Getting the Good Bugs: Farming for Conservation Biocontrol

XERCES SOCIETY for Invertebrate Conservation

Jessa Kay Cruz
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Photo: Adam Varenhorst

Who We Are

Photo: Nancy Adamson

Xerces Society – Who we are

Conservation, education, research, & advocacy to protect invertebrates and habitat

Now-extinct Xerces blue butterfly (*Glaucopsyche xerces*)

Major Programs:

- Endangered species
- Aquatic invertebrates
- Pollinator conservation & Ag biodiversity
- Pesticide program

Photos: Anne Averill; H. Ballard; Ed Ross

Xerces Society – Who we are

Xerces Pollinator Team

- Staff in CA, NC, NE, NJ, MA, MN, OR, VT, WA, WI
- Five joint Xerces / USDA-NRCS positions, ***including 2 in CA***

Pollinator Conservation Education

- Outreach to 75,000+ farm and agency professionals since 2008
- Training events in all 50 states, Europe, Asia, Latin America

Habitat Restoration

- Supporting 250,000+ acres of habitat created in the U.S. since 2008

Photos: Brianna Borders, Xerces Society; Jolie G. Dollar; Adam Varenhorst; Jen Knutson; Eric Lee-Mäder, Xerces Society; Kelly Gill, Xerces Society

What is Conservation Biological Control?

Photo: Jessa Kay Cruz

What is Conservation Biocontrol?

Biological Control:
Use of living organisms to provide pest control

Three Types of Biological Control:

- Classical/Introduced
- Augmentative
- **Conservation (CBC)**

Photo: Thelma Heidel-Baker

Common Beneficial Insect Groups: Introduction

Common Beneficial Insects

Comprised of many insect groups:
True bugs, beetles, flies, wasps, etc

- Insect Predators vs. Insect Parasitoids
  - Generalist vs. Specialists
- Non-insects

  Spiders, harvestmen, centipedes, mites, pseudoscorpions, nematodes, earthworms, soil microbes, entomopathogenic fungi
- Pollinators:

