Promoting Native Bee Pollinators in Organic Farming Systems

David Crowder and Elias H Bloom
Washington State University

March 10, 2015

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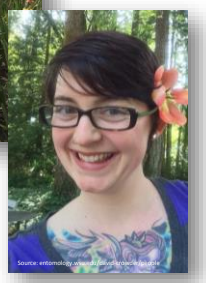
The Team

Bob Redmond:
Co-PI
Community Partner

Doug Collins
Co-PI
WSU Small Farms Team

Eli Bloom



Rachel Olsson

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David Crowder,
Renowned
Christian Rocker

Dr. David Crowder,
Lowly WSU Ecologist

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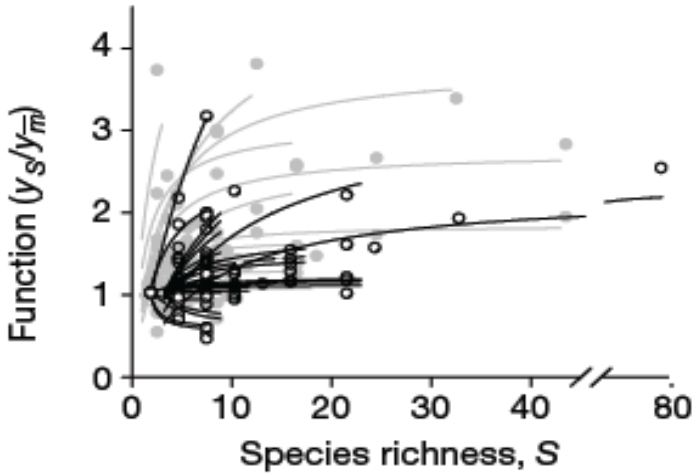
Diversity improves ecosystem function

- Data on pollinators is sparse



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Cardinale et al. 2006

What is a bee community?

Are honey bees
a bee community?

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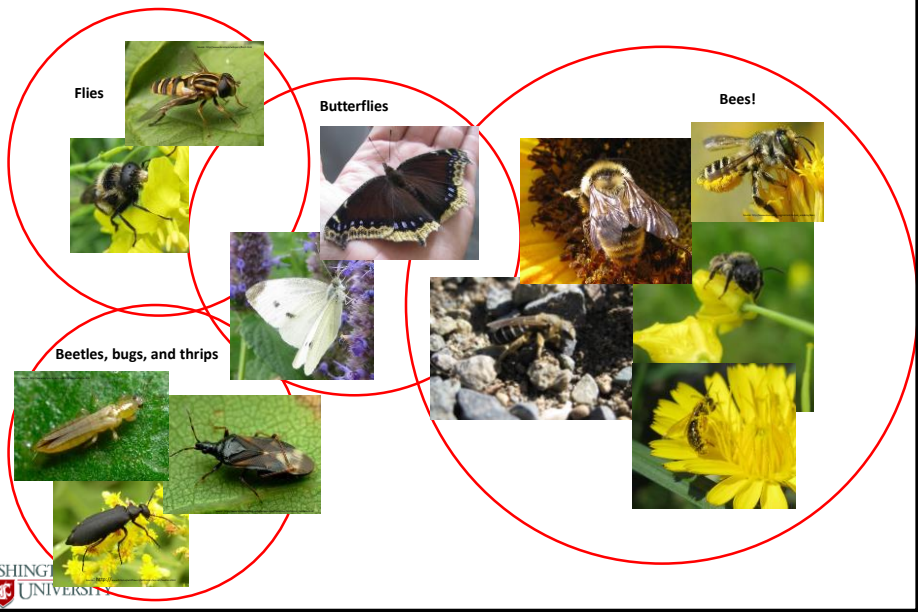
Insect Pollinators are Diverse



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We the people on pollinators…

- Created a federal pollinator task force
- Devise strategies to improve pollinator health

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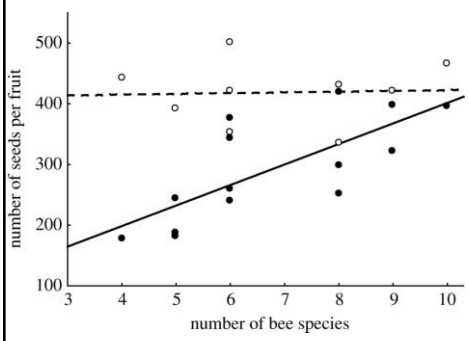
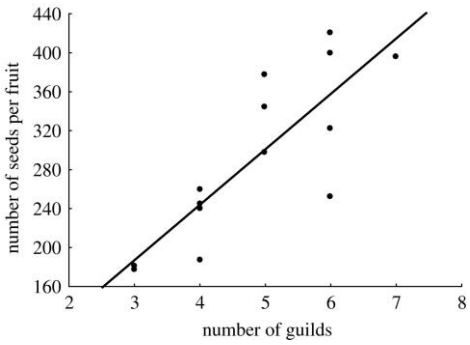
Pollinator Diversity Matters





