Photos by Celeste Ets-Hokin

Reversing threats to native pollinator communities and services

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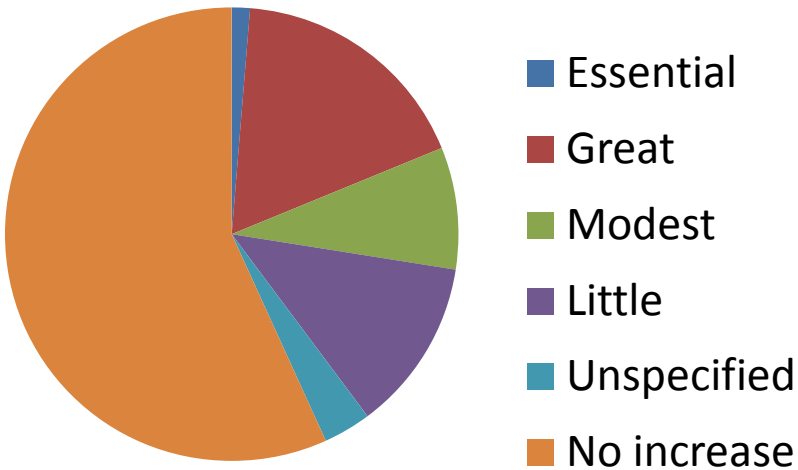
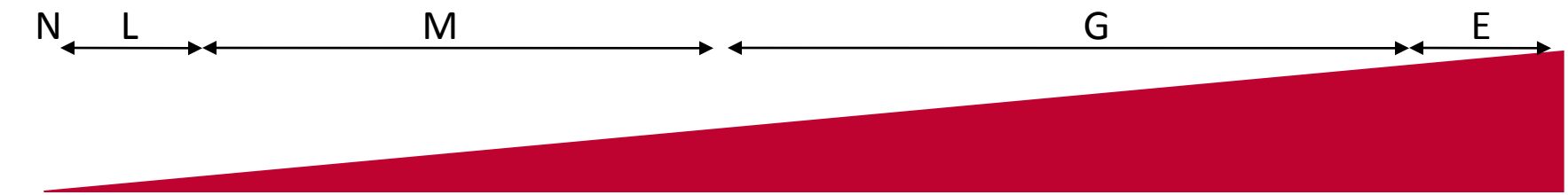
CA crops: dependency on pollinators



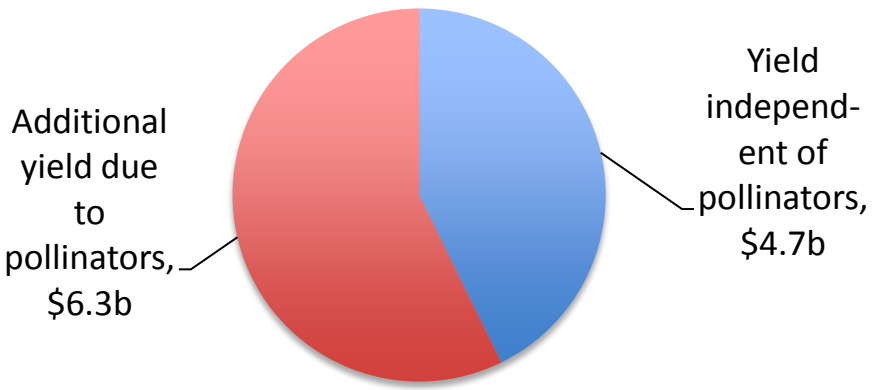
California crops, $29 billion;
Pollinator-dependent crops, $11 billion