  Bees, flies, wasps, beetles, butterflies, moths

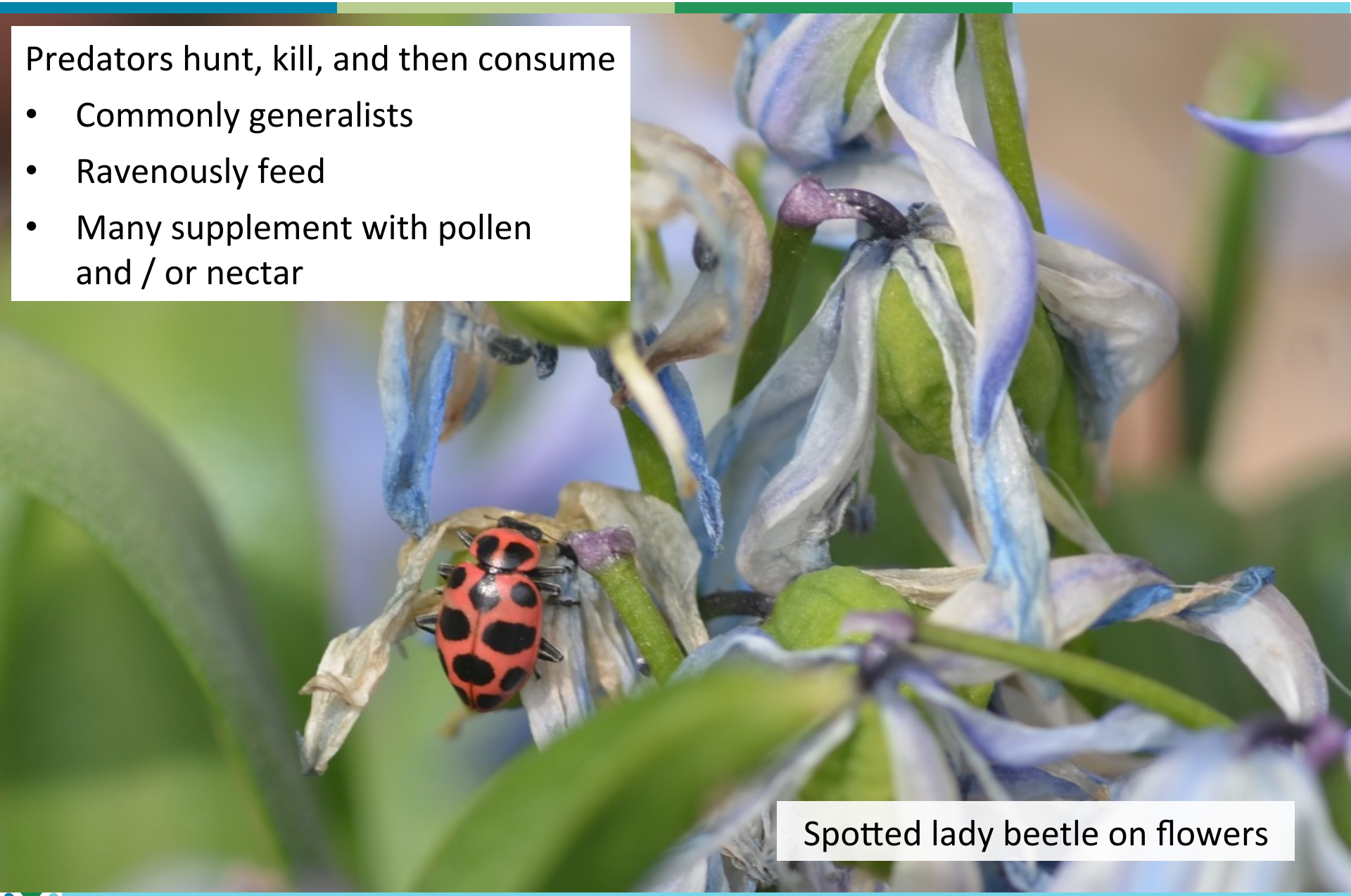
Lacewing larva consuming aphid

Photo credit: Alex Wild

Common Beneficial Insect Groups: Predators

Predators hunt, kill, and then consume

- Commonly generalists
- Ravenously feed
- Many supplement with pollen and / or nectar



Spotted lady beetle on flowers

Photo credit: Thelma Heidel-Baker

Common Beneficial Insect Groups: Parasitoids

Parasitoids

- Lay eggs on or in hosts or host eggs
- Larva feeds and eventually kills host
- Highly effective pest control
- Wasps and flies

