

NPI Brown Bag Seminar Series

Farming for Native Bees:

**Seeking a Solution to
the Honey Bee Crisis**

Ingrid Feng, BS

Project Policy Analyst, National Growth and Health Study

University of California, Berkeley

Tuesday, June 26th, 2018

<http://npi.ucanr.edu> • Twitter @UCNPI



University of California
Agriculture and Natural Resources

Nutrition Policy Institute

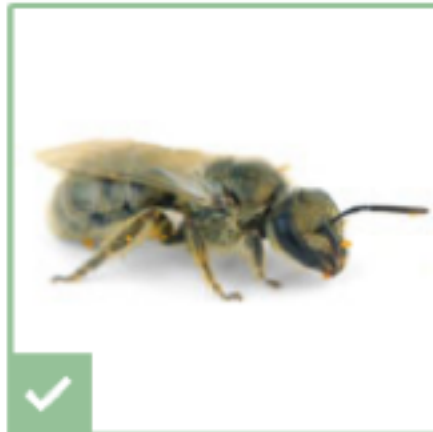
Farming for Native Bees: Urban to Ag

By: Ingrid Feng, Gordon Frankie, Marissa Chase
University of California Berkeley Urban Bee Lab

Outline

- General characteristics of native bees
- Early bee-flower work at UCB Oxford Tract
- Statewide survey of bee-flower relationships in urban California gardens: use and implications
- Transition to agricultural systems in Brentwood (Contra Costa Co.)







Native Bee Diversity

- ~ 4,000 bee species native to North America
- ~1,600 bee species recorded in California
- 6,000+ flowering plant species (angiosperms) in California



Centris rhodopus



Ceratina spp.

Native bees have evolved with native flowering plants in California and worldwide



Importance of Bee Pollination

- In the U.S. and Canada, about 100 crops are pollinated by bees
- Food from bee pollinated crops comprise ~30% of our daily diet
- Some crops require bee pollinators: alfalfa, avocado, almond, apple, berries, cantaloupe, kiwi, plum, squash, sunflower, watermelon,
- Economic value of honey bees= \$20 billion/year in the U.S.
- Economic value of native bees = \$3.07 billion/year

What is so special about Native Bees?

Native Bee Biology, Behavior & Ecology



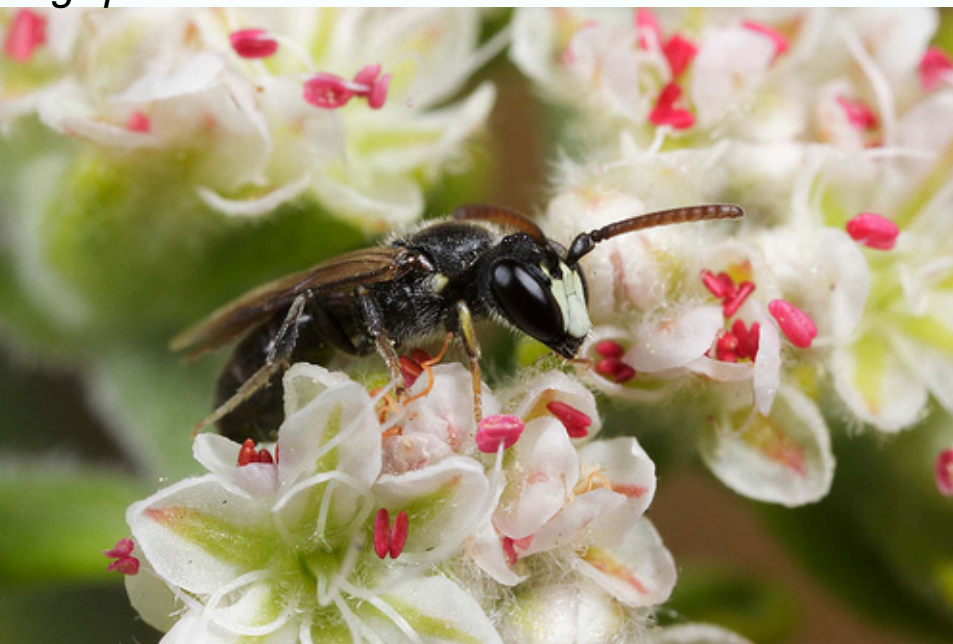
- Much variation among bee species
- **Each bee species has its own story**
- Fertile ground for research and outreach



Agapostemon texanus



Melissodes sp.