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Hoehn et al. 2008

Experimental Tests

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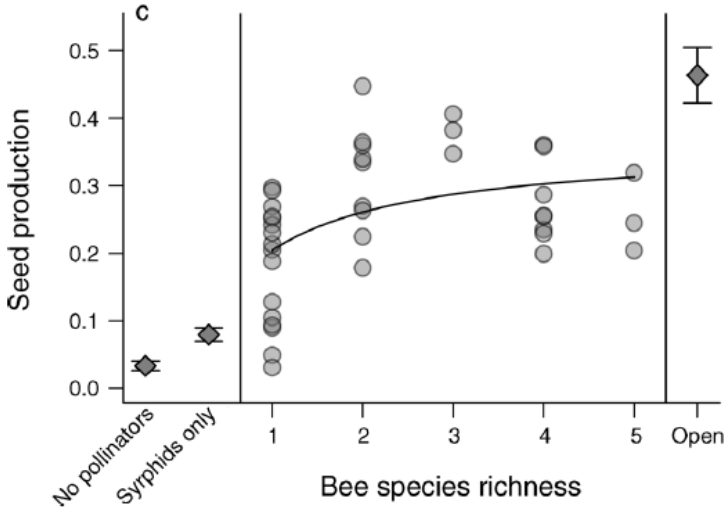
Frund et al. 2013

Experimental Tests



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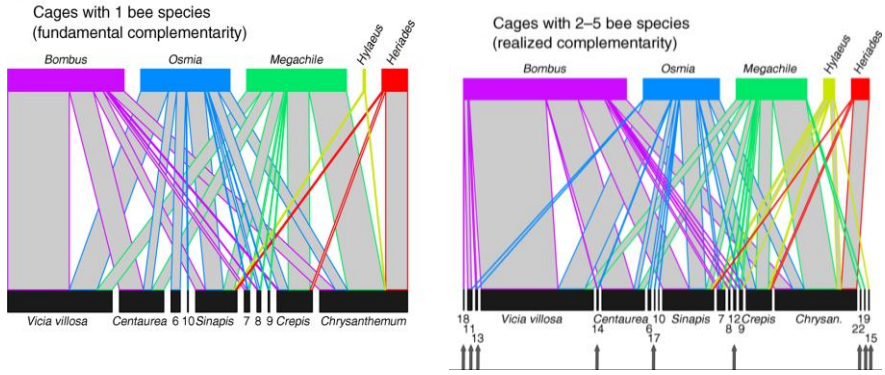
Frund et al. 2013

Networks also impacted?



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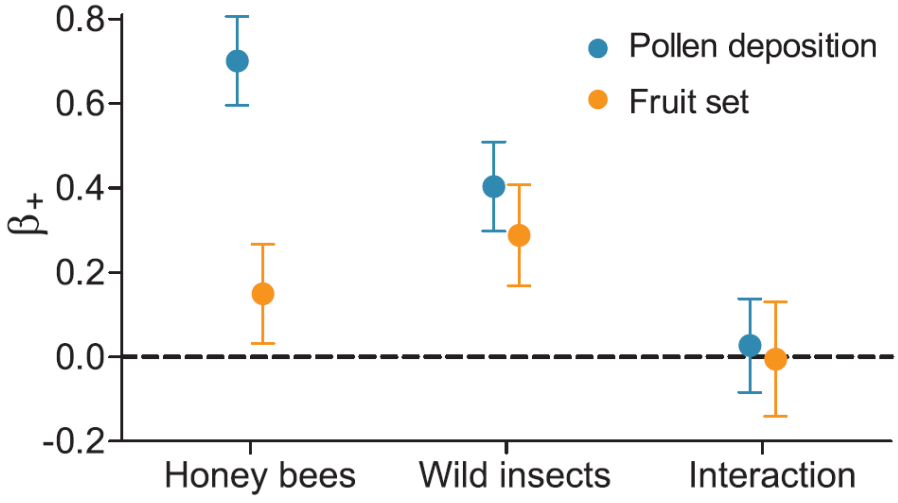
Fründ et al. 2012

