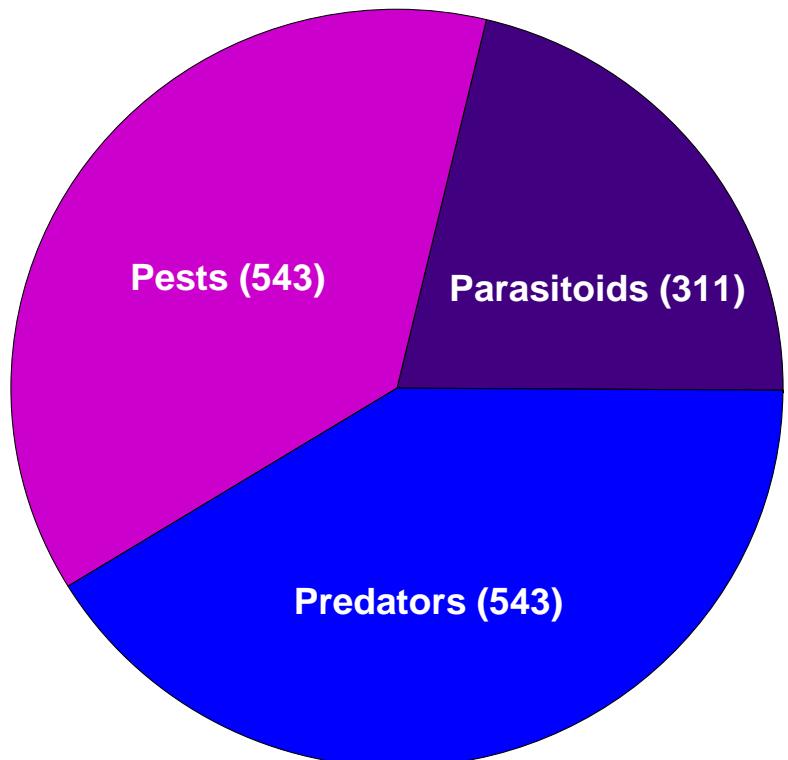


# Pest and Beneficial Insects

Weedy edges



Mature Hedgerow edges





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## Creating Habitat



The Challenge: how to bring this habitat into  
heavily managed landscapes...



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## Creating Habitat

In space-limited agricultural areas,  
getting creative and  
adding habitat  
anywhere and  
everywhere...