Hylaeus sp.



Megachile sp.



Xylocopa varipuncta



Trachusa bequarti



Halictus sp.



Andrena nigrocaerulea

Native Bee Ecology

- Most native bees are solitary nesters
- ~ 70% of bees nest in the ground; 30% in pre-existing cavities
- Nesting implications for habitat gardening



Pre-existing Cavity Nesters:

Leaf cutters in wooden trap nests



Native Bee Ecology

- Three things bees need: pollen, nectar, and mating
- Only females sting!
- Three types of pollen collection, depending on bee group



Xylocopa varipuncta male

Decline in native and honey bees

- Causes of decline include:
 - pesticides (esp. neonics)
 - habitat destruction and fragmentation
 - global climate change
 - drought and other extreme weather events



Female *Centris* sp.,
Calif. Palm Desert

Early Urban Bee Work: UCB Oxford Tract

- Urban areas can serve as habitat for native and honey bees
- Research by our lab has found
 - 88 bee species in Berkeley
 - ~60 bee species in Oxford Tract



Oxford Tract Garden 2005

Oxford Tract Evaluation Garden

- **Goal 1:** Evaluate basic **bee-flower relationships**
- **Goal 2:** Evaluate optimal **plant mgt** methods for vigorous flowering
- **Goal 3:** Use evaluations for **habitat gardens** statewide



Oxford Tract July 2003



Oxford Tract 2008

Oxford Tract Evaluation Garden

Major Findings

- Certain plant families highly attractive to bees
 - Asteraceae, Lamiaceae, Boraginaceae (Hydrophyllaceae)
 - Polygonaceae, Rosaceae



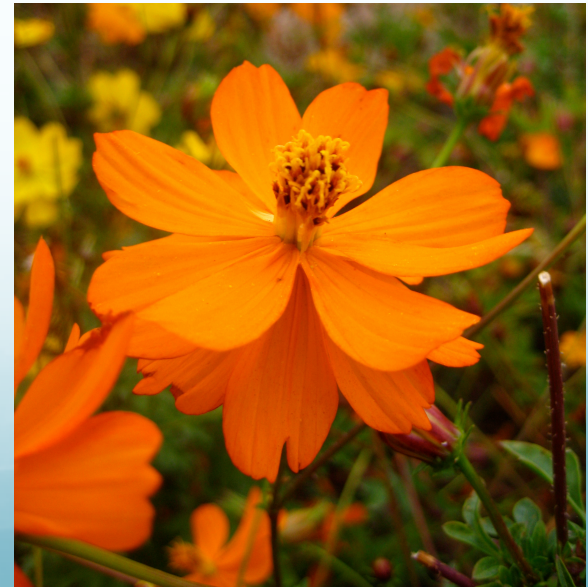
Osmia sp. on *Phacelia campanularia*



Anthophora urbana on *Phacelia campanularia*

Oxford Tract Major Findings

- Native bees foraged at **native plants** more often than non-native plant species
- BUT, non-native plants also important for native bees
 - For example: *Cosmos* spp.
 - *Salvia* spp.
 - *Lavandula* spp.
 - *Nepeta* spp.
 - *Vitex agnus-castus*



Statewide Survey

- 15 cities surveyed
- ~50 gardens throughout the state
- Variety of garden types: schools, botanical gardens, residential, and a cemetery



Ukiah



Sacramento



San Luis Obispo



Major Bee-Flower Findings

- **Aerial collections (by net) of bees on flowers:**
 - Current bee species count: 400+ bee species
 - Current host plant types: 500+ plant types
- Bee species, location, date, and plant host info added to Access database
- Relatively high bee species diversity in most cities

Bee Species from 5 Surveyed Cities

Location	Families	Genera	Species
Ukiah	5	28	95
Sacramento	5	23	82
Berkeley	5	25	88
San Luis Obispo	5	32	99
La Cañada Flintridge (near Pasadena)	5	34	112