Pollinator communities may provide greater services than honey bees alone



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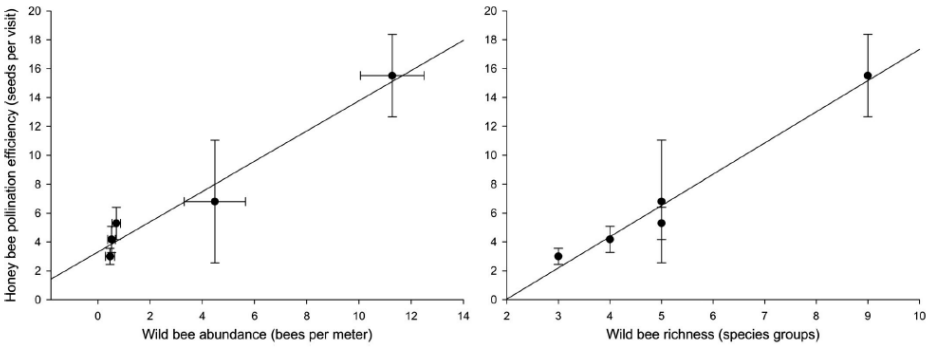
Garibaldi et al. 2013

Wild bees may impact honey bees



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Greenleaf & Kremen 2006

Wild bees may pollinate some crops more effectively than honey bees

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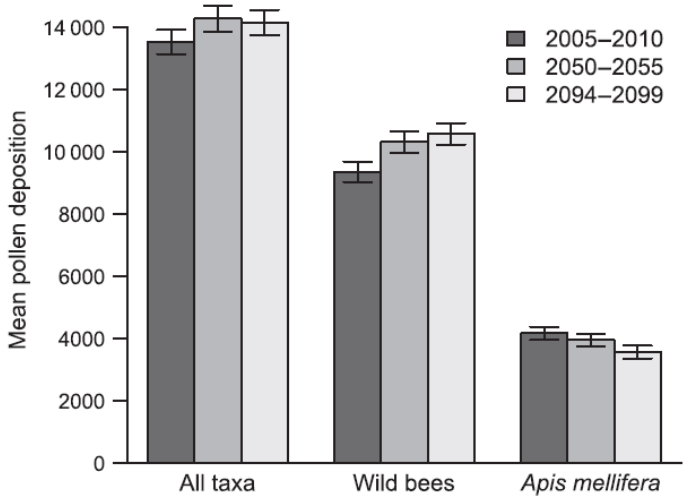
Wild bees provide insurance



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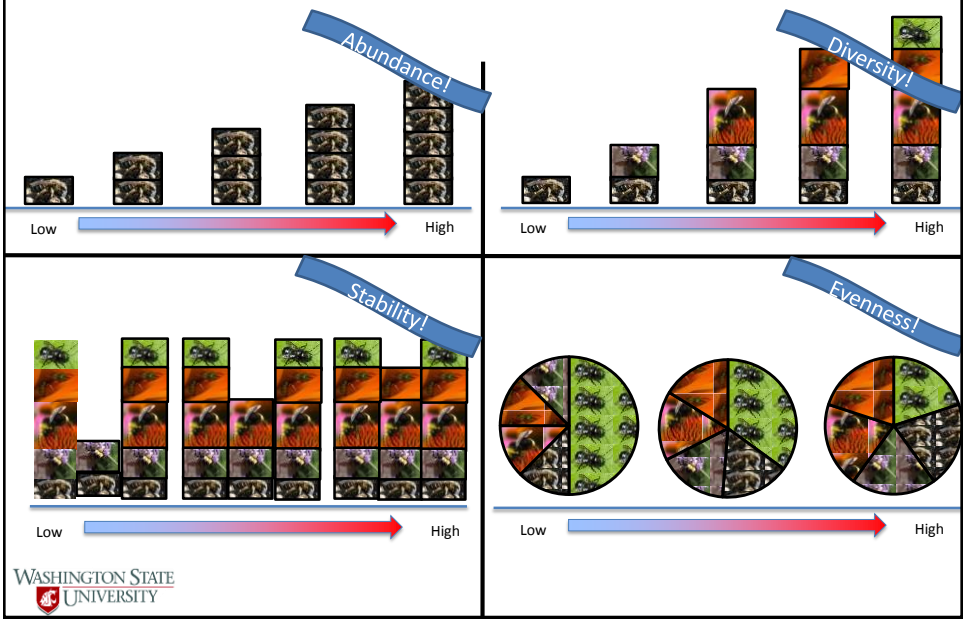
Rader et al. 2013