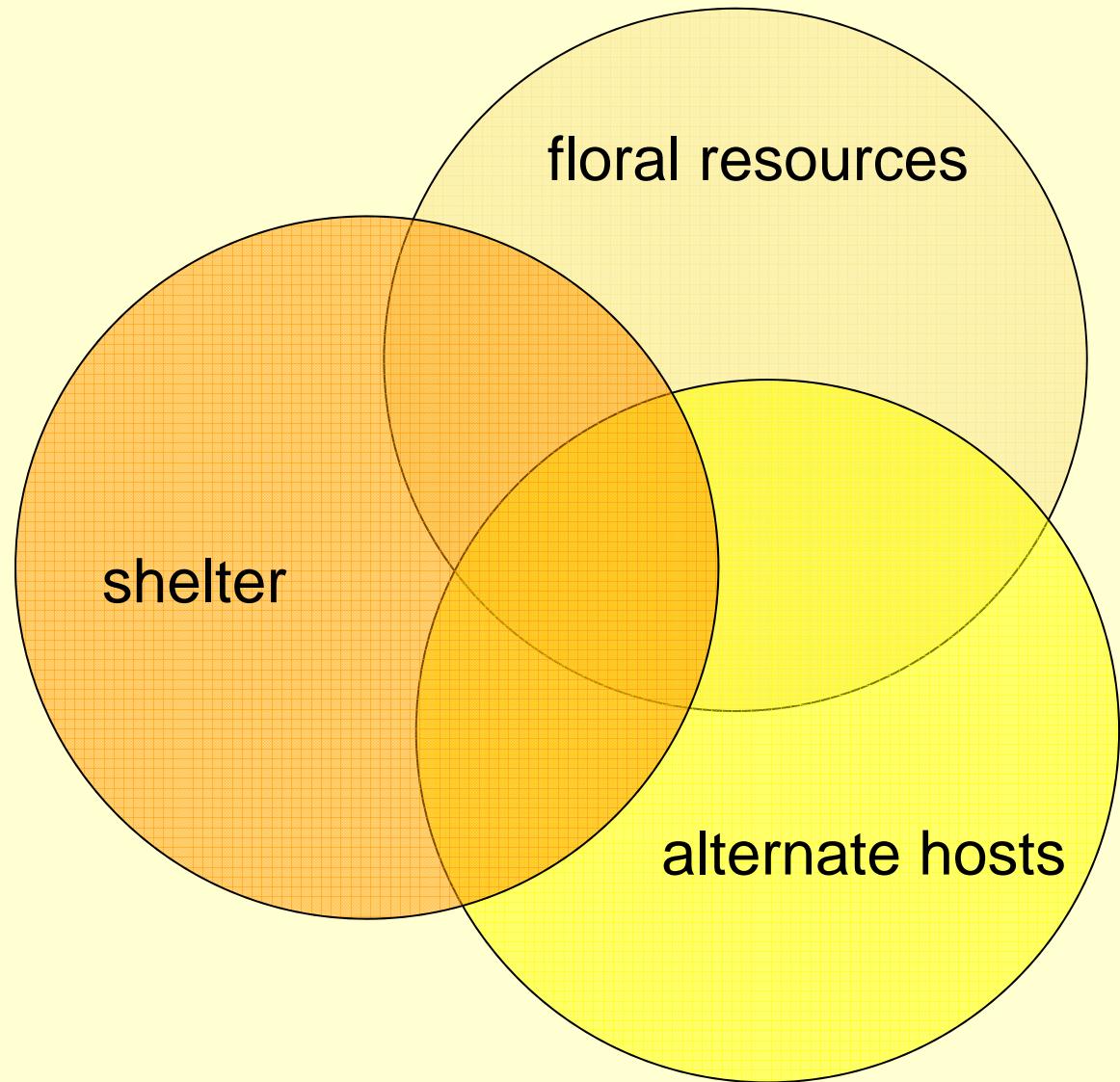
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## Creating Habitat





**Diverse and overlapping resource and habitat needs of various natural enemies**



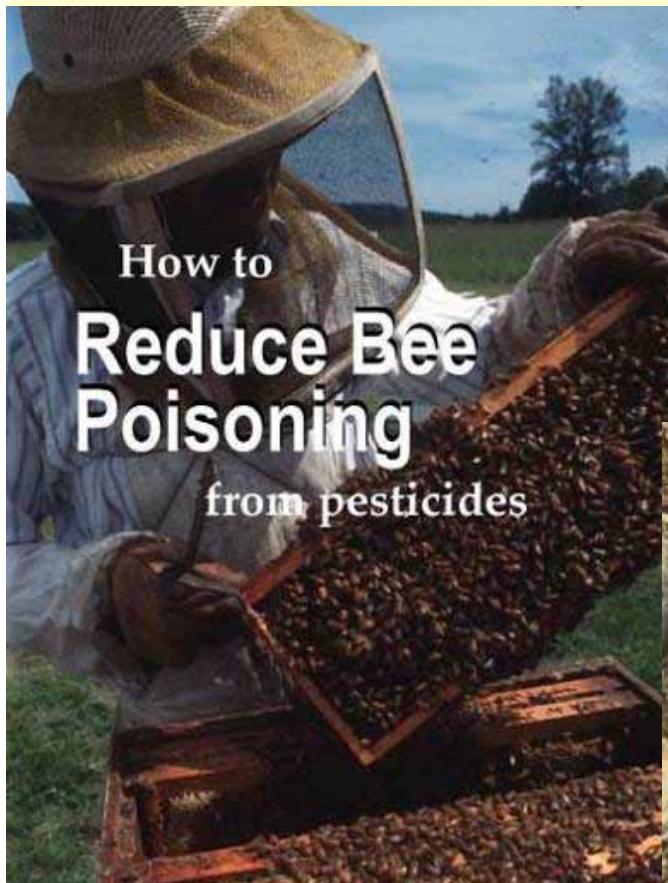


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## Creating Pollinator Habitat

