Promoting Native Bee Pollinators in Organic Farming Systems

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Washington State University
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The Team

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Community Partner

Doug Collins: Co-PI
WSU Small Farms Team

Eli Bloom

Rachel Olsson
Diversity improves ecosystem function

- Data on pollinators is sparse

Cardinale et al. 2006
What is a bee community?

Are honey bees a bee community?

Source: entomology.wsu.edu/david-crowder/photos

Insect Pollinators are Diverse

Flies
Butterflies
Bees!

Beetles, bugs, and thrips

Source: http://www.fs.fed.us/wildflowers/pollinators/animals/beetles.shtml

Source: http://www.britishbugs.org.uk/heteroptera/Anthocoridae/Anthocoris_confusus.html

Source: http://www.agf.gov.bc.ca/cropprot/grapeipm/thrips.htm

Source: http://www.dereila.ca/whispers/flies1.html

Source: http://www.savenature.org/content/nature_academy/Bees_Flies_Butterflies_Beetles, bugs, and thrips

Bees!
We the people on pollinators...

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

Pollinator Diversity Matters

Hoehn et al. 2008
Experimental Tests

Frund et al. 2013

Frund et al. 2013

Frund et al. 2013
Networks also impacted?

Pollinator communities may provide greater services than honey bees alone

Fründ et al. 2012

Garibaldi et al. 2013
Wild bees may impact honey bees

Wild bees may pollinate some crops more effectively than honey bees
Wild bees provide insurance

Defining a healthy bee community

Rader et al. 2013
Diversified organic production – unique spatial and temporal pollination needs

- Sunflower
- Raspberries
- High Tunnel Tomato, Pepper, and Tomatillo
- Pole Bean
- Squash
- More Peppers
- Asparagus

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
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
Farm Characteristics

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

Evaluating Farms

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

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
There are at least 20 genera of bees in these systems

These groups may vary in diversity...
and abundance over time...

...and space
Bees likely visit similar plants in different landscape contexts...

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

Although, some bees may have plant preferences
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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Cavity nesting bees

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

Illustration by Celeste Green and Phyllis Thompson From: Bumblebee Economics (by Bernd Heinrich)

Smaller cavities appear to have the highest occupancy

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

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
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!

Invited talks and citizen science demo course

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

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
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!!!

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
  
  dcrowder@wsu.edu
  elias.bloom@wsu.edu
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

Questions, Comments, Concerns