Defining a healthy bee community



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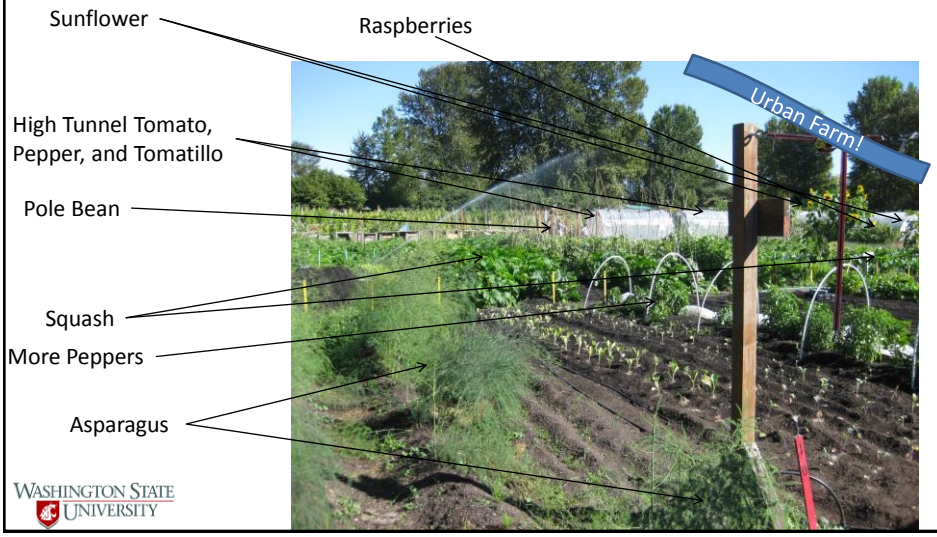
Diversified organic production – unique spatial and temporal pollination needs



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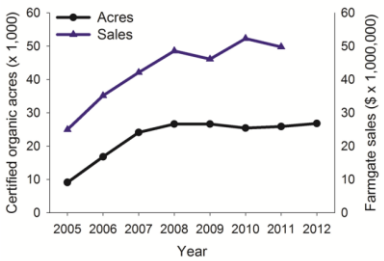
Certified organic produce sales in PNW

- Rapid growth in diversified farms, particularly in western WA
- Most operations produce many crops per growing season needing pollination



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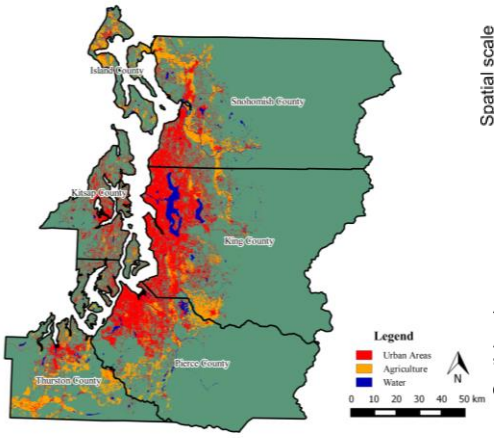
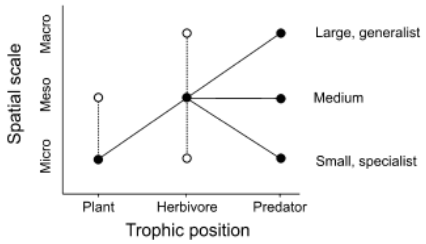
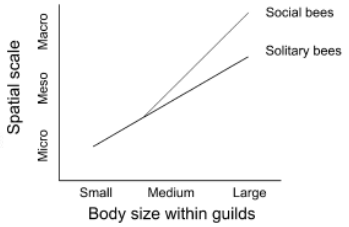
Agriculture/urbanization impact bees







Tscharntke et al. 2005

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Our Questions

- How are bees and pollination services impacted by farming practices on long-term organic and transitioning farming systems?
- Can we augment on-farm habitat to increase bee community health and pollination services?
- Are we able to engage growers on these issues, and are these practices applicable to their farming systems?

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Setup a network of 18 farms

- Create database USDA and WSDA lists of certified organic farms
- Contact through email
- Visit farm and talk to farmers about project
- Cursory evaluation to match farms by characteristics

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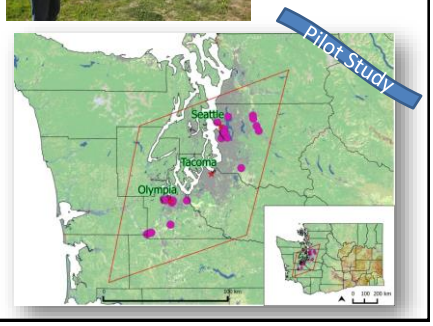
Farm Characteristics

- Rural Small-holder
  - 3 to 30 acres
  - Urban can be smaller
- Diversified Production
  - Numerous crops
  - Expansive bloom-time
- Geographically homogenous
  - Farm Clusters



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Evaluating Farms

Factors Influencing Bee Communities	Predicted Effect on Bee Communities			Methods of Gathering Data		
Production Factors	**Beneficial**	**Neutral**	**Detrimental**	**Field Samp.**	**OSP Eval.**	**GIS**
Crop diversity	X					
Endemic plant diversity	X					
Farm size			X			
Farm age (time since transition)	X					
Honey bees	X	X	X			
Farming Methods						
Organic pesticides		X	X			
Tillage, plow, disk			X			
Conservation biocontrol	X					
Livestock rotation integration	X	X	X			
Landscape Proximity Factors						
Urbanization pressure			X			
Agricultural land			X			
Native/unmanaged lands	X					
Bare ground	X					
Habitat Management						
Forage and habitat (annual)	X	X	X			
Forage and habitat (perennial)	X					