### Bees Need:

- **Floral Resources**
- **Nesting & Overwintering sites**
- **Pesticide Protection**





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## Pollinator Habitat





## Special Considerations

### Including Forbs in Hedgerow Plantings:

- Providing abundant resources quickly

### New Challenges:

- Formulating forb mixes
- Methods of establishing forbs





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## Additional Resources

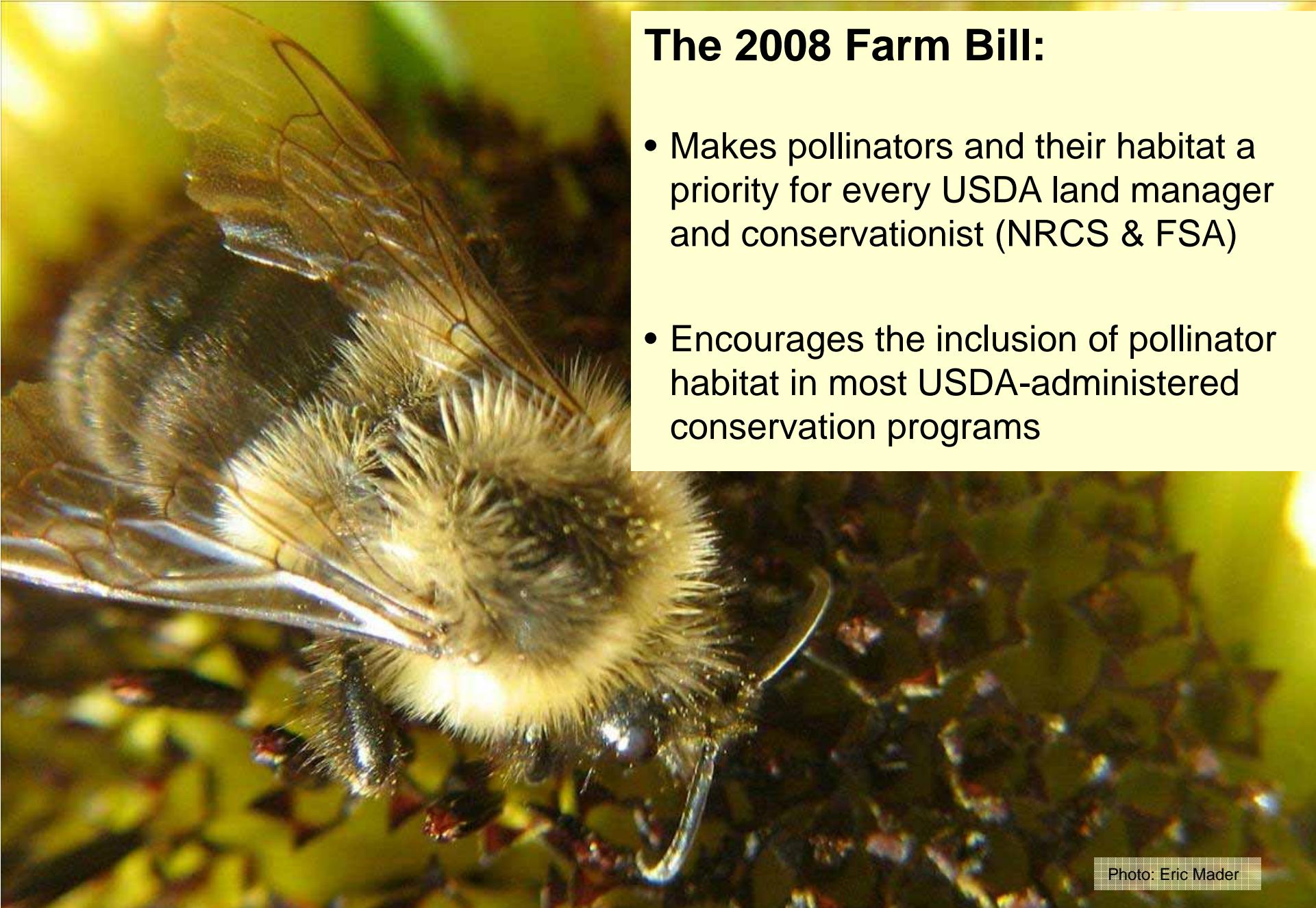


Photo: Rollin Coville

## 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





# Information: Xerces Society web site

- [www.xerces.org](http://www.xerces.org)

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**Pollinator Conservation Resource Center**

Welcome to the Pollinator Conservation Resource Center, where you can find regional information about plant lists, habitat conservation guides, and more. Scroll over the map below and click on your region of the country. For questions or comments about the Resource Center, or to suggest additional content, please contact [Eric Mader](#), Xerces' Assistant Pollinator Program Director.

**Program Features**

- [Plant Lists](#)
- [Pollinator Resource Center](#)
- [Academics](#)
- [Agriculture Resources](#)
- [Native Habitat for Pollinators](#)
- [Awards](#)
- [Books & Courses](#)
- [Bumble Bees in Decline](#)
- [List of bees](#)
- [Resources for Teachers](#)
- [Xerces Pollinator Publications](#)

**Program Highlights**

- [On-line presentation](#) on pollinator conservation basics in farm landscape
- The Xerces Society works with congressional staff to include [pollinators in the Farm Bill](#)
- Xerces organizes a [brief to D.C. legislators](#) on honeybees, Colony Collapse Disorder and native pollinators
- The National Research Council issues a [report](#) on the status of Pollinators in North America
- [Agriculturally important bumble bees in decline](#)