Common Beneficial Insect Groups: Parasitoids

- Most parasitoids are specialists
- Adults are nectar-feeding

Tiny wasp parasitizing stink bug eggs

Photo credit: MJ Hatfield

Common Beneficial Insect Groups: Parasitoids

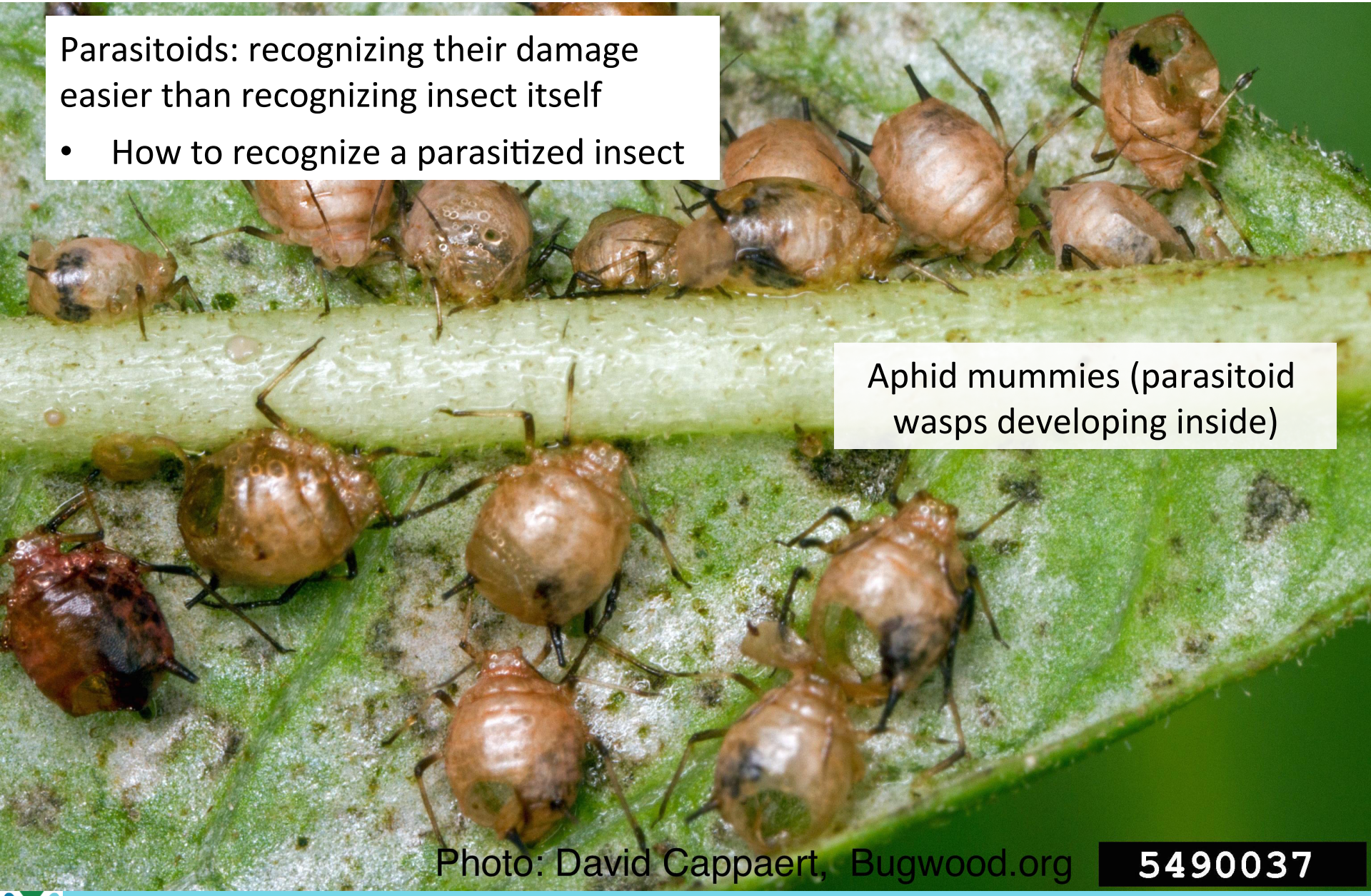


Photo credit: David Cappaert, Bugwood.org

Conservation Biocontrol and Habitat

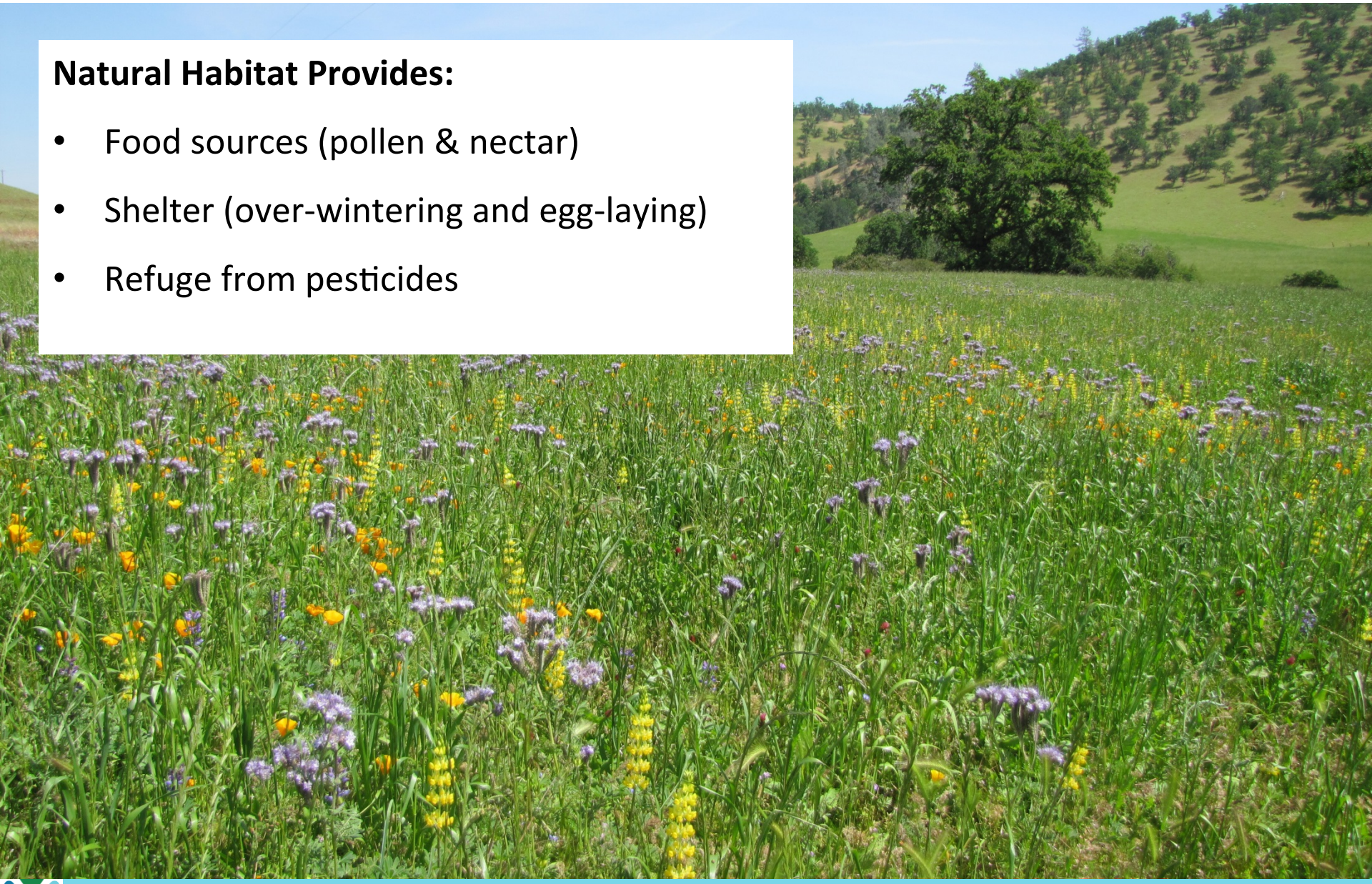
In conservation biological control, habitat is the key ingredient…

- Studies show direct link between habitat and beneficial insect abundance and diversity

