Mapping how wild bees use Maine's landscape

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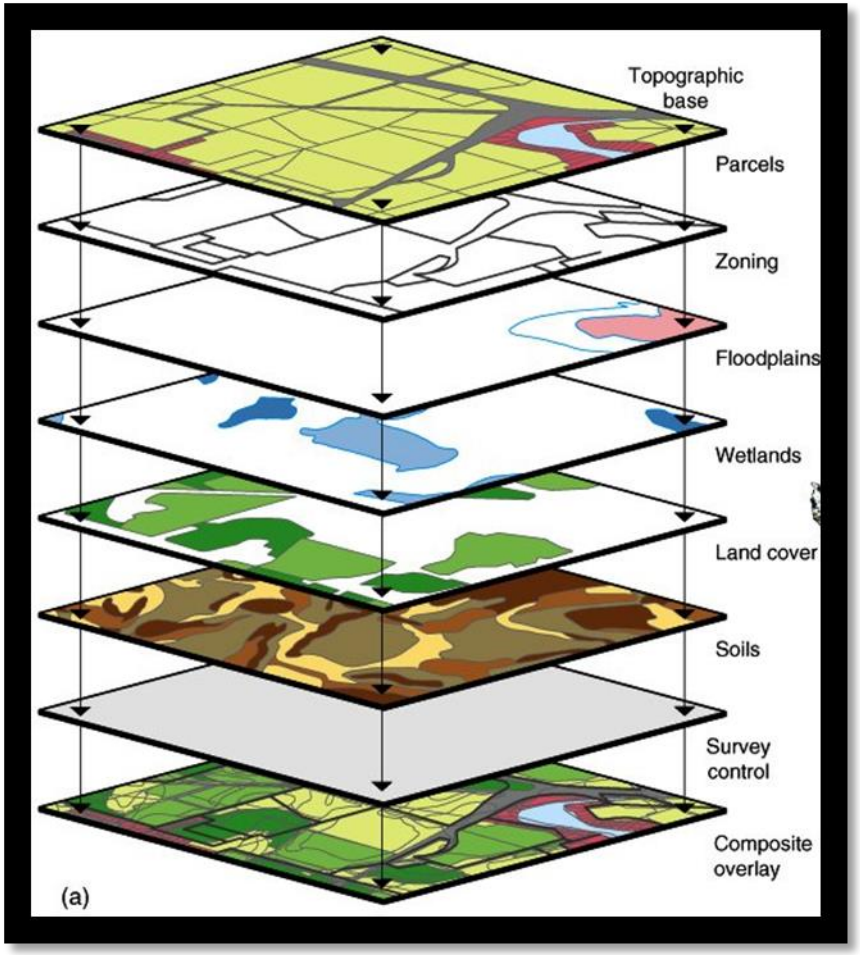
Outline

- Bee landscape ecology
- How we map bees in Maine's landscape
- BeeMapper
- Field surveys for bees
- Where are the bees in Maine's landscape?

Bee landscape ecology



What do bees need in their landscape?

Food:
pollen and nectar

Habitat:
open soil, dead logs and twigs

Within their flight limit

Bee flight limit

Colletes inaequalis
Max flight limit: 1096 yd

Osmia inspergens
Max flight limit: 495 yd

Lasioglossum leucomomum
Max flight limit: 31 yd

What makes good bee habitat?

- Lots of sun
- Some shade
- Some water

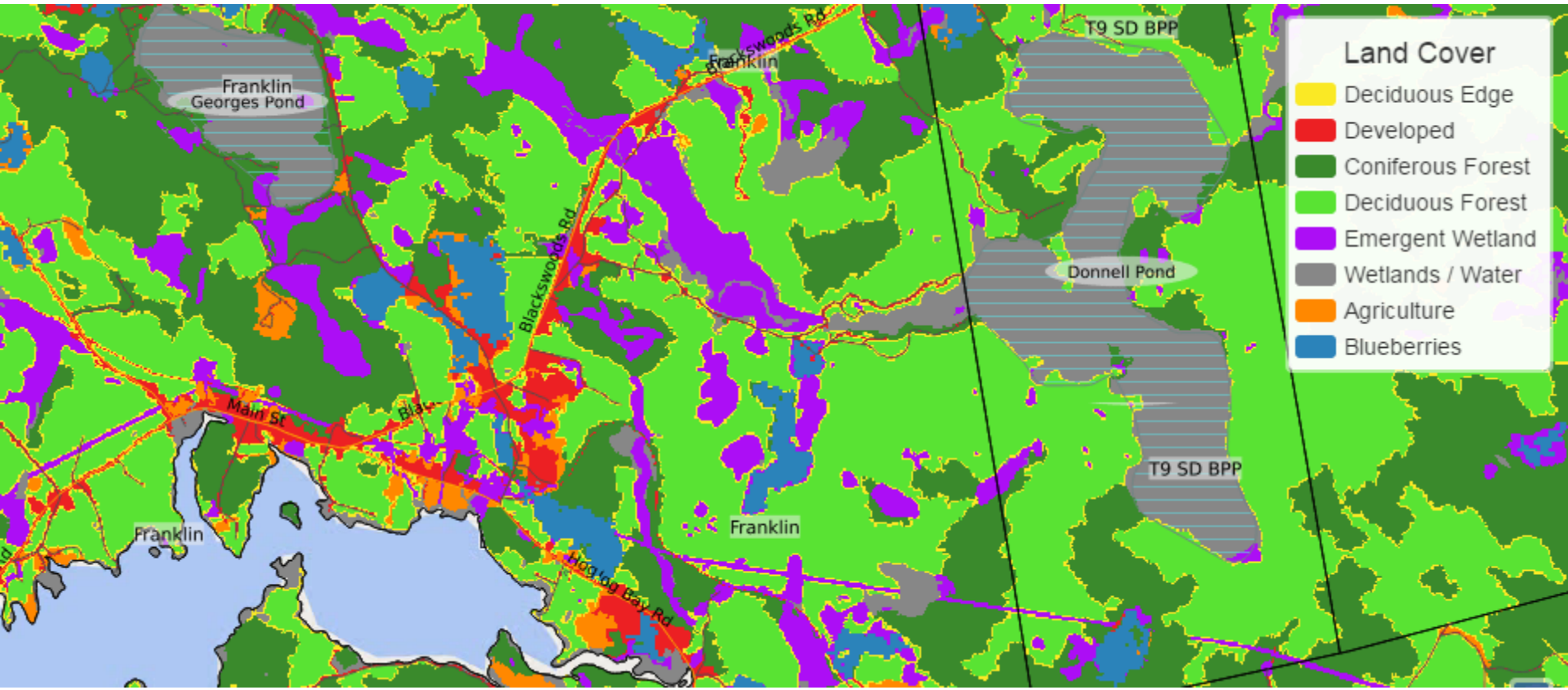
- Woody flowering shrubs
- Well-drained soils

Photos via Maine Natural Areas Program

Some types of land are better than others!