This resource center is a collaboration of the Xerces Society and Sean Williams at the University of California, Davis. Significant funding was provided by a grant from NEARE. Additional funding was provided by the USDA Natural Resources Conservation Service, the Columbia Foundation, Turner Foundation, Santa Rita Foundation, Disney Wildlife Conservation Fund, CS Fund, Wildwood Foundation, CERES/Greater Milwaukee Foundation, Bullitt Foundation, Organic Valley, Organic Farming Research Foundation, The White Pine Fund/The Hawkeye Foundation, and Xerces Society members.

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**Pollinator Conservation: Agriculture**

The diversity and abundance of native bees on a farm, and subsequently their ability to serve as crop pollinators, are strongly influenced by two factors: suitable habitat on the farm and in the surrounding landscape, and pesticide use on the farm. The basic habitat needs of native pollinators in any location are the same - nesting or egg-laying sites, flowers on which to forage, secure overwintering sites, and a refuge from pesticides. We engage in education, outreach, research, advocacy and policy to achieve pollinator conservation. This work is done on a national level, as well as in the targeted regions of California, the Upper Midwest, the Pacific Northwest, and the Northeast.

**How to Farm for Pollinators**

**Know the habitat on your farm**

Look for areas on and around your farm, such as old sage, bare soil, fallow fields and weedy road edges, that can support native bees. [Read more](#)

**Protect flowering plants and nest sites**

Once you know where native bees are living and foraging, do what you can to protect these resources from disturbance and pesticides. [Read more](#)

**Enhance habitat with flowering plants and additional nest sites**

Adding native flowering plants that bloom throughout the growing season, leaving some areas of soil untilled, and providing nest sites can increase the number of native bees on your farm. [Read more](#)

**Ways to manage habitat to protect pollinators**

We provide recommendations on how to protect, enhance and attract pollinators to anyone managing large areas of farmland and other habitats. [Read more](#)

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photo: long-horned bee (Hemaris sp.) on sunflower by Mac Vaughan