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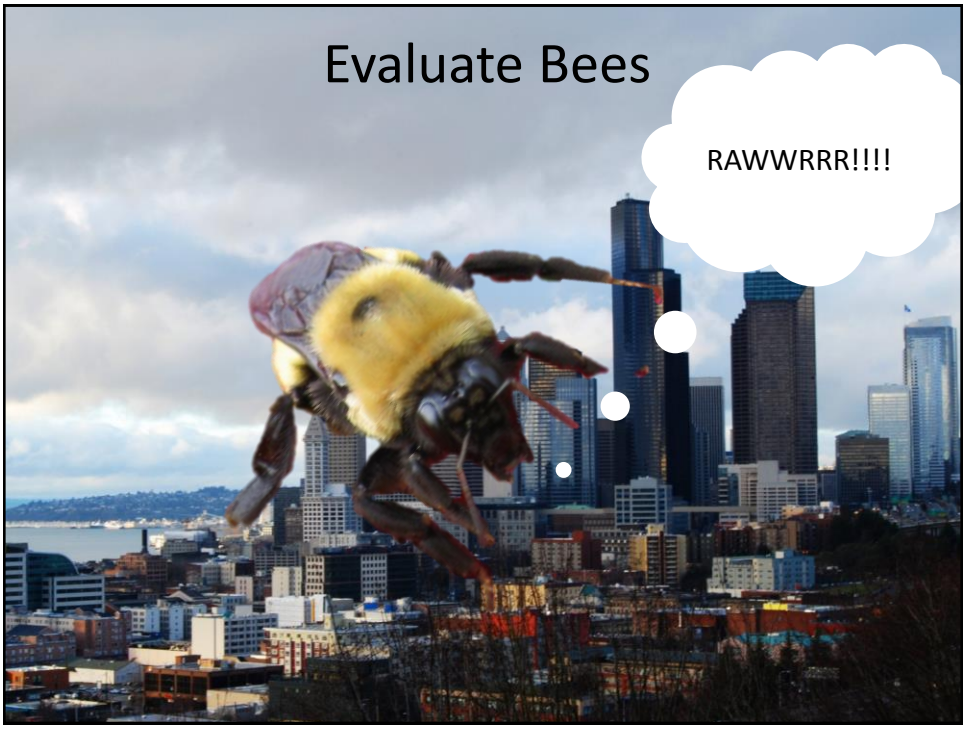
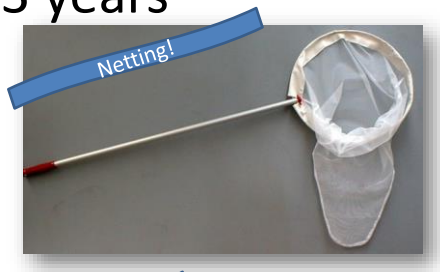


Use standardized sampling techniques over all 3 years

- In our pilot study we've developed our techniques
- Each farm is sampled for 9hrs
  - Early, mid, and late season
- Passive and active sampling techniques



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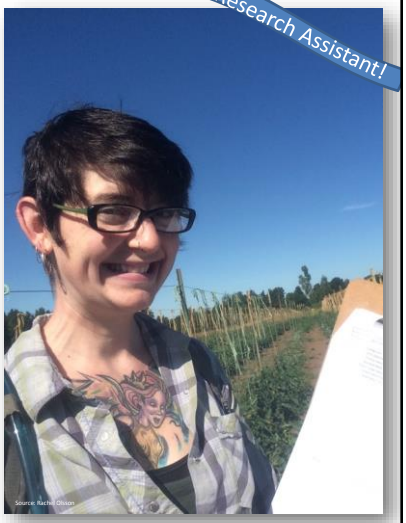
Getting out to do the field sampling!

- Conventional methods to get to our fields
- Sampling on days that are warm, sunny, and not too breezy



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Process, catalog and identify specimens

- Bees come from field in ethanol
- They are washed and cleaned of debris
- Once dry, they can be pinned
- Identification with standard taxonomic keys