Photos via Wikimedia Commons

How do we map where bees are?



Start with land cover type…

…find suitability values…

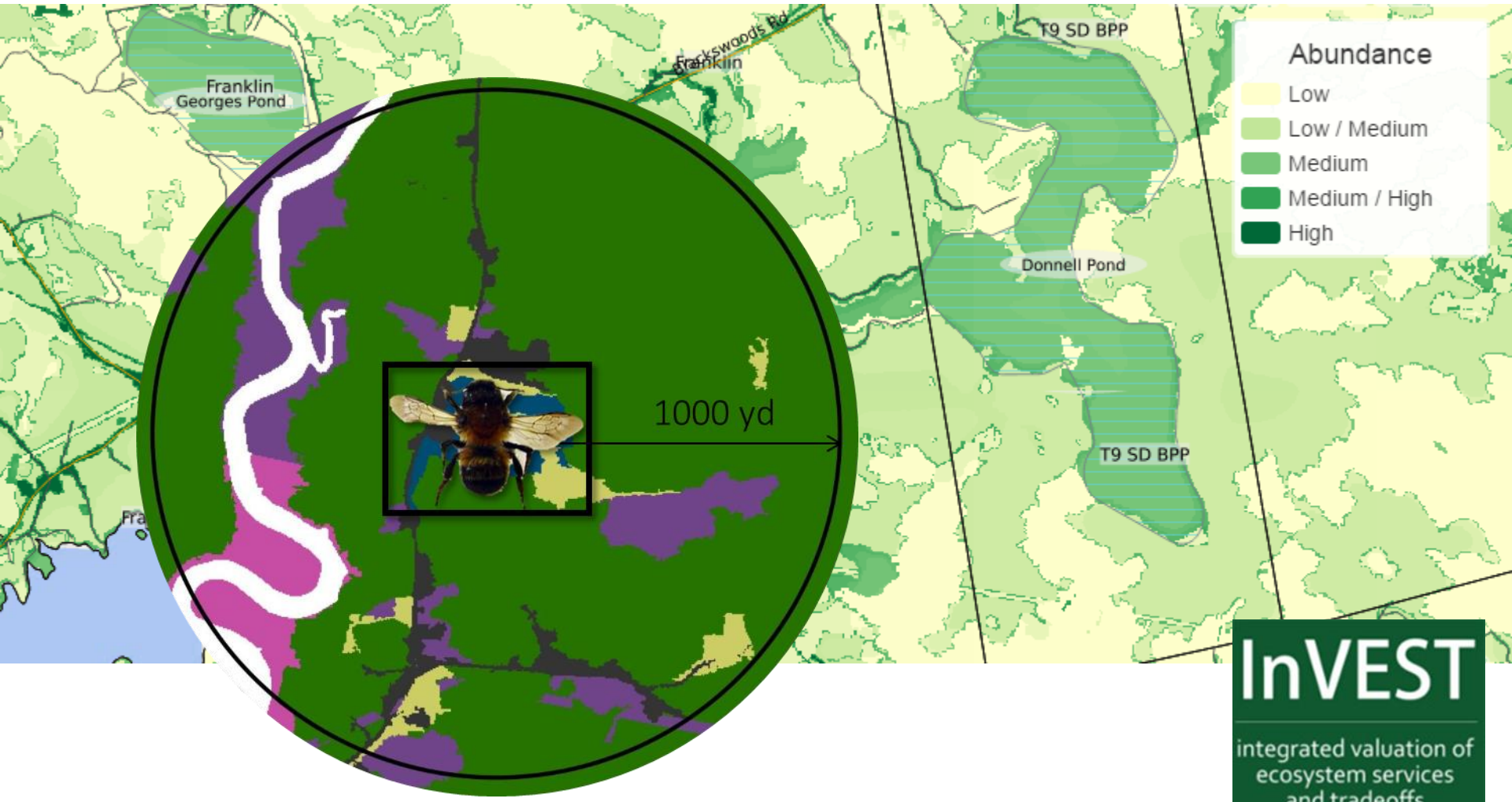
Table 3. Average (± standard deviation) scaled landcover suitability values assigned through expert opinion.

Landcover	Ground nesting	Cavity nesting	Spring forage	Early Summer forage	Late Summer forage
Deciduous/mixed forest, edge	0.9(0.17)	1.0(0.19)	0.9(0.24)	0.9(0.24)	1.0(0.22)
Developed/other	0.9(0.25)	0.6(0.30)	1.0(0.27)	0.9(0.26)	1.0(0.22)
Coniferous forest	0.5(0.23)	0.6(0.28)	0.1(0.24)	0.1(0.21)	0.1(0.29)
Deciduous forest/mixed forest	0.6(0.21)	0.9(0.22)	0.7(0.21)	0.5(0.29)	0.4(0.18)
Emergent wetlands/scrub-shrub	0.2(0.14)	0.4(0.24)	0.7(0.22)	0.6(0.25)	0.6(0.20)
Wetlands/water	0.1(0)	0.1(0.05)	0.3(0.20)	0.2(0.16)	0.5(0.18)
Agriculture/field	0.7(0.29)	0.2(0.18)	0.9(0.31)	0.7(0.27)	0.9(0.33)
Blueberries	1.0(0.25)	0.4(0.26)	0.4(0.29)	1.0(0.28)	0.5(0.26)