Great golden digger wasp sipping wingstem nectar

Photo: Nancy Adamson

Conservation Biocontrol and Habitat



Natural Habitat Provides:

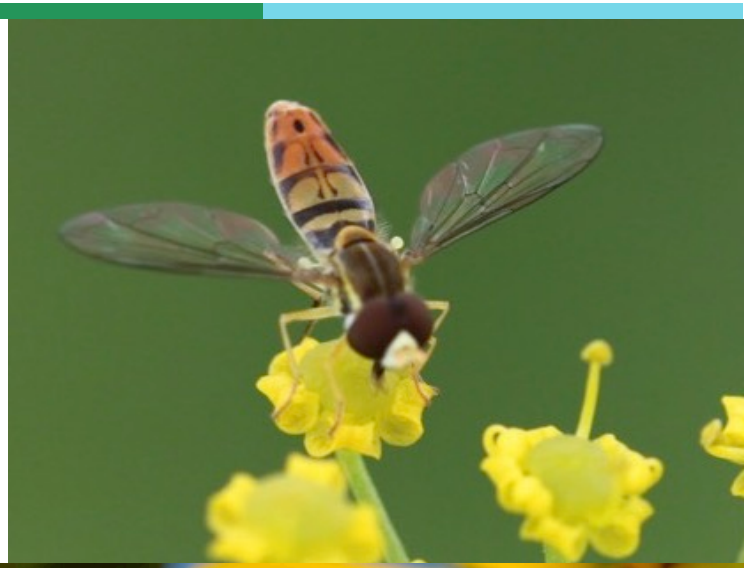
- Food sources (pollen & nectar)
- Shelter (over-wintering and egg-laying)
- Refuge from pesticides

Photo: Claudia Street

Conservation Biocontrol and Habitat

Habitat: Floral Resources

Many beneficial insects rely on pollen or nectar at specific periods of their life cycle, or can use these floral resources to supplement their diets when insect prey are not available



Lady beetle eating pollen

Predatory wasp and fly on cupplant flower

Photos: Adam Varenhorst, Thelma Heidel-Baker

Conservation Biocontrol and Habitat

Habitat: Shelter

Beneficial insects need over-wintering & egg-laying locations

- Brush piles, stone piles
- Pithy-stemmed plants
- Bunch grasses
- Undisturbed ground

Nesting Isodontia wasp (grasshopper hunter)

Photos: insecte.org; Alex Wild

Conservation Biocontrol and Habitat

Example: Hedgerows increase pest control in CA Tomato fields

- Study comparing stink bug parasitism in tomato fields adjacent to hedgerows to tomato fields without habitat.
- Parasitism rate 3x as high in fields adjacent to hedgerows

Scelionidae wasps parasitize stink bug eggs

Consperse stink bug

Morandin LA, Long RF, Kremen C Agric Ecosyst Environ, 2014

Photos: Jessa Kay Cruz, Lora Morandin, Russ Ottens, Jennifer Hopwood

Conservation Biocontrol and Habitat

Planning and Design

- Include permanent habitat
- Focus on native plants
- Abundant pollen and nectar
- Diversity for season-long bloom

Photo: Jessa Kay Cruz

Conservation Biocontrol and Habitat

Hedgerows:

- Shrubs and perennials
- Usually linear
- Farm roads and borders
- Protect from pesticides

Photo: Jessa Kay Cruz

Conservation Biocontrol and Habitat

Herbaceous Field Borders:

- Permanent sources of pollen, nectar and nesting habitat
- Perennial or re-seeding annual forbs
- Useful in areas too narrow for hedgerows
- Protect from pesticides