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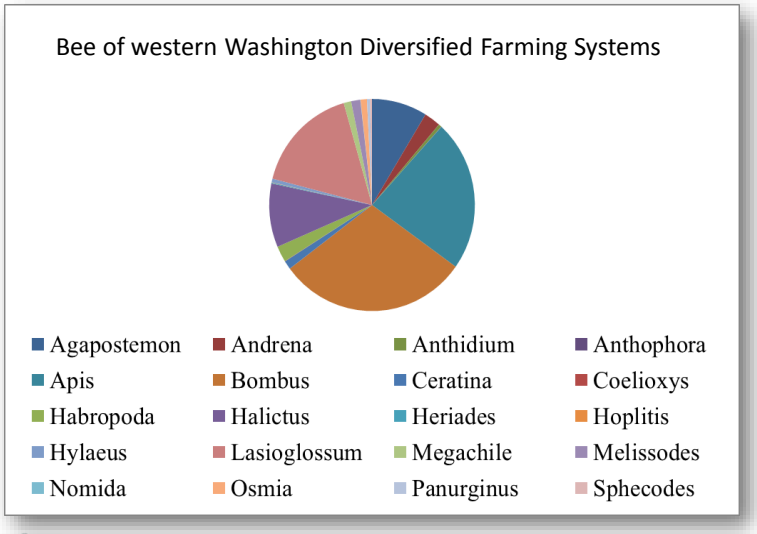
There are at least 20 genera of bees in these systems



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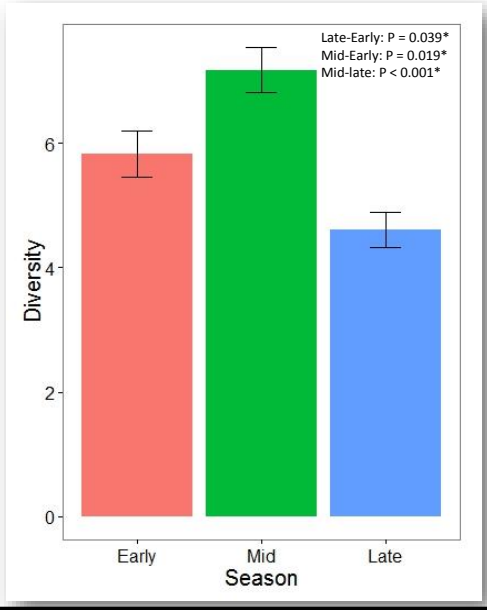
These groups may vary in diversity…



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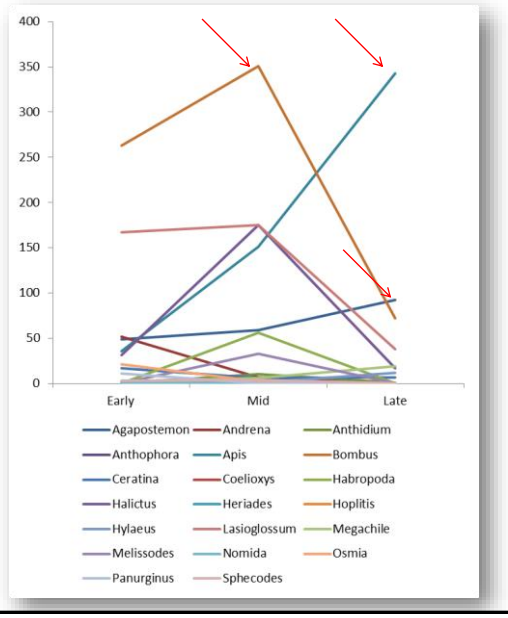
and abundance over time…



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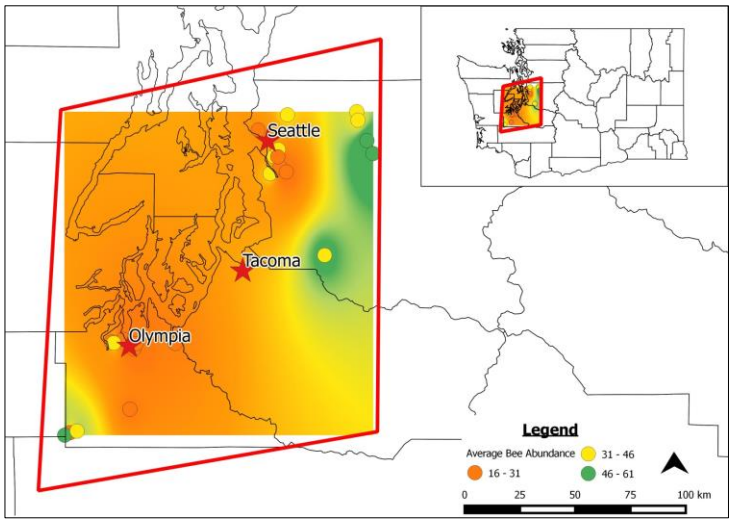
…and space