Chapin 2014

…include wild bee characteristics…

And make a map!
predicted wild bee abundance



InVEST
integrated valuation of ecosystem services and tradeoffs

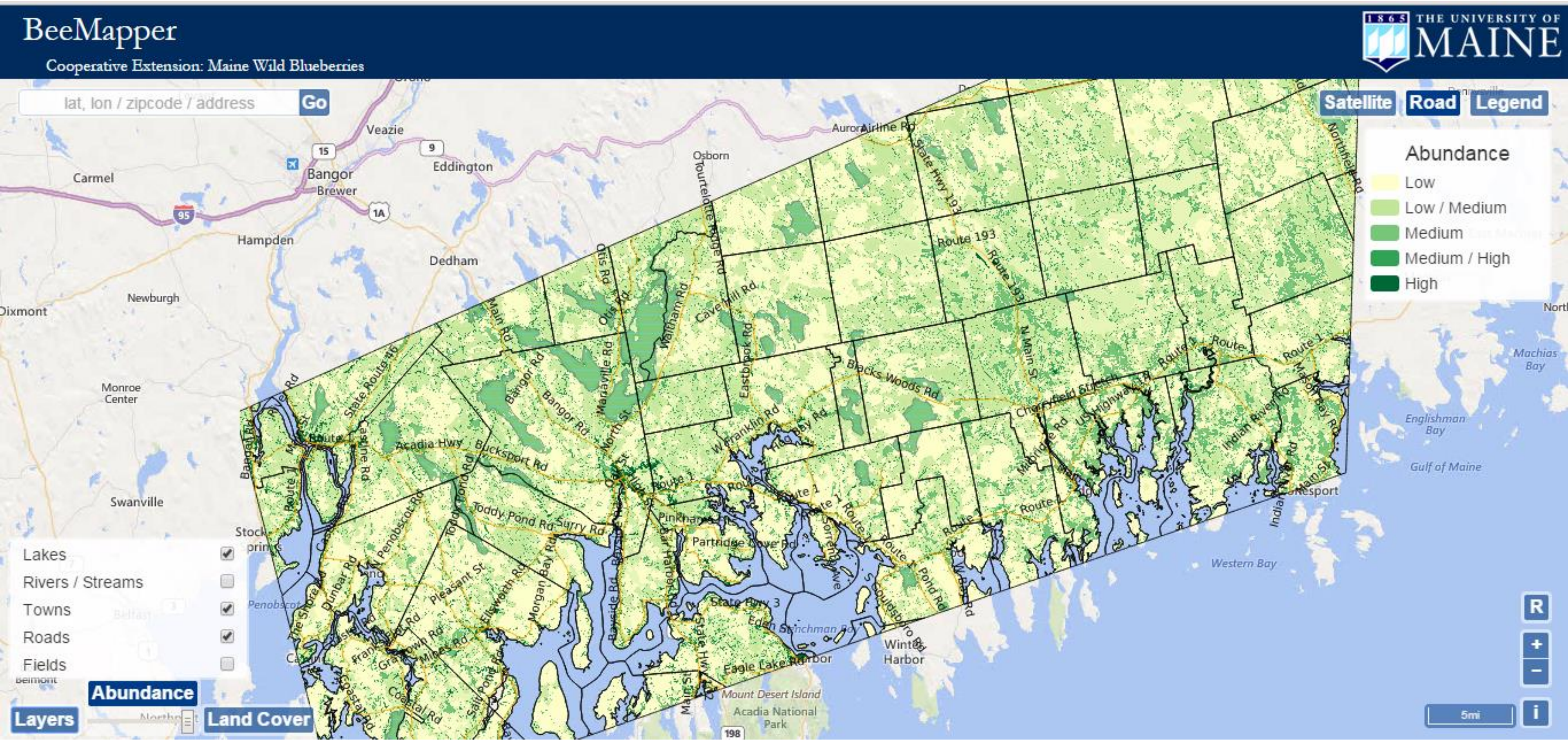
BeeMapper

- Aim: to display wild bee habitat around wild blueberry fields
- Features:
  - Maps
    - Land cover
    - Predicted wild bee abundance
    - Navigational aids
  - User's guide
  - Links for further reading

Why BeeMapper?

- Increasing reliance on honey bees may be unsustainable
- Need to understand contribution from wild bees
- Get information to growers!
  - umaine.edu/blueberries

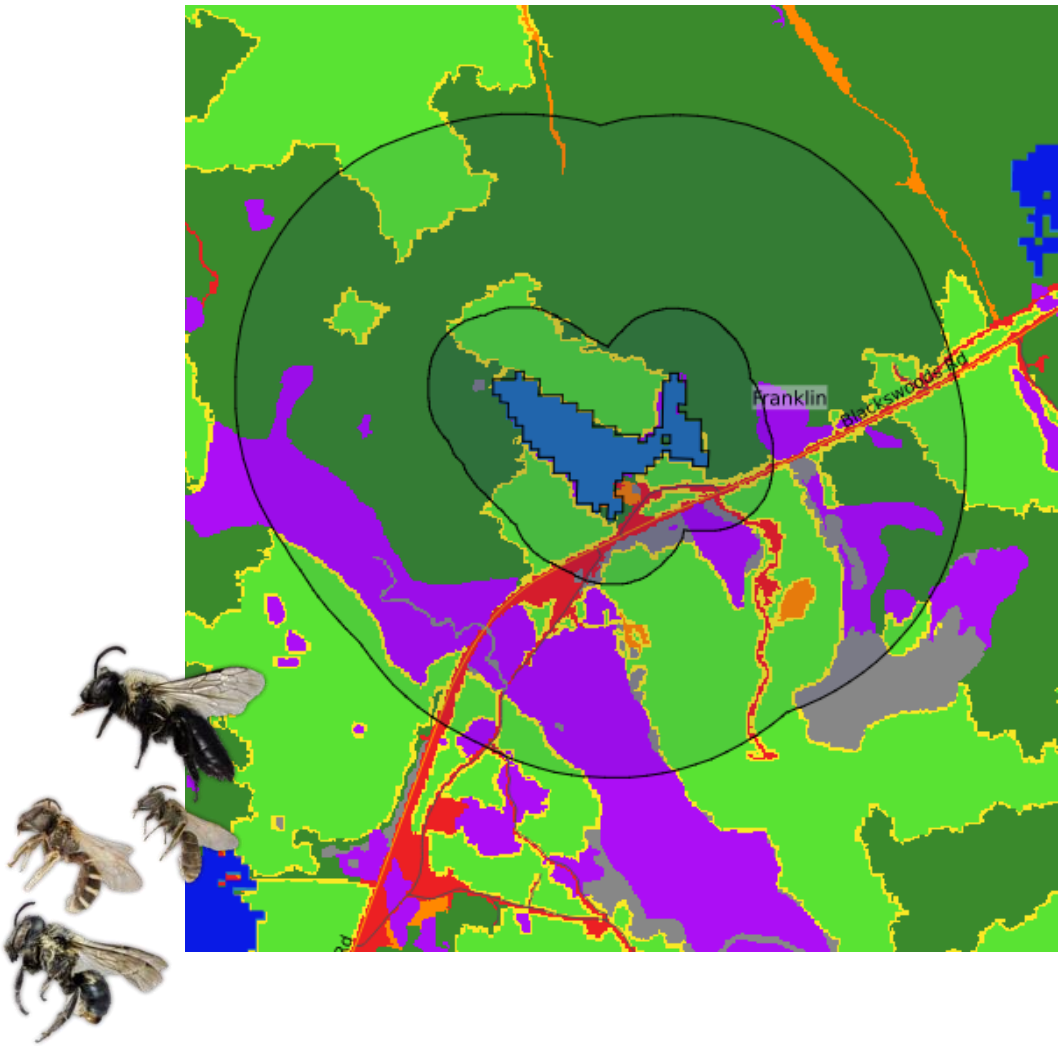
Photos: Wyman's of Maine, University of Maine



BeeMapper
Cooperative Extension: Maine Wild Blueberries
THE UNIVERSITY OF MAINE
1865
lat, lon / zipcode / address
Go
Satellite
Road
Legend
Abundance
Low
Low / Medium
Medium
Medium / High
High
Lakes
Rivers / Streams
Towns
Roads
Fields
Abundance
Layers
Land Cover
R
5mi
i
Bangor
Brewer
Veazie
Eddington
Carmel
Hampden
Dedham
Newburgh
Dixmont
Monroe Center
Swanville
Osborn
Machias Bay
Englishman Bay
Gulf of Maine
Western Bay
Mount Desert Island
Acadia National Park
Winter Harbor