Chaplin-Kramer, Tuxen-Bettman & Kremen 2011

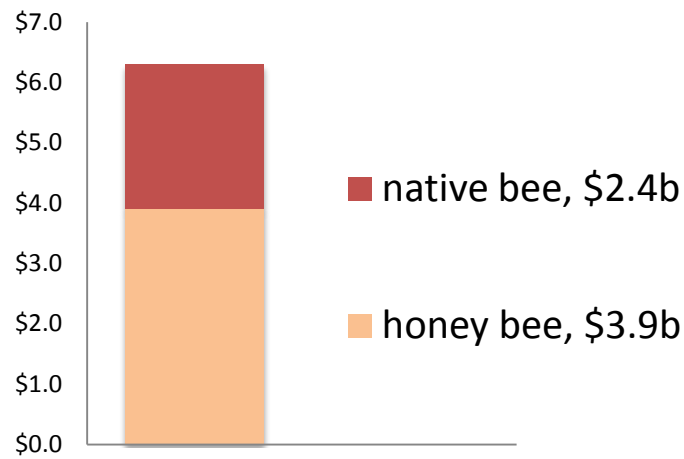
Value of pollination services

Pollinator-dependent crops, $11b



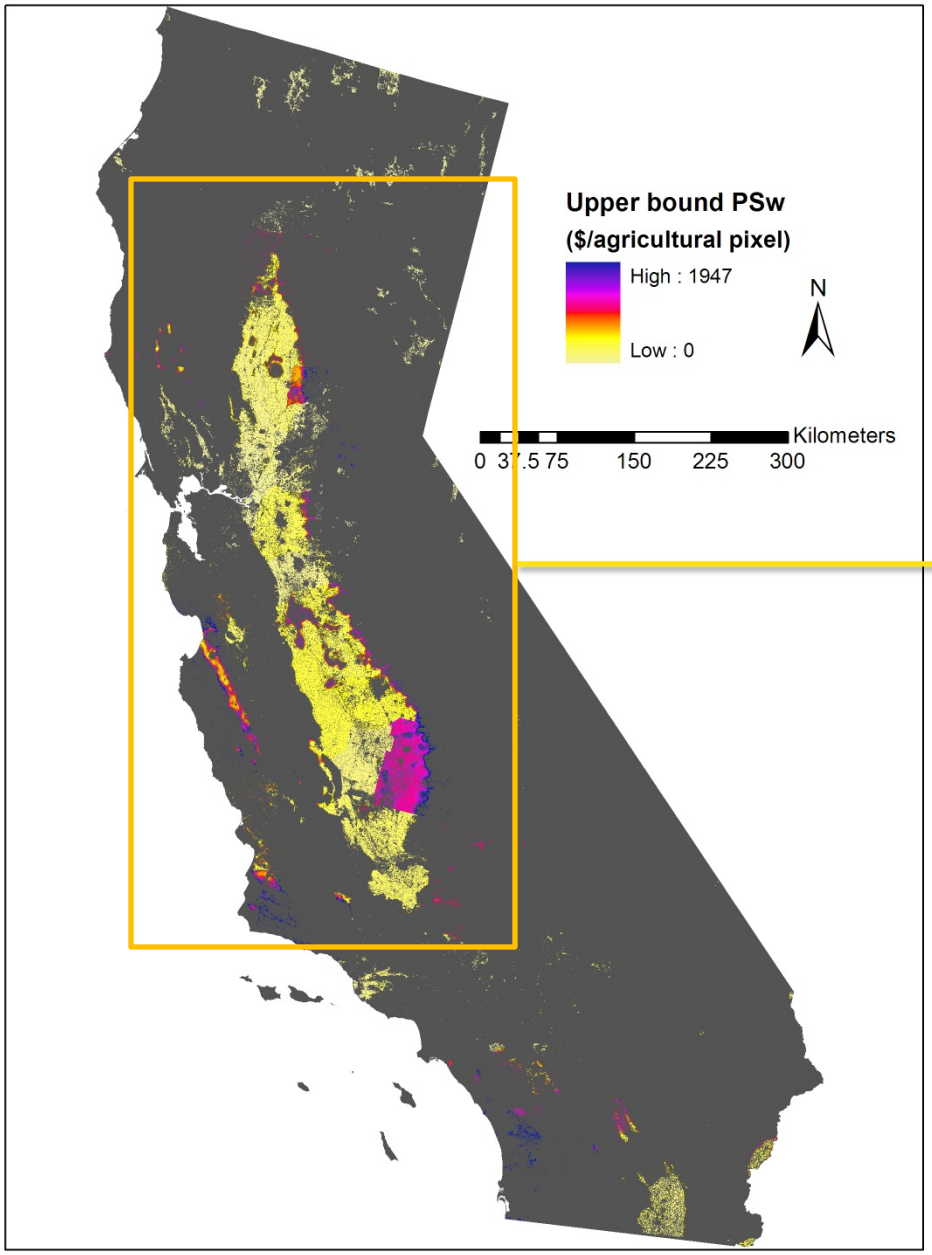
Upper range estimates

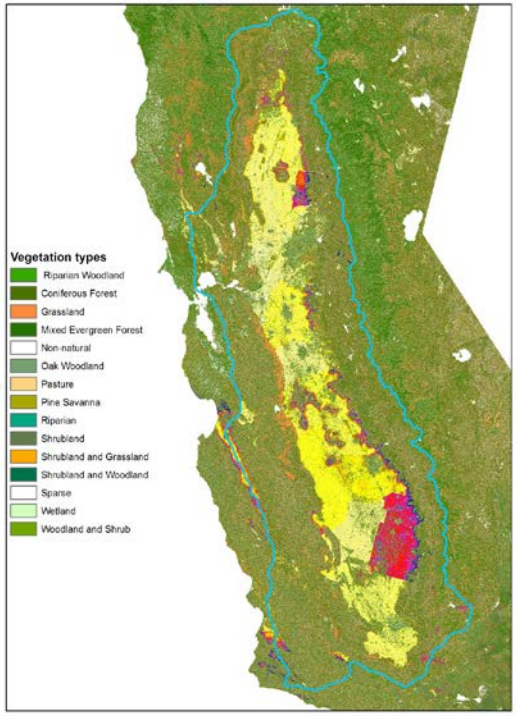
Pollination Service Values, $6.3b



Chaplin-Kramer, Tuxen-Bettman & Kremen 2011

California blessed with remaining natural areas near crops…..



