Using Digital Collections in Community Ecology
Community Ecology

• The study of ecological communities
  – Interactions between organisms
  – Biogeographic patterns
  – Assembly processes

• Data Intensive
Community Ecology

- Limited resources and time
- Naturally rare species
- Trapping biases
Digital Collections are Treasures

• Allow for rigorous hypothesis formation
• Verifiable data
• Accessible
  – GBIF
  – Discoverlife
• Leverage with other open data sources e.g. satellite imagery
Bees
Environmental Filtering
Study Area
Study Area
Study Area

![Map of study area in the United States](image-url)
Study Area
Study Area

Bee Collection techniques
Expected Community

- **Species**: 250
- **Solitary**: 182
- **Plants**: 430
- **Generalists**: 142

**Note:** The chart shows the expected count for different categories in the community.
Observed vs Expected

Community Data

- Species
- Solitary
- Plants
- Generalists

Count

- Observed
- Expected
Bee Survey Results

The diagram shows the abundance of various bee genera across different sites. Each cell represents a bee genus, with the color intensity indicating relative abundance. The x-axis represents the sites, while the y-axis lists the bee genera. The color scale on the right side indicates the square root of abundance, with darker colors representing higher abundance.
NMDS Visualization

K = 3, Stress = 0.16
NMDS plot

- Wind pollinated Crops (1600m)
- Latitude
- Grassland (3200m)
- Grassland (1600m)
- Developed Land (400m)

Legend:
- High Cropland
- Medium High Cropland
- Medium low Cropland
- Low Cropland

(k = 3, stress = 0.16)
Predictive Models

Species Richness

Coefficient = 9.4x10^{-7}
R-squared (adj) = 0.24
F = 5.96 on 2 and 29 DF
p = 0.006

Percent Corn, Wheat and Sorghum within 1600m
Landscape Effects on Bee Communities
Environmental Filtering
Integrating the Digital Data

- Using Western Great Plains Data
- Pollination networks
- Identify key food resources
Pollinator Networks

• Look for flowers that support many Bee species
• Specialist relationships
• Bees that pollinate many flowers
Pollinator Networks

Node Size = Number of Records

Node Position = Taxa + Number of Connections

Edge Width = Number of Connections

Color = Taxa
Pollinator Networks
Pollinator Networks
Pollinator Networks
Conclusions

This records based pollinator network shows a great deal of redundancy.
Conclusions

The presence of a plant species may be a better predictor of bee community composition than landscape attributes.
Future Directions

Use plant records in combination with landscape attributes to develop predictive model

Provide recommendations for land managers
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Questions?