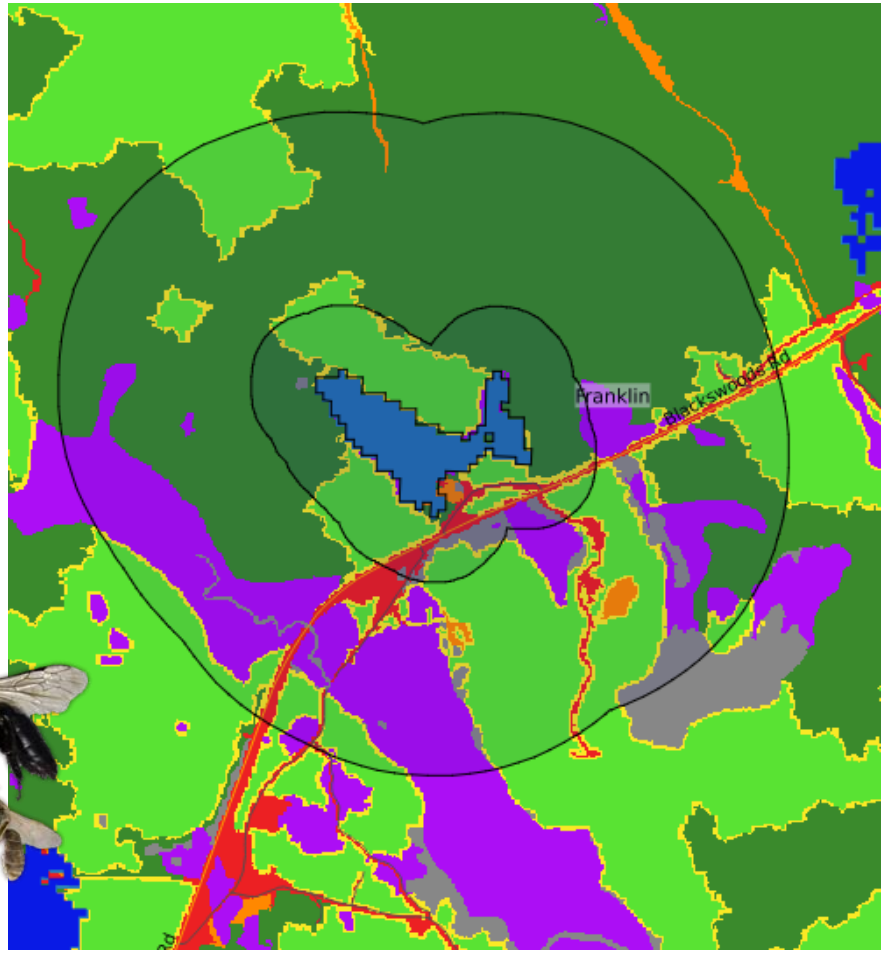
What can we do with bee maps?

- Strategically place honey bee hives



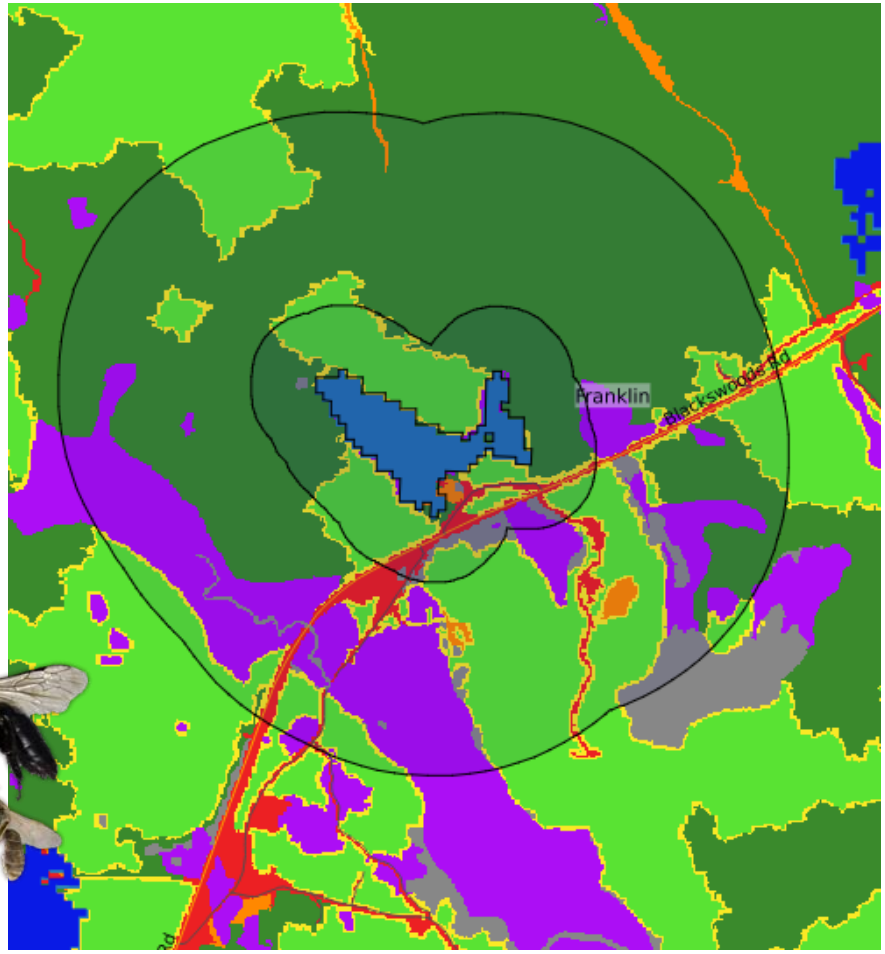
What can we do with bee maps?

- Strategically place honey bee hives
- Determine existing lands for conservation