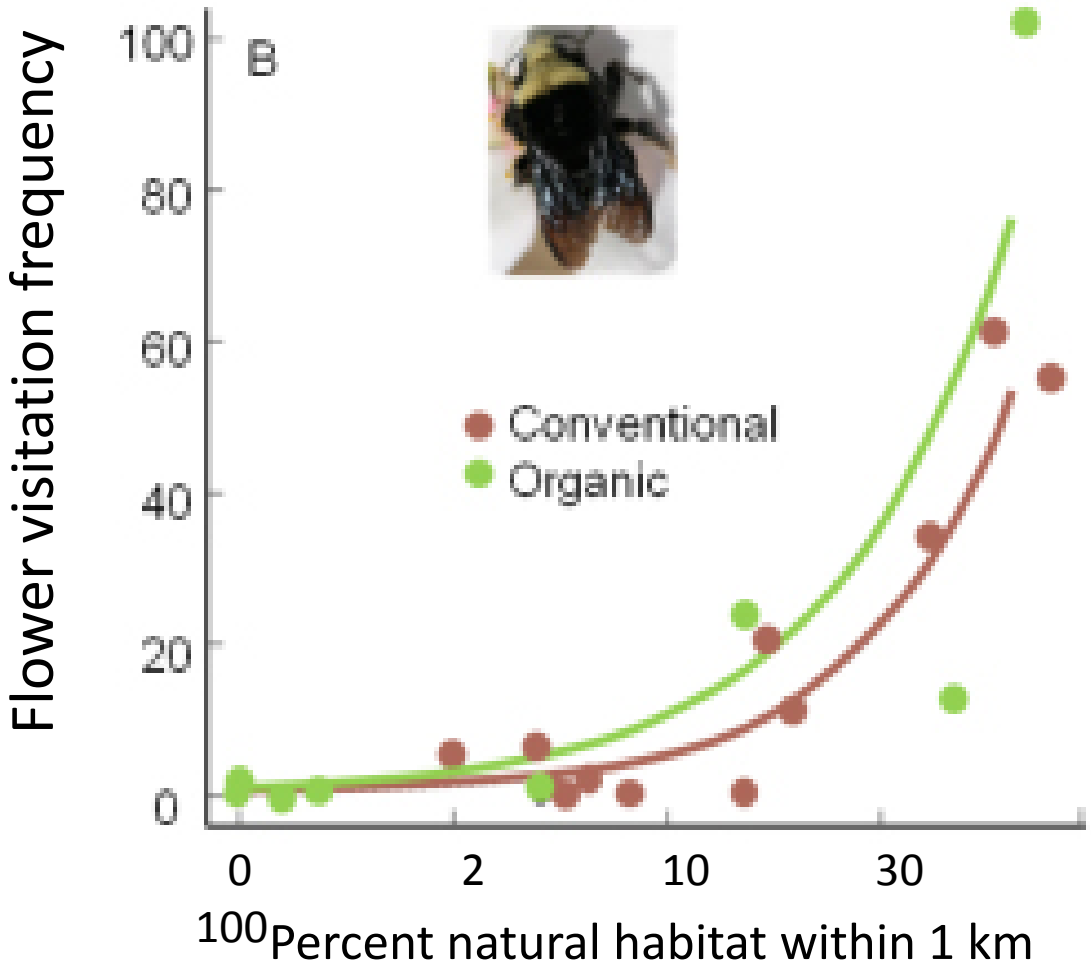


…..Including pollinator-dependent crops →→ native bee importance

Upper range estimate

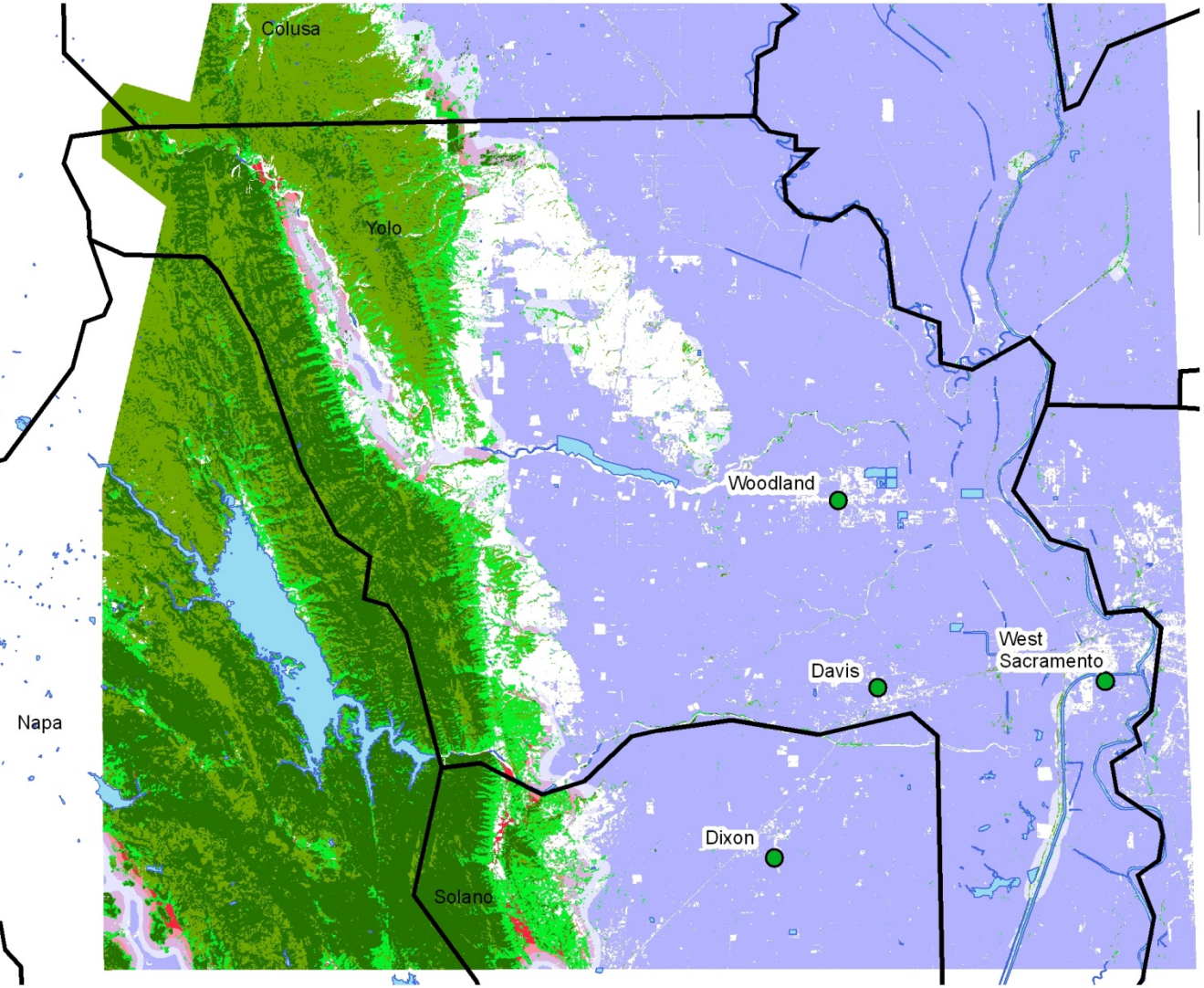
Photos courtesy of Rollin Colville

Pollinators don’t occur uniformly



Klein et al. 2012