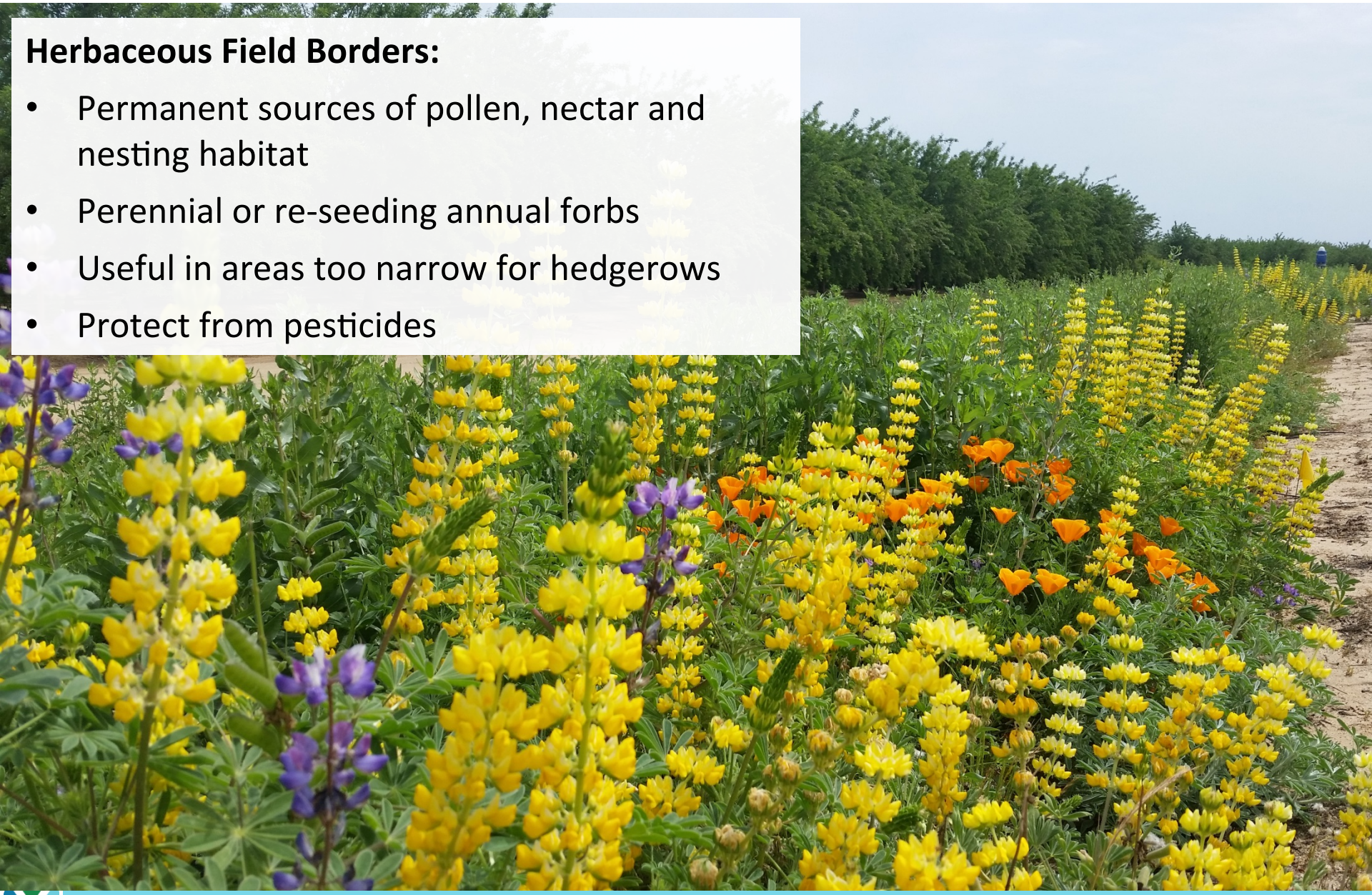


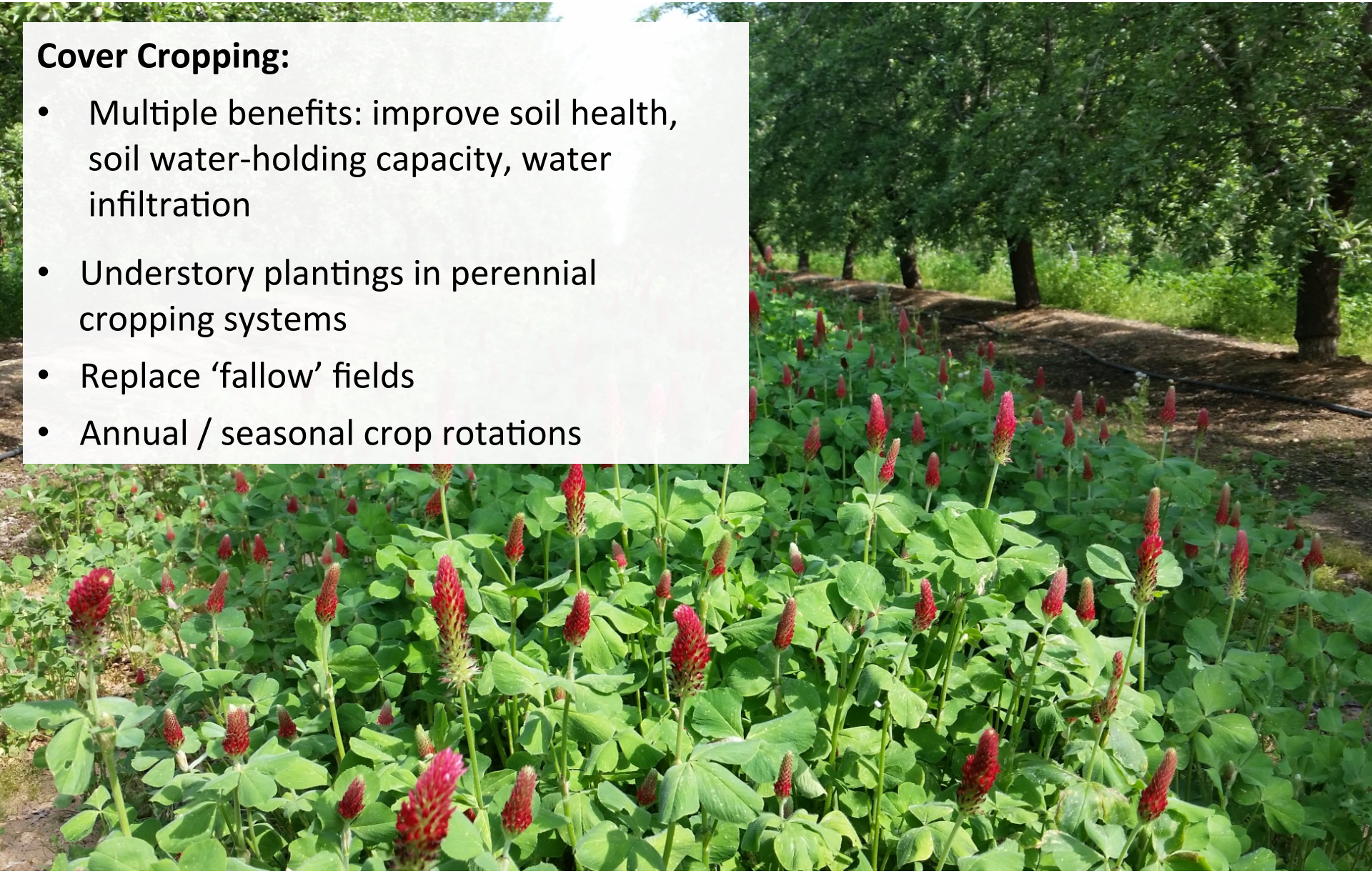
Photo: Jessa Kay Cruz

Conservation Biocontrol and Habitat

Insectary Strips:

- Between row crops
- Same dimensions as row crop beds
- Dispersed throughout field

Farm Planning: Cover Crops



Cover Cropping:

- Multiple benefits: improve soil health, soil water-holding capacity, water infiltration
- Understory plantings in perennial cropping systems
- Replace ‘fallow’ fields
- Annual / seasonal crop rotations

Photo: Jessa Kay Cruz

Farm Planning: Beetle Banks

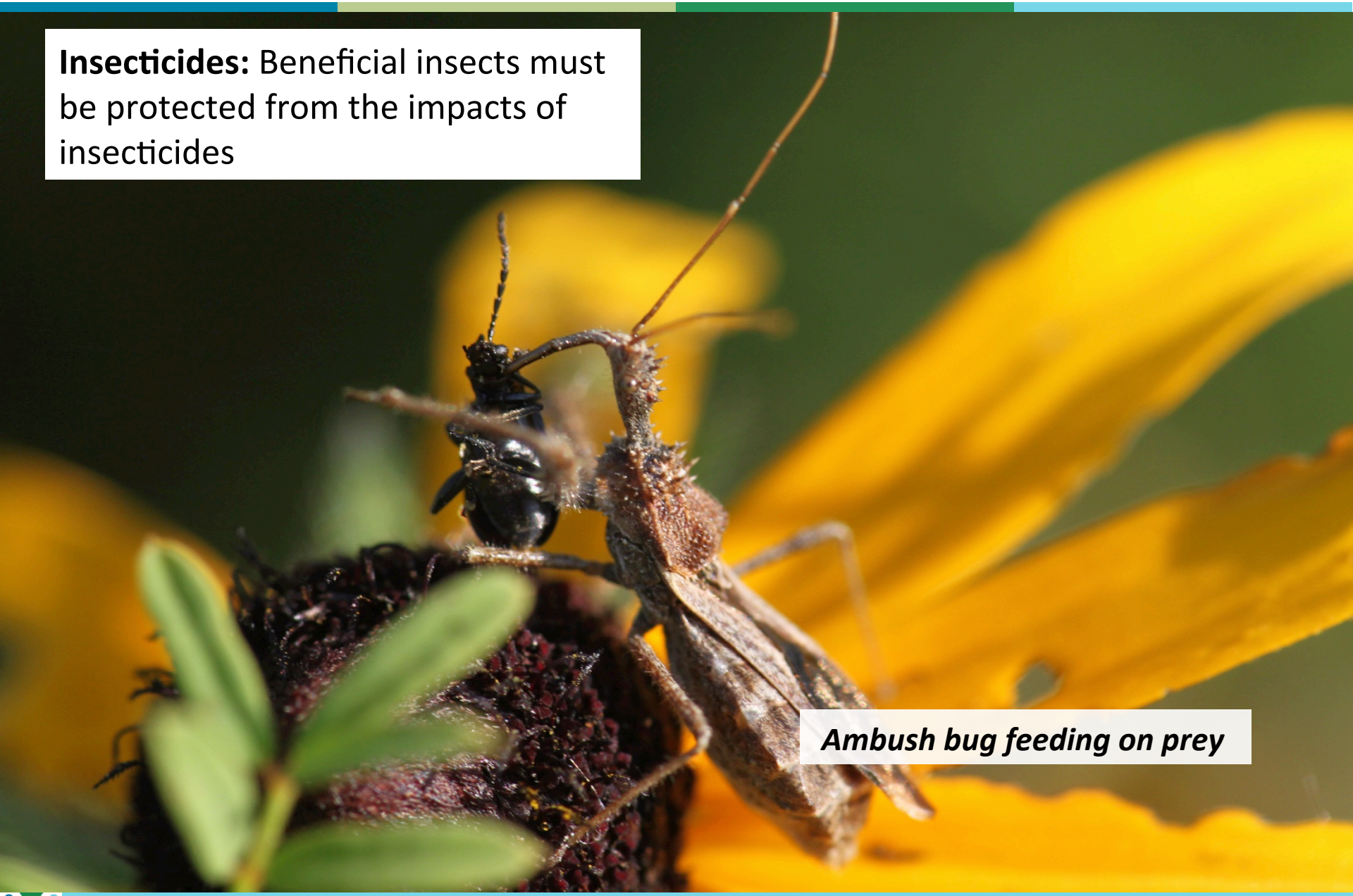
Beetle Banks:

- Raised bed of perennial bunch grasses
- Cover for predatory ground beetles

Photo: Gwendolyn Ellen, OSU

Conservation Biocontrol and Pesticides

Insecticides: Beneficial insects must be protected from the impacts of insecticides



Ambush bug feeding on prey

Photo: Adam Varenhorst

Conservation Biocontrol and Pesticides

Reducing Pesticide use through IPM

1. Reduce conditions that favor pest population growth
2. **Regularly monitor and scout for pest and beneficial insect populations**
3. Properly identify insects (both pests and beneficials)
4. **Determine thresholds to make treatment decisions**
5. Select appropriate management strategies when threshold is reached

Photo: Thelma Heidel-Baker

Conservation Biocontrol and Pesticides

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES

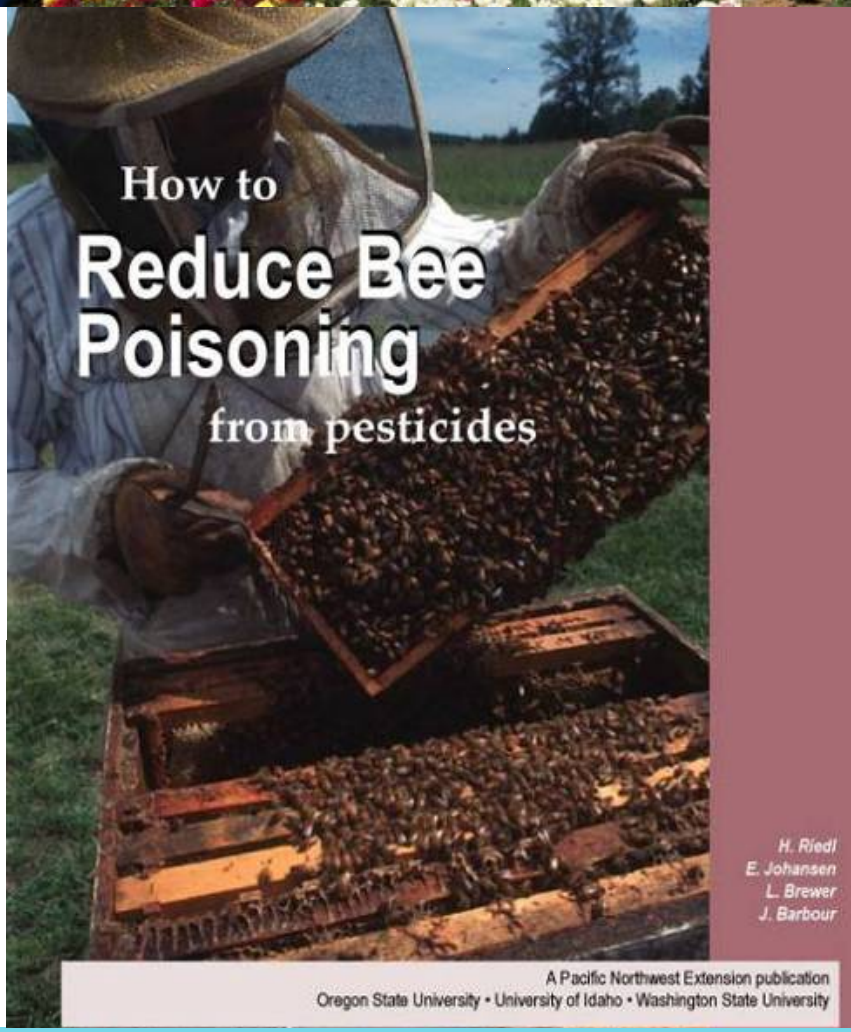
UC IPM Online

Statewide Integrated Pest Management Program

Insecticides can cause significant harm to beneficial insects

- Use most targeted / least toxic options
- Avoid broad spectrum and systemic insecticides

UC IPM Website: http://www.ipm.ucdavis.edu/mitigation/index.html OR http://www2.ipm.ucanr.edu/beeprecaution/