Frequency Counts

- Bee visitation counts on selected plant species statewide
- Visitation counts on indiv. flower type for 3 minute intervals



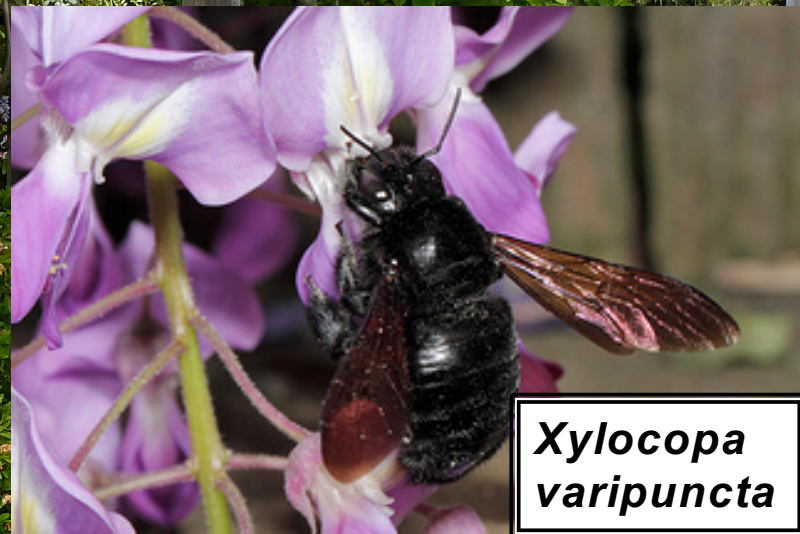
Bee-Flower Relationships



Bombus vosnesenskii



Halictus farinosus



*Xylocopa
varipuncta*

Phacelia tanacetifolia
attracts 60+ bee spp.



Transition to Agricultural: Brentwood

- Invitation* in 2009: To bring urban bee-plant knowledge to Frog Hollow farm to:
 - Construct habitat in orchards to attract native bees to **supplement** honey bee pollination
 - **Monitor populations** of native bees through time
 - **Outreach** to farmers, agr. professionals, USDA-NRCS, UCCE, Brentwood Agr. Land Trust, schools, and CNPS