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# Information: Publications

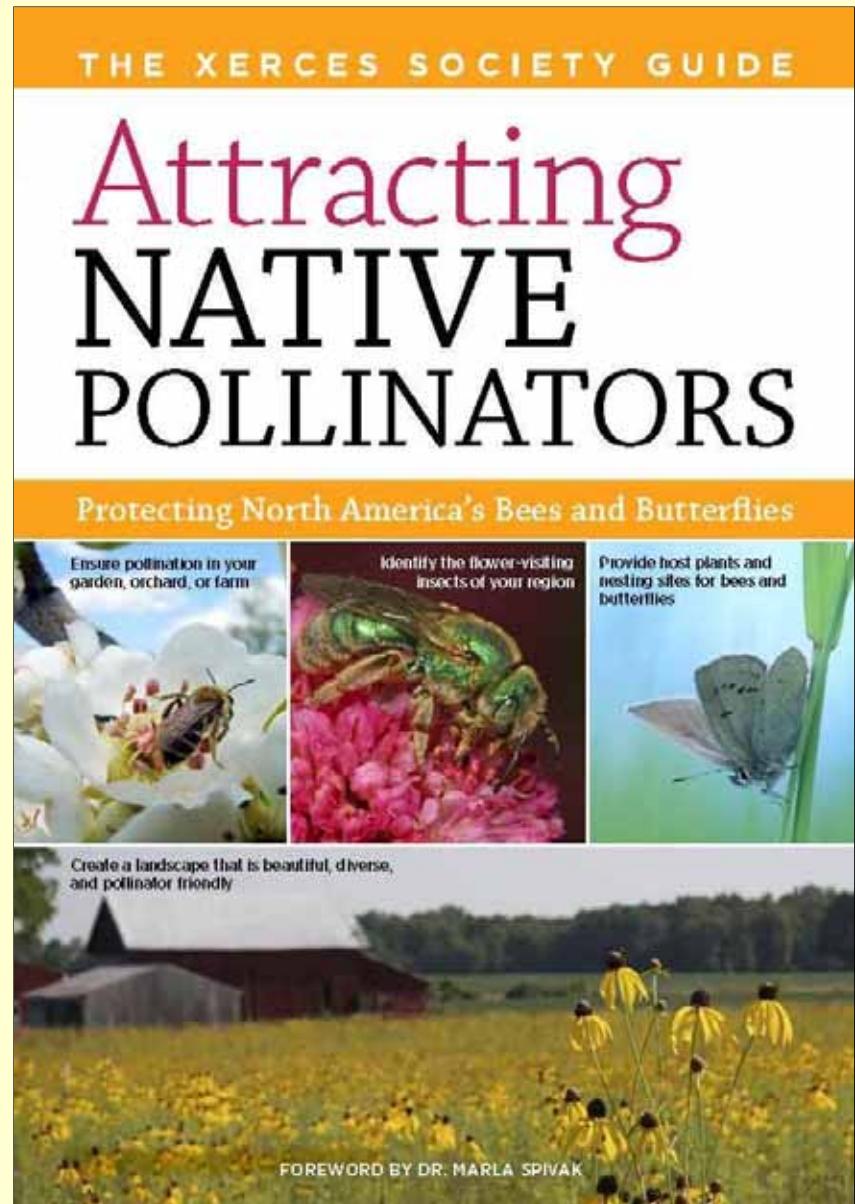
## Published in February 2011

“*Attracting Native Pollinators* belongs on the bookshelf of everyone who values the future of the natural world.”

- Douglas W. Tallamy, researcher and author of *Bringing Nature Home*

“Precise, elegant and thoughtful, the recommendations offered by the Xerces Society will become essential to advancing a healthy and diverse food production system.”

- Gary Nabhan, author of *The Forgotten Pollinators* and *Renewing America's Food Traditions*



# Thanks: UCCE, RCD and FFFP

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conservationists, and farmers

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- Bill Healy Foundation
- Bradshaw-Knight Foundation
- Wildwood Foundation
- Organic Farming Research Foundation
- Oregon Watershed Enhancement Board
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- Organic Valley
- USFWS
- WSARE



Photo: Mace Vaughan