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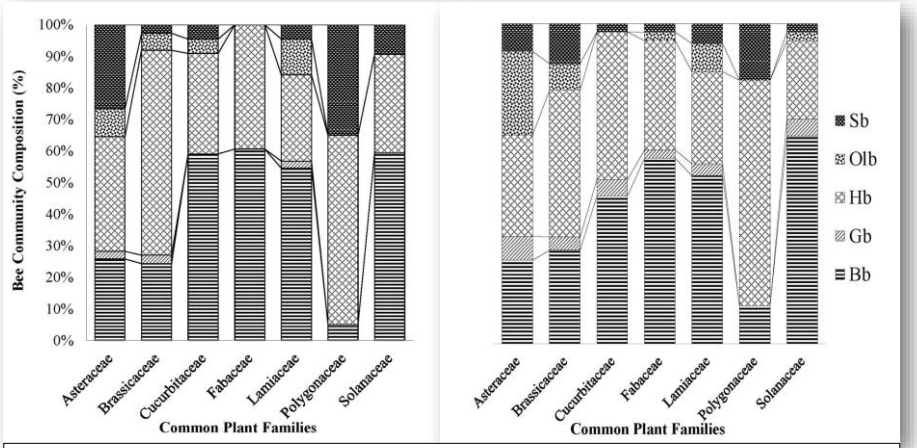
Bees likely visit similar plants in different landscape contexts…



(Sb = Small; Olb = Other large bee; Hb = Honey bee; Gb = Green bee; Bb = Bumble bee)

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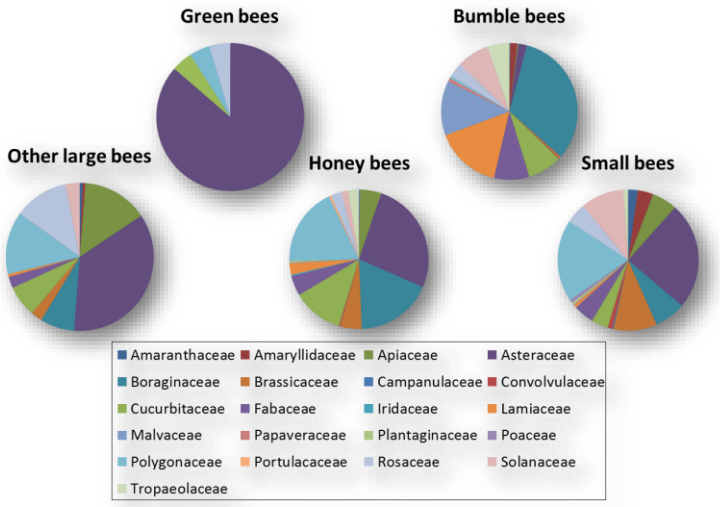
Although, some bees may have plant preferences



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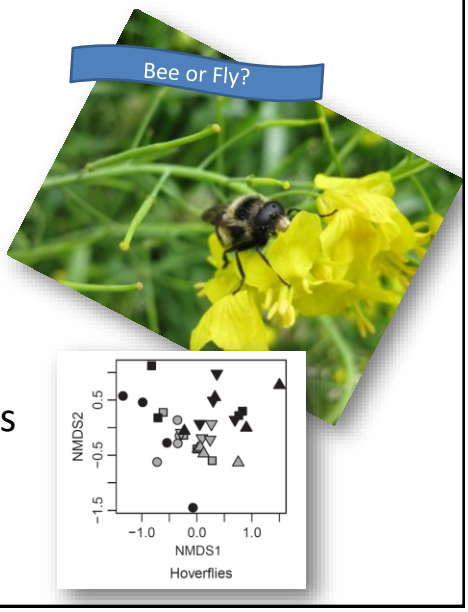
Future sampling and analysis

- We will repeat these techniques in 2015/'16/'17
- We are also adding in other pollinators, particularly hover flies
- Interviews will be conducted with growers in winter 2016



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Our Questions

- How are bees and pollination services impacted by farming practices on long-term organic and transitioning farming systems?
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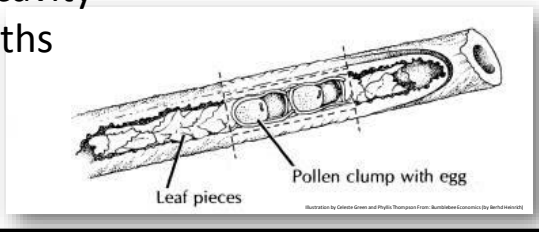
Cavity nesting bees

- In another project, we worked with trap-nesting bees
- 12 habitat structures were installed
- 8 different cavity sizes, 3 depths



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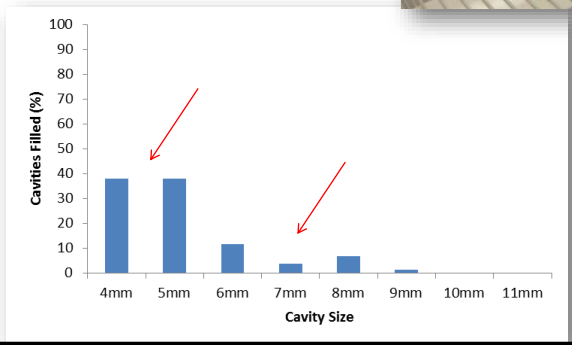
Smaller cavities appear to have the highest occupancy