Conservation Biocontrol and Pesticides

Timing is everything:

- Don't spray on plants in bloom
  - Includes crops, cover crops and weeds
  - Mow before spraying
- Spray at night and when dry
  - Only for short RTs
  - Not effective for all beneficial insects

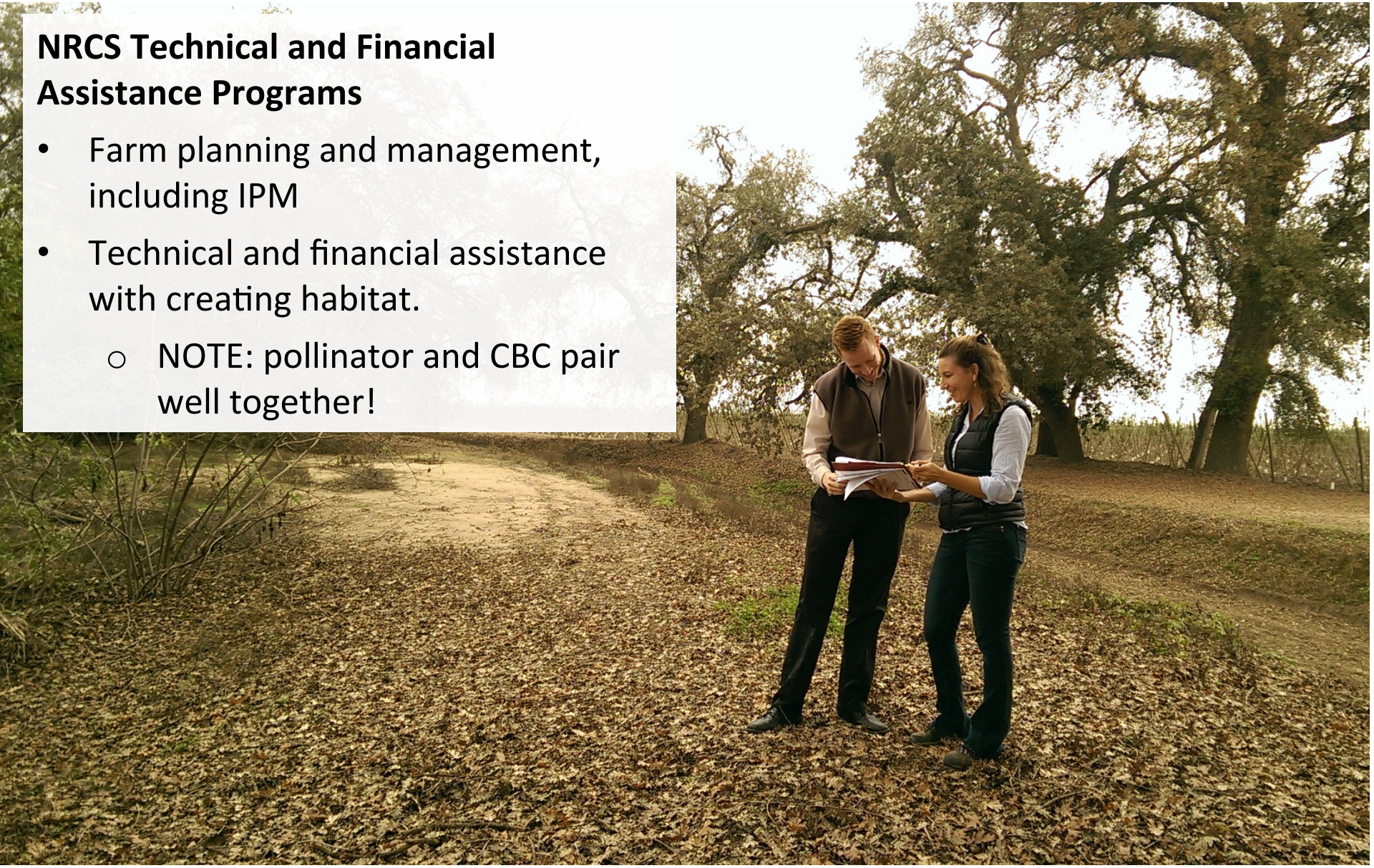
Conservation Biocontrol and Pesticides

Minimizing Drift: Protect Habitat Areas

- Establish buffers or setbacks
  - Unsprayed area (30’ – 60’)
- Improved technology
  - Nozzles and Sprayers

Photo: Jessa Kay Cruz

USDA / NRCS: Programs for Beneficial Insects



NRCS Technical and Financial Assistance Programs

- Farm planning and management, including IPM
- Technical and financial assistance with creating habitat.
  - NOTE: pollinator and CBC pair well together!

Resources: Xerces Society Publications

Final Thoughts

Final Thoughts

As the single largest land use on Earth, farming is critical to the future of biodiversity...

Photo: Matthew Shepherd

Final Thoughts

…And biodiversity is critical to the future of farming.

Photo: Sarah Foltz Jordan

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Photo: Sarah Foltz Jordan