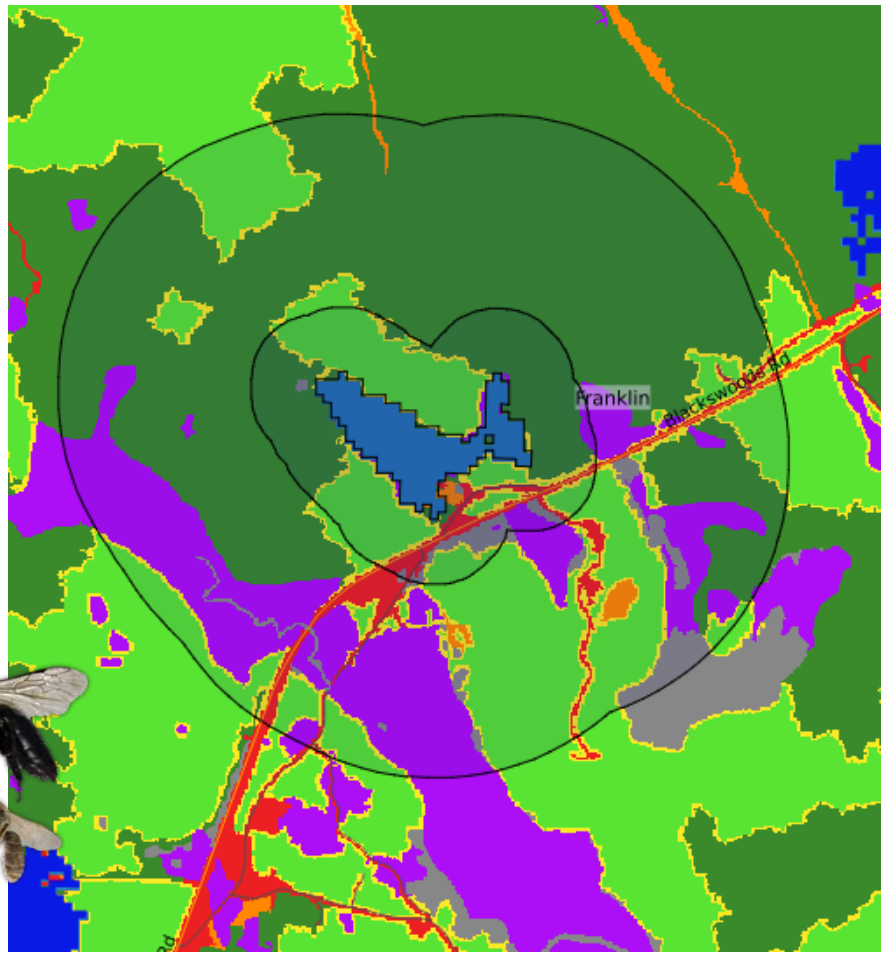
What can we do with bee maps?

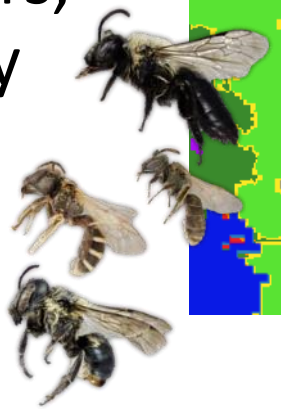
- Strategically place honey bee hives
- Determine existing lands for conservation
- Find potential sites for pollinator plantings



What can we do with bee maps?

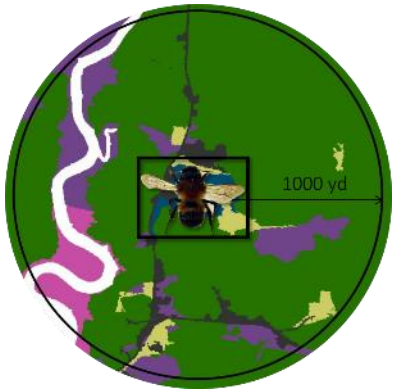
- Strategically place honey bee hives
- Determine existing lands for conservation
- Find potential sites for pollinator plantings
- Targeted to growers, but can be used by everyone