- 588 Cavities were completely filled
- We will know more soon…



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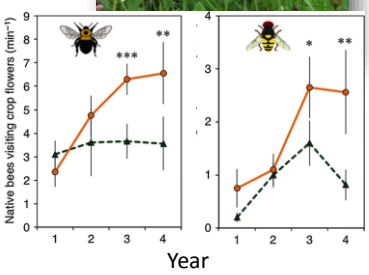
Pollen and nectar resources

- We are also looking into floral blends
- We will demo these blends this coming year at our extension facility in western Washington
- On-farm trails will begin in 2016



Blaauw & Isaacs 2014

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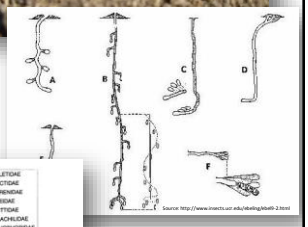
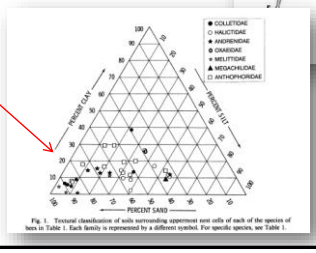
Ground nesting bees

- Approximately 70% of bees nest in the ground
- We are looking into creating bee beds
- Trails will be conducted in western Washington this year
- On-farm trials will begin in 2016





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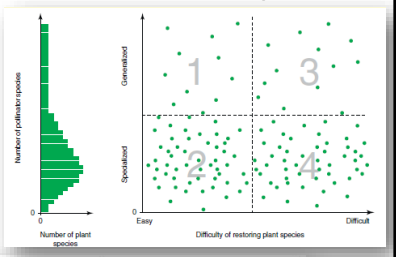
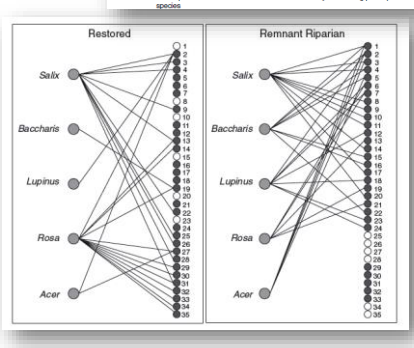
Implementation and future analysis

- Explore easy to restore plants that service many pollinators
- Better understand how habitat augmentation influences visitation





(Williams 2011, Menz et al. 2011)

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Pollinator Week Event

- Town Hall Seattle
- Marla Spivak
  - Keynote address
- Networking with interested community members
- Local bee people out in force!

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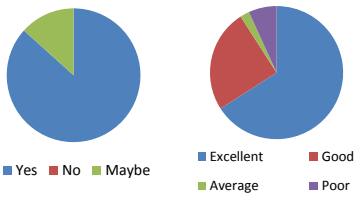
Invited talks and citizen science demo course

- Partnered with Seattle Tilth
- Sold out course
- 15 invited talks in the Puget Sound Region during 2014



Demo course for bee ecology, n=16

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We also launched a website!

- The Northwest Pollinator Initiative will be our umbrella for public engagement
  - Field days
  - citizen science updates
- Come find us on the web!
  - nwpollinators.org

NORTHWEST POLLINATOR INITIATIVE

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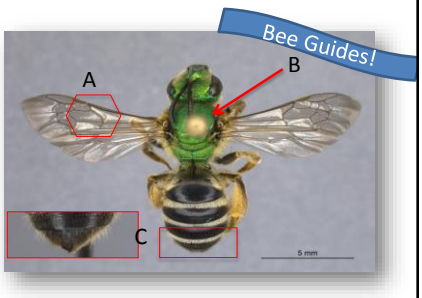
Future engagement

- Pollinator Week 2015!
  - Eric Mader
- Annual Webinars
  - Four in the next 3 years!
- Field Walks
  - Nine spatially unique field days
- Citizen science courses!!!
- Extension publications



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So, what's next?

- Our field season starts in May… Sample, Sample Sample!!!
- Start to explore the characteristics of transitioning and long-term organic farms
- Work more with habitat augmentation
- Host field days and develop resources for growers!!!

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What can you do now?

- Assess bees, promote pollinators, get involved
- Contact us if you want more information or are interested in participating in citizen science

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elias.bloom@wsu.edu

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Acknowledgements

- Presentation host:
  - Thank you eOrganic!!!
- Research host:
  - Many thanks to our farmers, we owe you everything!
- The pollinators:
  - Every third bite we eat is because of you!
- Funding:
  - USDA, Western SARE, NSF

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Questions, Comments, Concerns

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