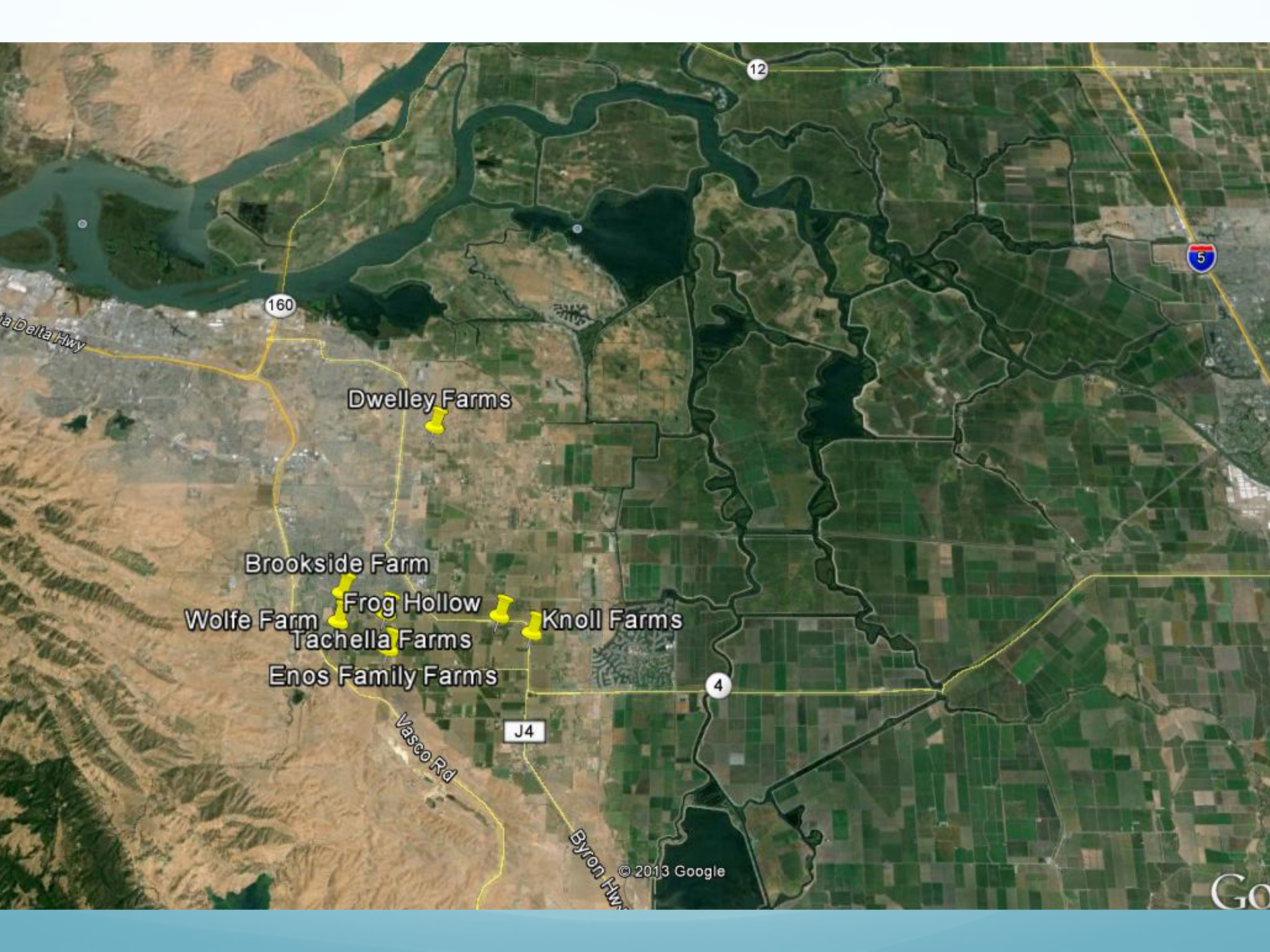
* USDA-NRCS and Farmer Al Courchesne of Frog Hollow





Brentwood Farms

- By 2012 project participants grew to 8 farms (organic and conventional) for comparisons
- 4 control farms with no plants added
- 4 treatment farms with added plants