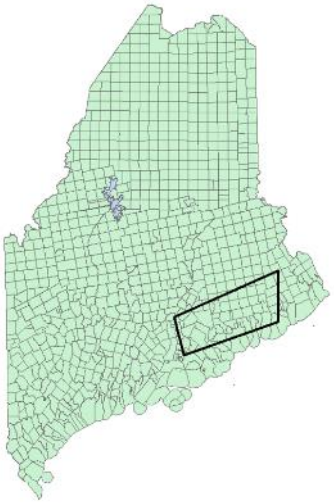


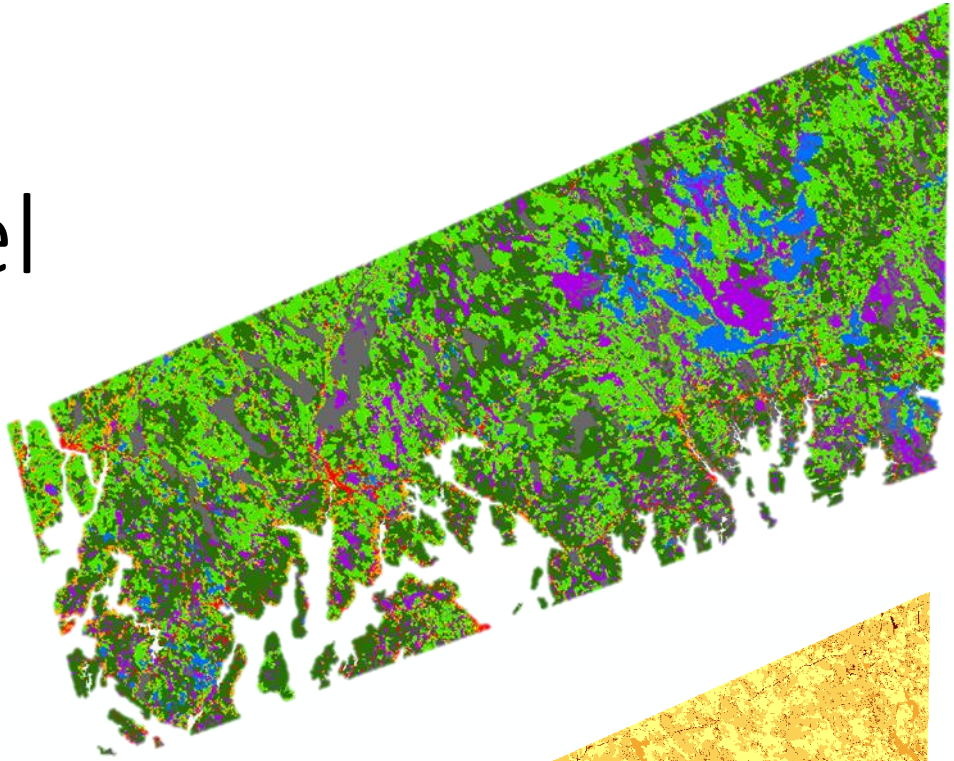


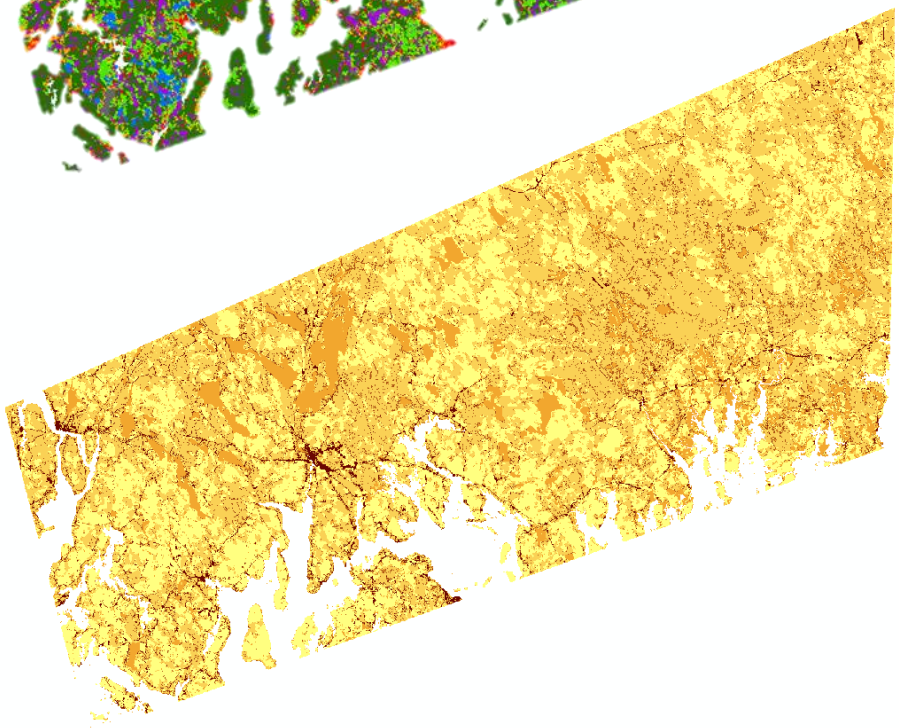
InVEST Crop Pollination Model

- Input:
  - Land cover data
  - Suitability values
  - Bee species life history
- Output: predicted wild bee abundance





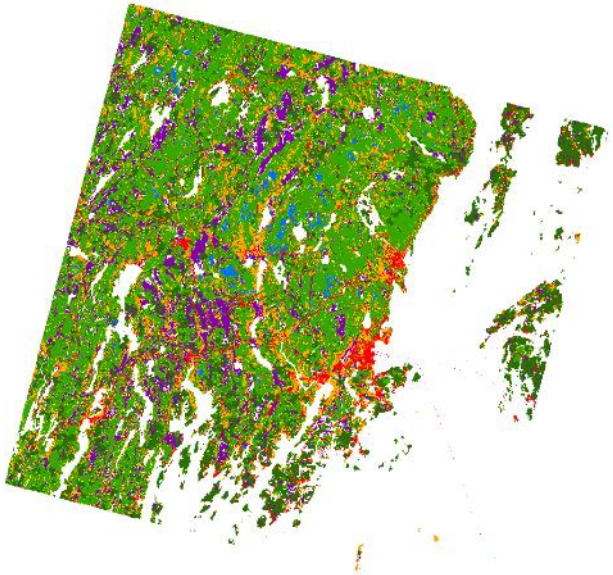


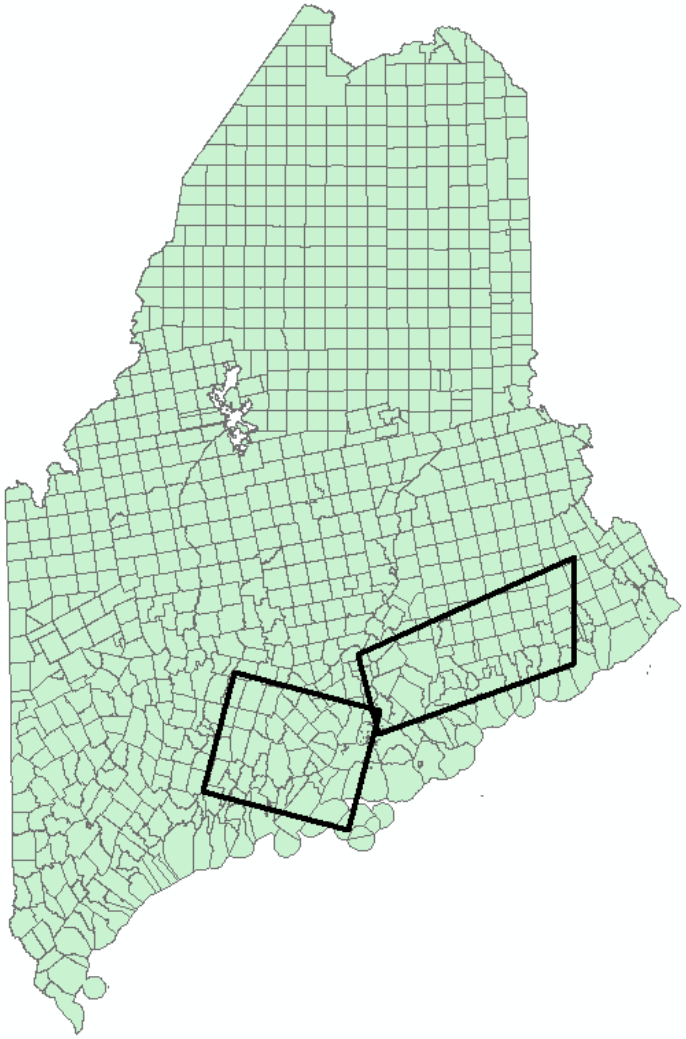


Groff et al. 2016

Improving and expanding InVEST

- Incorporate the Midcoast wild blueberry landscape
- Create robust parameters for more accurate predictions