Native Pollinator Contributions in Yolo County, CA

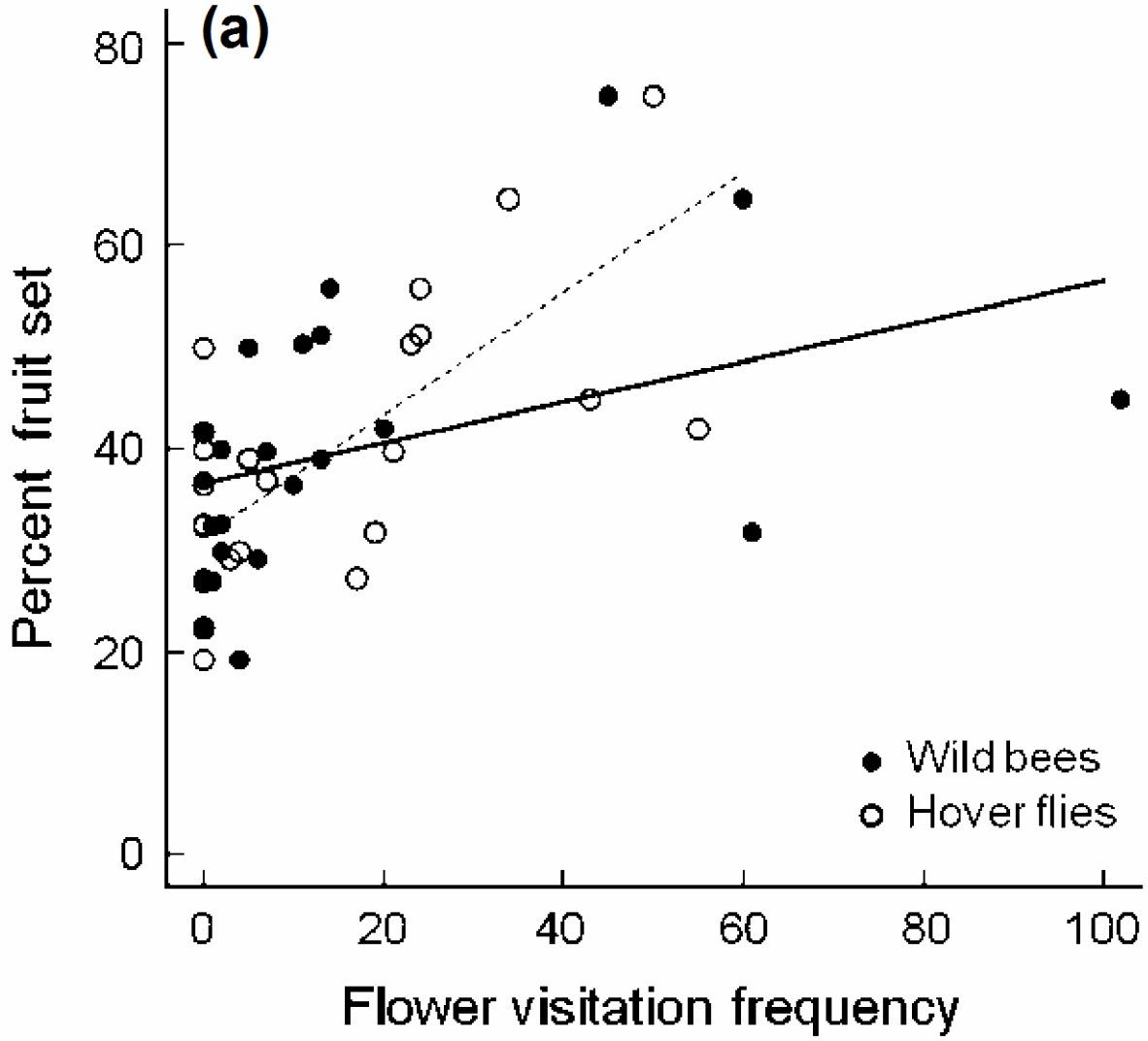


- Cities
- County Boundaries
- Water Bodies
- 100% Pollination
- 60-100% Pollination
- 30-60% Pollination
- 20-30% Pollination
- 10-30% Pollination
- Chaparral
- Mixed Oak
- Oak

N
W E
S

3 6 12 18 24
Kilometers

Benefits from wild pollinators



Klein et al. 2012

What causes this decline in native pollinators with agriculture?

- Habitat loss
- Pesticides
- Interaction with honey bees – diseases, competition for resources

What causes this decline in native pollinators with agriculture?