Dwelley Farms

Brookside Farm

Wolfe Farm

Frog Hollow

Tachella Farms

Enos Family Farms

Knoll Farms

J4

© 2013 Google

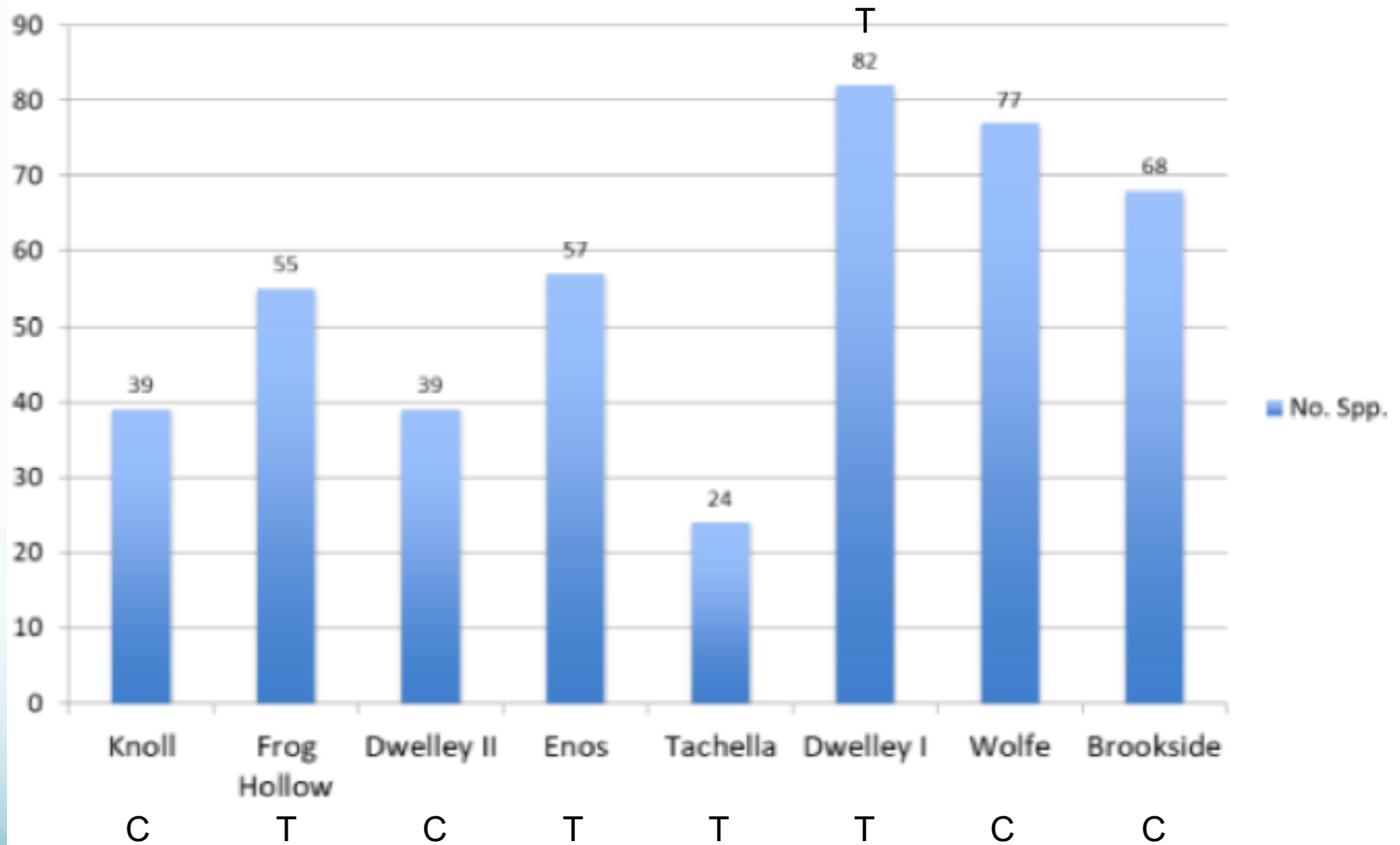




Dwelley Farm



Figure 2. Total No. Spp. at Brentwood Farms (2010-2016)



Where do the bees come
from?

East Contra Costa Hills







Brentwood Farm Results: Bees

- Numerous bee plants (**80 types**) added in 2010-2017 attracted **146 species** of bees
- Main bee groups moving between bee plants and crop flowers
 - 2 species of *Bombus* (Bumble bees)
 - 2 species of *Ceratina* (Small carpenter bees)
 - >4 halictid species (Sweat bees)
 - *Andrena* species (Mining bees)
 - Apids (*Anthophora* and *Habropoda*) species (Digger bees)



Additional Results

- New information on managing bee plants in Ag systems
- Bee plants also provide pollen and nectar for resident honey bees
- Interfacing **bee ecology** info with **farming ecology**
- **Partnering** with farmers to share and exchange knowledge





New bee condo work

Conclusions

1. **Can attract** diverse native bees to constructed habitats in urban and Ag areas.
2. **Can synchronize** flowering of crop plants with flowering of bee plants.
3. **Can attract** native bees to crop flowers.
4. **Can encourage target native bee species** with floral and nesting resources

Conclusions cont.

5. New **partnerships** with farmers can guide implementation. **Pollinator Habitat Advisor (PHA)**
6. Analysis of **business/economics** of implementation of ecological data
7. Challenges and opportunities: farmer adoption methods, extreme environmental factors
8. Implications for public health?

Burkle, L.A., Depphia, C. M., O'Neill, K. M. and Gibson, D. (2017), A dual role for farmlands: food security and pollinator conservation. J Ecol, 105: 890-899.
doi:10.1111/1365-2745.12784

THANK YOU!

Questions?



<http://helpabee.org>