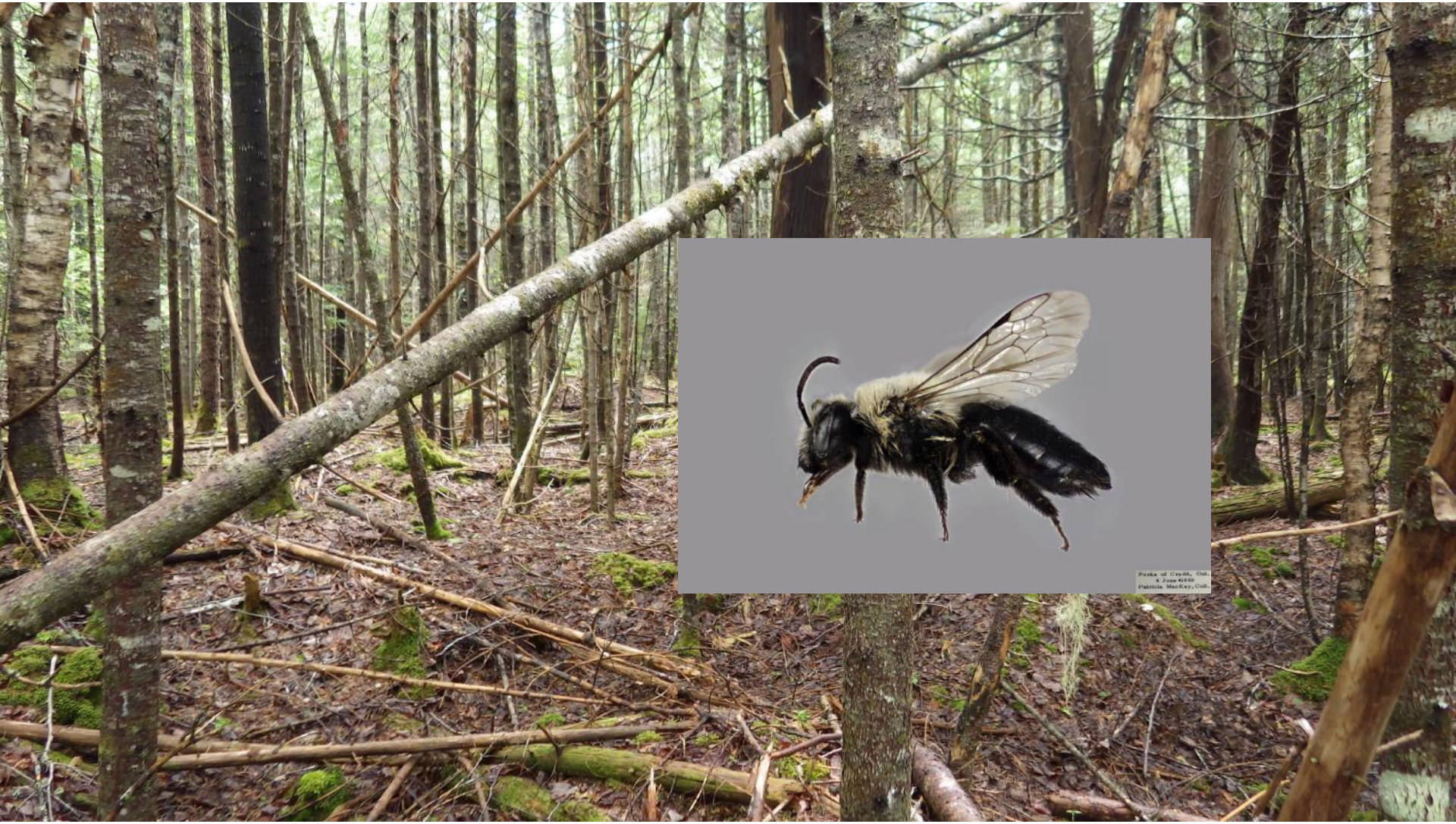
Field-collected ecological data

- Four sampling areas:
  - Midcoast (Waldo and Knox Counties)
  - Washington County
  - Hancock County
  - Orono/Old Town (Penobscot County)
- Early, mid, and late summer 2015
- Eight types of land

Photo: Holland Haverkamp, University of Maine

1) Agriculture/grassland

2) Blueberry field



3) Coniferous forest

4) Deciduous/mixed forest

5) Deciduous/mixed forest edge

6) Urban/developed

7) Emergent wetland

8) Wetlands/water


2015_89
2015_121
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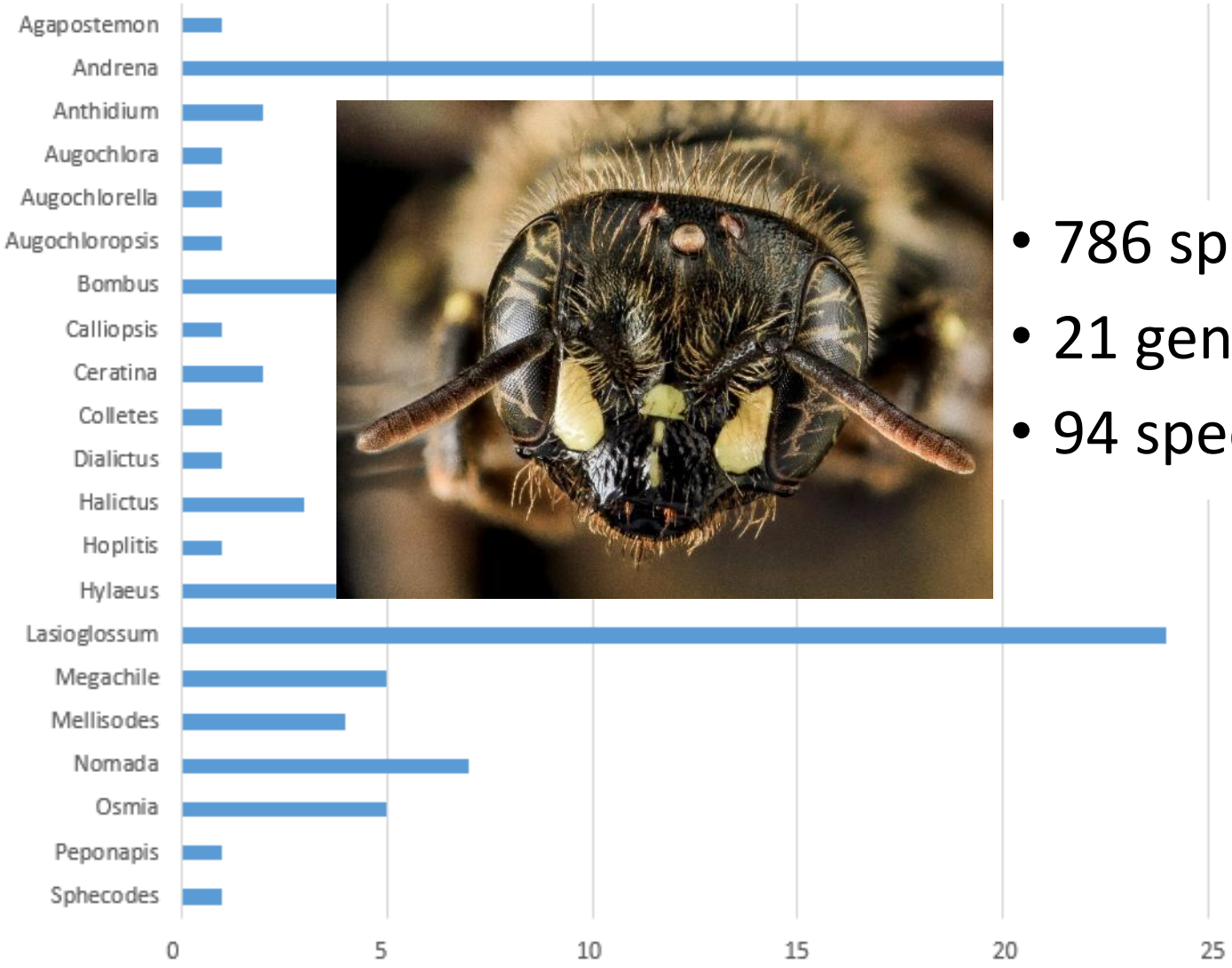
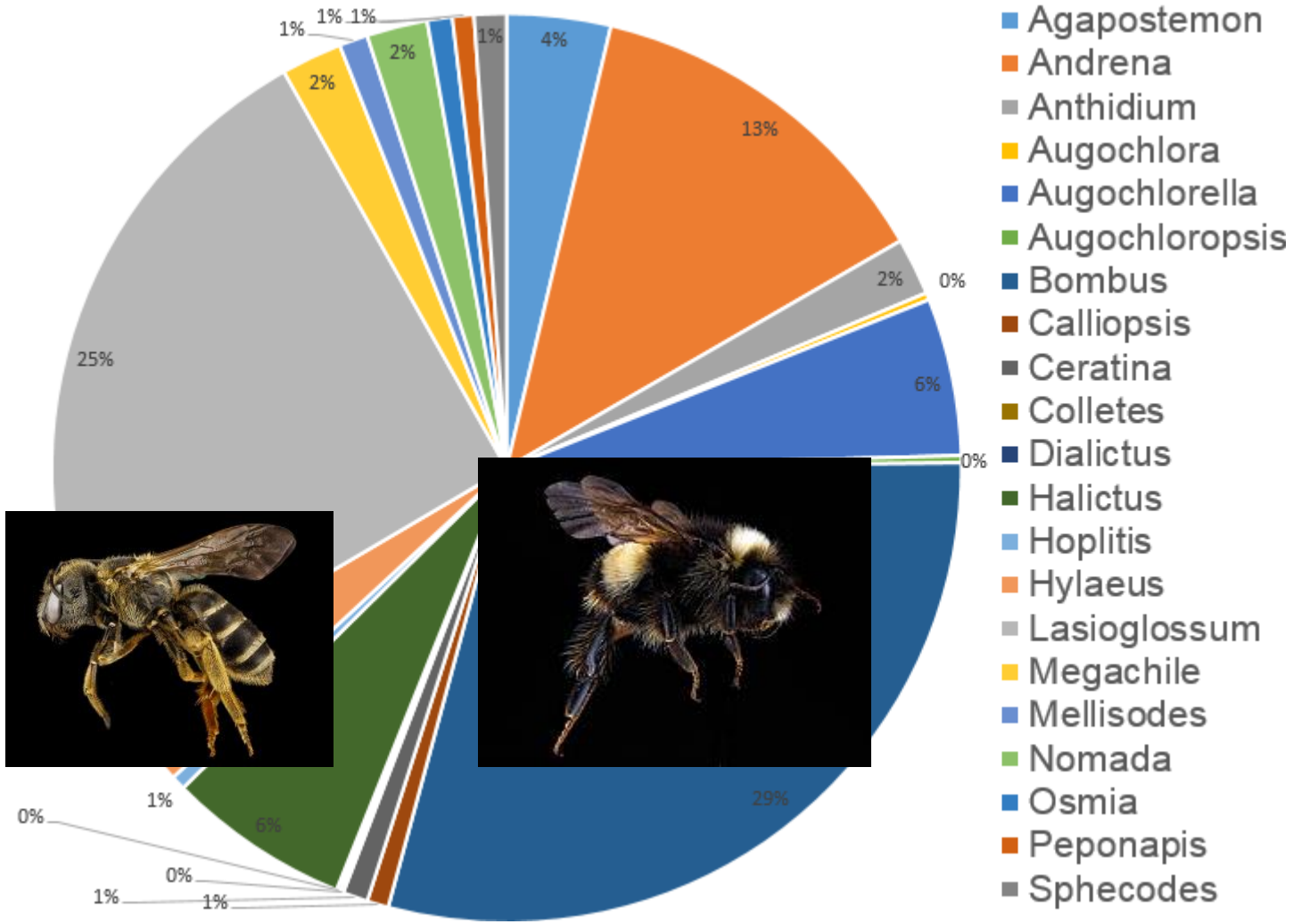
Preliminary results