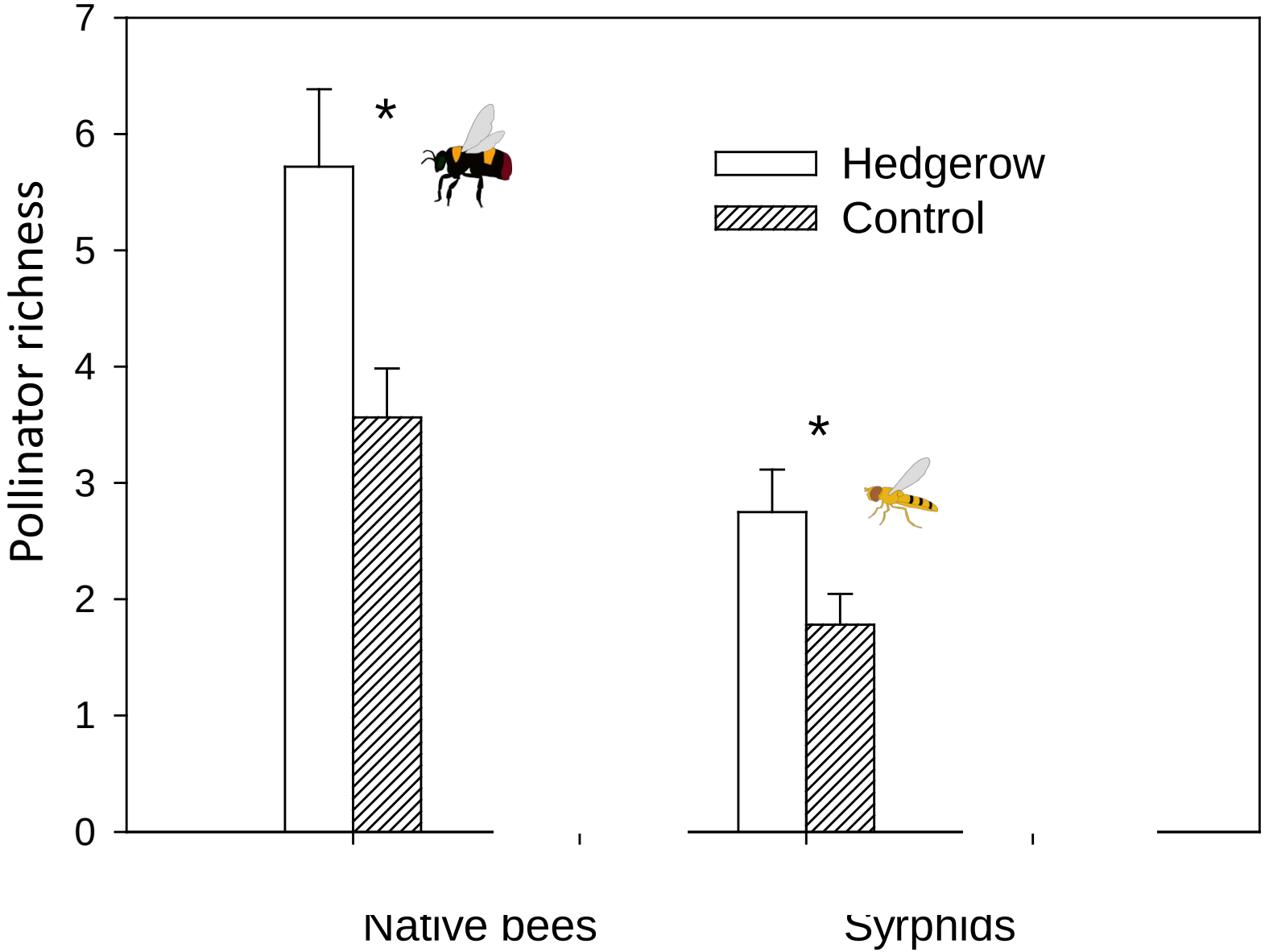
- **Habitat loss**
- Pesticides
  - Difficult to assess impacts in field conditions, sub-lethal effects of neo-nics (Goulson 2013 JAE)
  - Neonicotinoid bumble bee kill in Oregon, 2013
- Interaction with honey bees – diseases, competition for resources
  - Emerging evidence for honey bee – bumble bee disease transmission in UK (Furst et al. 2014 Nature)

How can we bring back native bees?

