1. Jane S. Huestis
   Phylogenetics of plant-pollinator networks

1. Andrew N. Guide
   Pollinator preferences

1. Elaina G. Thomas
   Beta diversity in montane meadows

1. Lydia S. Miller
   Modularity of plant-pollinator networks

1. Joshua B. Griffin
   Modeling bee behavior
Examining phylogenetic relatedness as a driver of plant-pollinator interactions in montane meadows.

Jane S. Huestis | August 2017
Oregon State University
Eco-Informatics Summer Institute
Introduction

HJ Andrews Experimental Forest
- Blue River, OR
- LTER estd. 1948
- “a center for forest and stream ecosystem research in the Pacific Northwest” (AND LTER)

Plant-Pollinator Networks
- Agricultural significance
- Integral to healthy ecosystems

Phylogeny
- No existing phylogeny for plant or pollinators observed as part of the EISI program at HJ Andrews
- Minimal literature
- Phylogeny may inform conservation insights & practices
How does phylogenetic relatedness of plant families correlate with frequency of interactions by members of the same pollinator families?

STUDY GOAL
Field Methods

Meadows & Plots
- 3 meadow complexes
- 4 meadows per complex, 10 plots per meadow
- 120 total plots surveyed

Anthesis
- Count number of stalks & flowers per stalk
  - Every species in anthesis in the plot

Interactions
- 15 minute watch period
- All plant-pollinator interactions (successful or otherwise) recorded
Phylogenetic Methods

Pollinators
- Bug Guide (Iowa State University Dept. of Entomology)
- American Insects 2nd Edition

Plants
- National Center for Biotechnology Information (NCBI) Taxonomy Browser
- USDA Natural Resources Conservation Service PLANTS Database

Tree Building & Visualization
- phyloT & NCBI
- Interactive Tree of Life (iTOL)

Distance Metrics (Plants)
- Distance matrix

Image courtesy of iTOL
Analytical Methods

**Jaccard Index**
- Pairwise comparison between plant families
- Intersection & union of sets
  - Percent of shared pollinator families

**Scatterplot**

**Linear Regression**

**RStudio**
Results | Phylogenies

Figure 1 (left). Phylogeny of plant families annotated with distance metrics

Figure 2 (right): Phylogeny of pollinator families
Results | Phylogenetic distance versus shared pollinators

Figure 3. Relationship of shared pollinator family interactions as a function of phylogenetic distances between pairwise comparisons of plant families.
## Results | Points of interest

<table>
<thead>
<tr>
<th>Plant families compared</th>
<th>Percent of pollinator families shared</th>
<th>Phylogenetic distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berberidaceae x Orchidaceae</td>
<td>75</td>
<td>41</td>
</tr>
<tr>
<td>Violaceae x Orchidaceae</td>
<td>66.7</td>
<td>54</td>
</tr>
<tr>
<td>Boraginaceae x Orchidaceae</td>
<td>66.7</td>
<td>54</td>
</tr>
<tr>
<td>Berberidaceae x Violaceae</td>
<td>66.7</td>
<td>39</td>
</tr>
<tr>
<td>Boraginaceae x Berberidaceae</td>
<td>66.7</td>
<td>39</td>
</tr>
<tr>
<td>Polemoniaceae x Polygonaceae</td>
<td>66.9</td>
<td>14</td>
</tr>
<tr>
<td>Apiaceae x Polygonaceae</td>
<td>64.5</td>
<td>18</td>
</tr>
</tbody>
</table>

Table 1. Points of interest due to their high percentage of pollinator families shared.

<table>
<thead>
<tr>
<th>Plant families compared</th>
<th>Phylogenetic distance</th>
<th>Percent of pollinators shared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iridaceae x Orchidaceae</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Berberidaceae x Ranunculaceae</td>
<td>2</td>
<td>9.5</td>
</tr>
<tr>
<td>Caryophyllaceae x Polygonaceae</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Crassulaceae x Saxifragaceae</td>
<td>2</td>
<td>38</td>
</tr>
<tr>
<td>Polemoniaceae x Ericaceae</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>Polemoniaceae x Primulaceae</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Ericaceae x Primulaceae</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Campanulaceae x Asteraceae</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Valerianaceae x Caprifoliaceae</td>
<td>2</td>
<td>7.7</td>
</tr>
<tr>
<td>Apocynaceae x Rubiaceae</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Scrophulariaceae x Lamiaceae</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Hydrophyllaceae x Boraginaceae</td>
<td>2</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 2. Percent of pollinators shared between plant families with low phylogenetic distance.
Discussion & Conclusions

Goal
How is phylogenetic relatedness of plant families correlated with frequency of visits by the same pollinator families?

Key Findings
Slight negative correlation between phylogenetic distance & shared pollinator families

Further Directions
Flower morphology
Acknowledgments

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