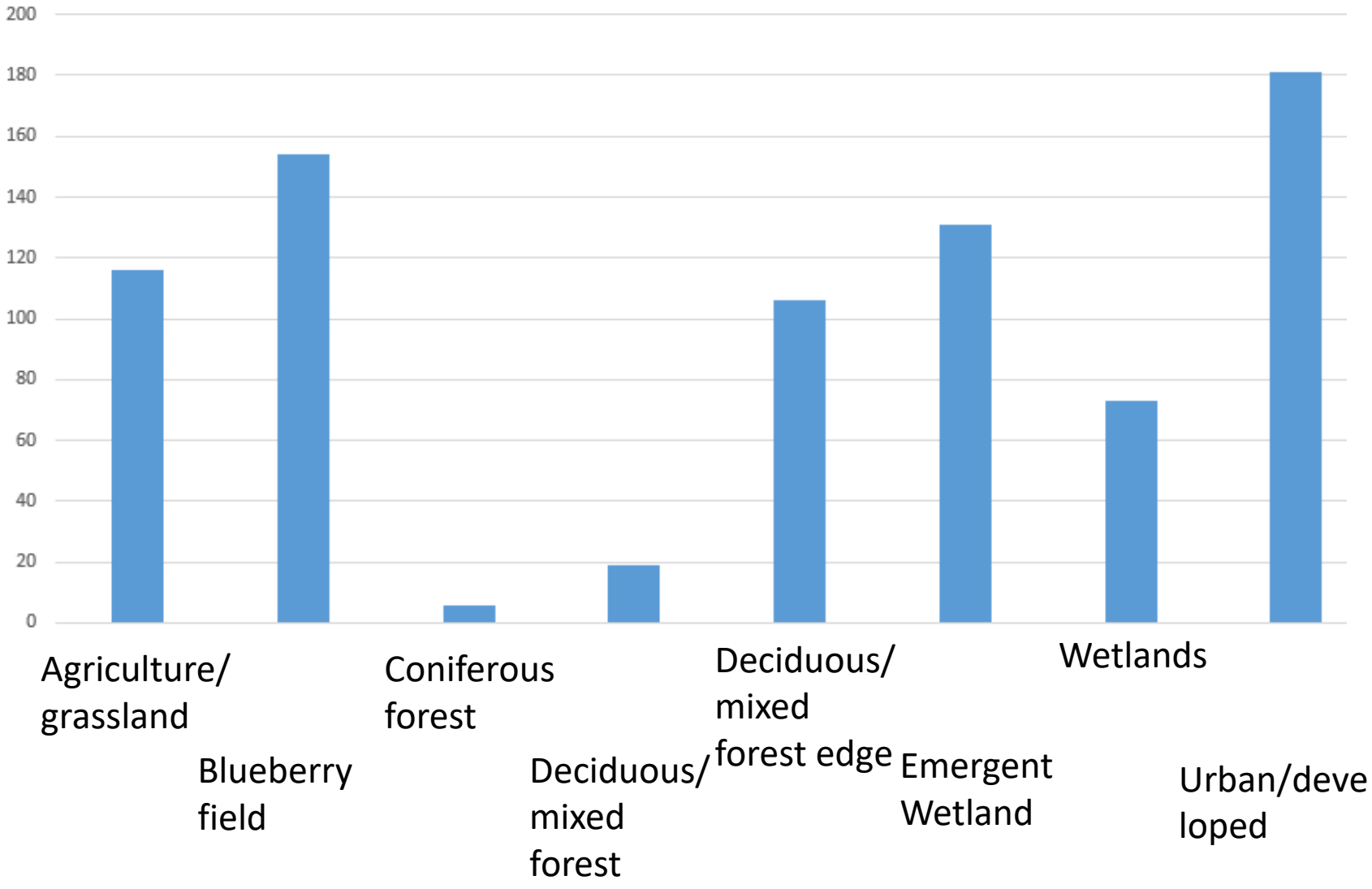


- 786 specimens
- 21 genera
- 94 species

Which bees are most common?



Where are the bees found?



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