Diversified Farming Systems

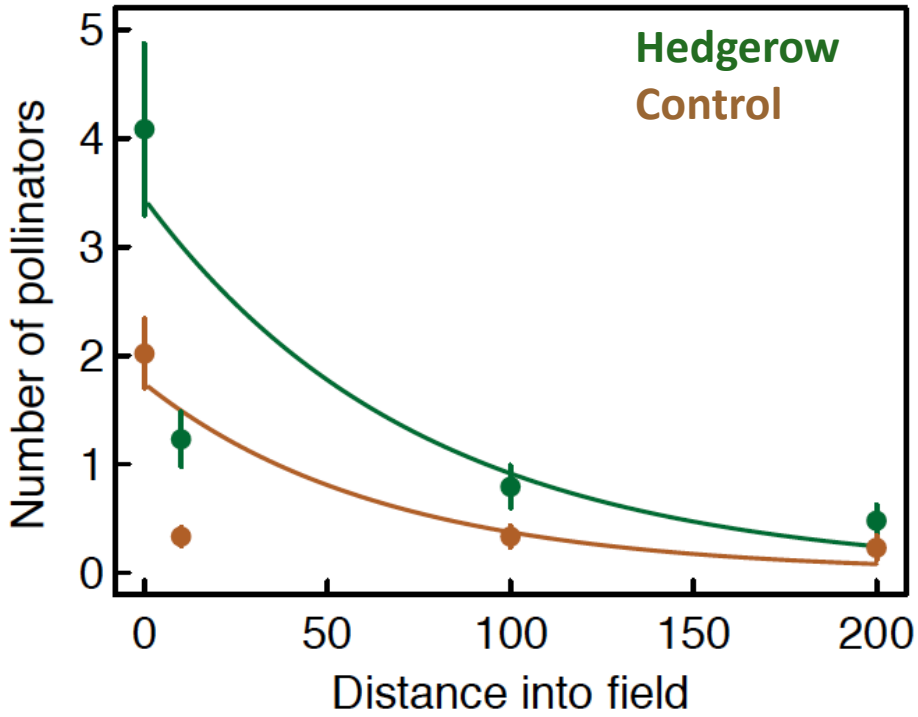
Native plant hedgerow

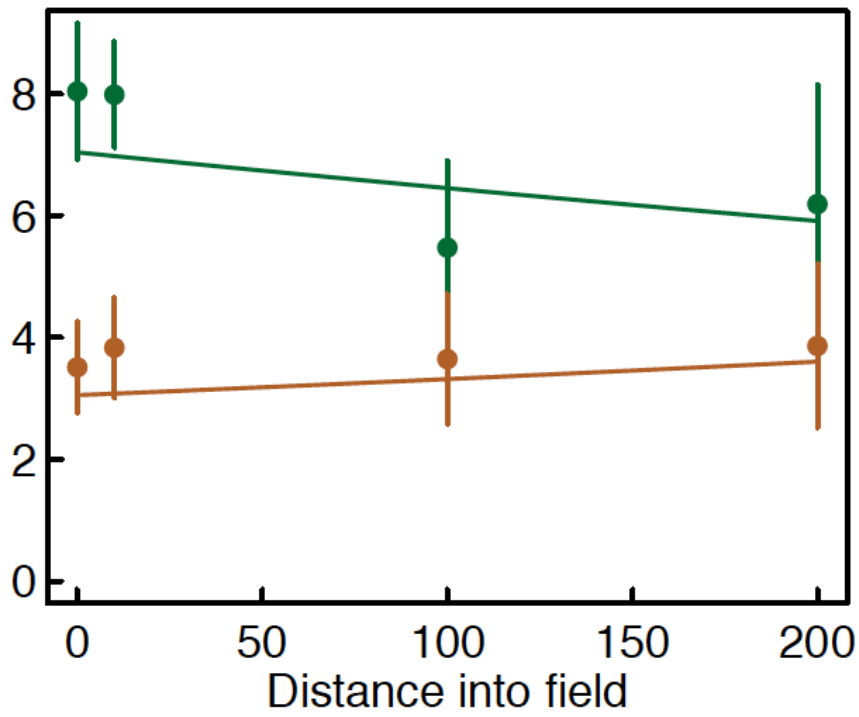
Effects on species richness



Morandin and Kremen, Ecol. App, 2013

Abundance: adjacent fields

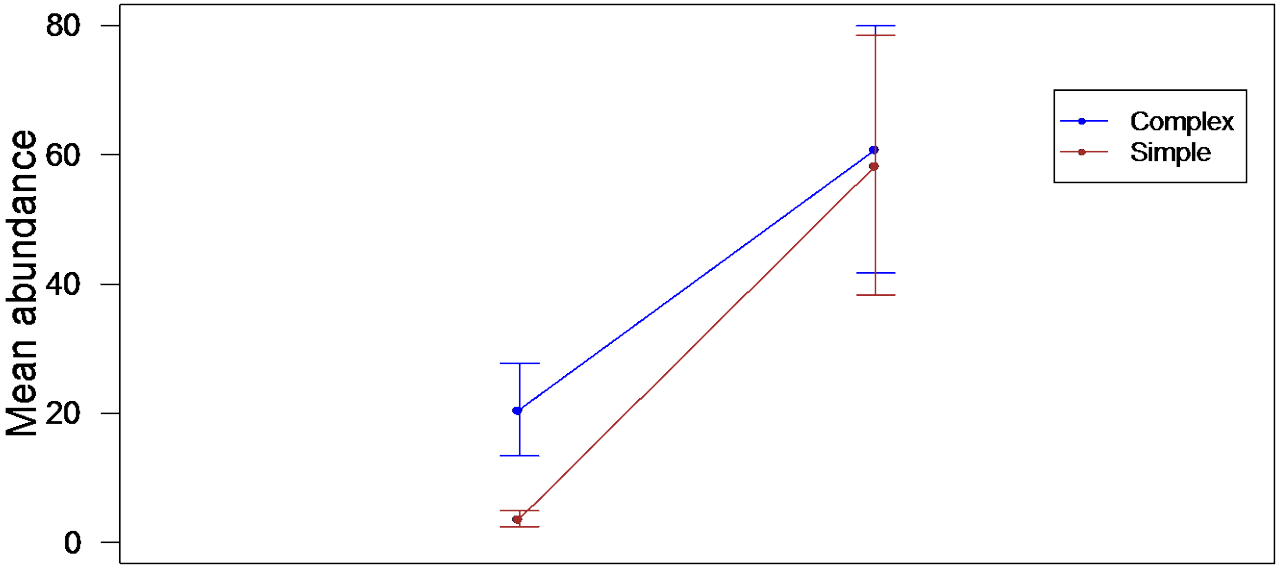




HR >> C up to 100 m

HR >> C to 200 m

Morandin and Kremen 2013 Ecol. App.; Morandin et al. in prep.



Field Diversity: ***
Landscape complexity:***
Interaction: *

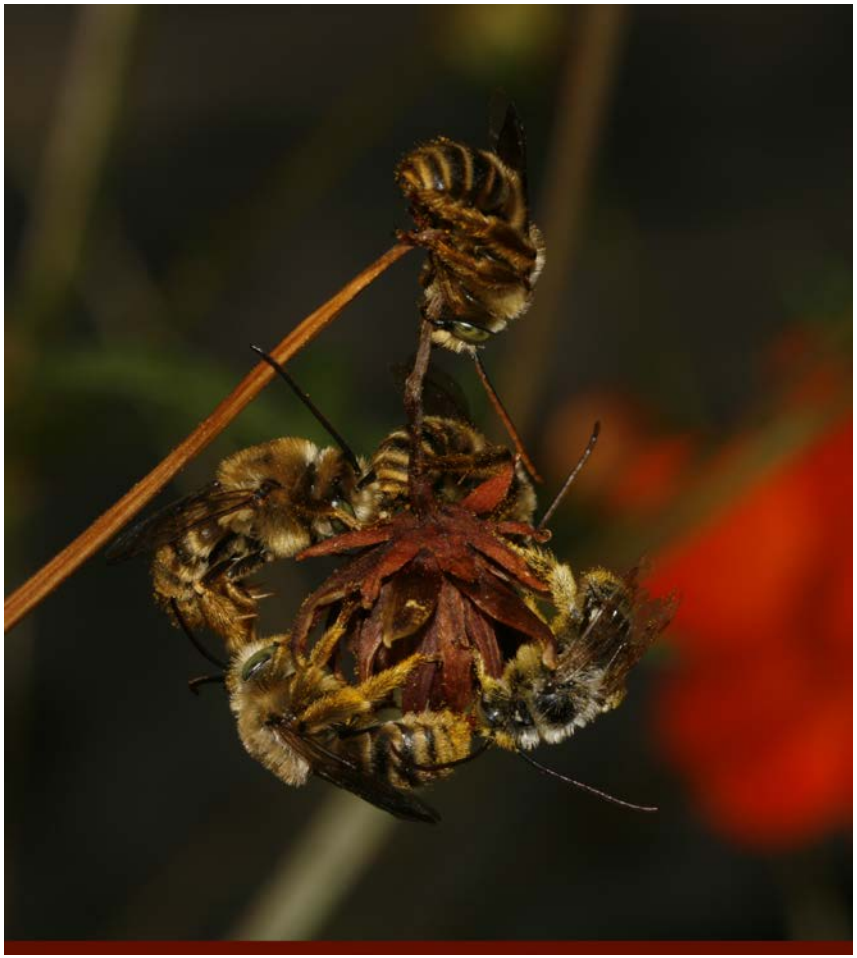
Sciligo, M'Gonigle and Kremen, in prep.

Conclusions: Native Pollinators

- Important: supply about 40% of pollination services in California
  - But largely limited to farms near natural habitat
  - Provide insurance against honey bee loss
- Threatened by habitat loss, pesticides, possibly honey bee diseases
- Habitat can be improved through farm management practices: hedgerows, insectary strips, smaller block plantings of different crops

Thanks

- Collaborators
  - Becky Chaplin-Kramer
  - Alexandra Klein
  - Lora Morandin
  - Amber Sciligo
  - Robbin Thorp, bee ID
  - Martin Hauser, fly ID
- Many student assistants and landowners
- *Funding*: NSF, NRCS-CIG, ARO, CS-Fund, Humboldt Foundation, Hellman Foundation, URAP, SPUR, BSP



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