

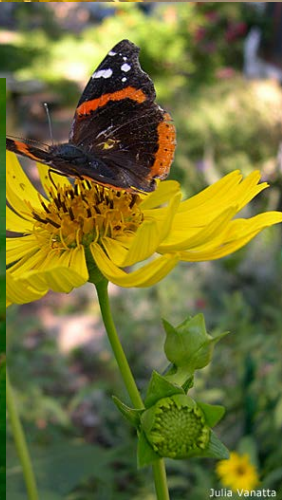
The Status of Maine Native Pollinators



Dr. Frank Drummond
School of Biology and Ecology &
Cooperative Extension
University of Maine

major animal pollinators in Maine ?

- insects
 - bees
 - moths
 - butterflies
 - flies
 - beetles
 - ants and wasps
 - thrips, hemiptera
- hummingbird

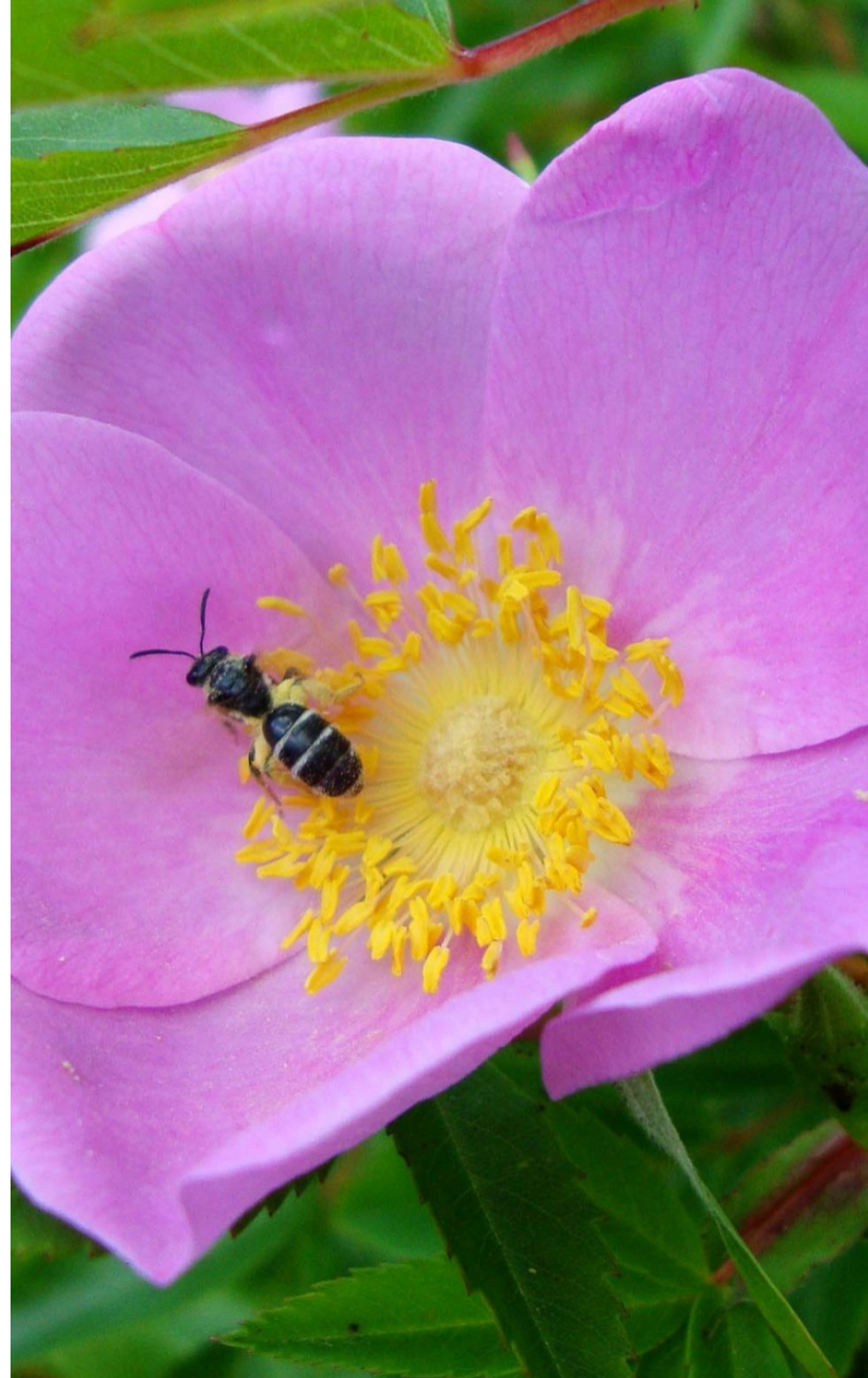


bees & pollination



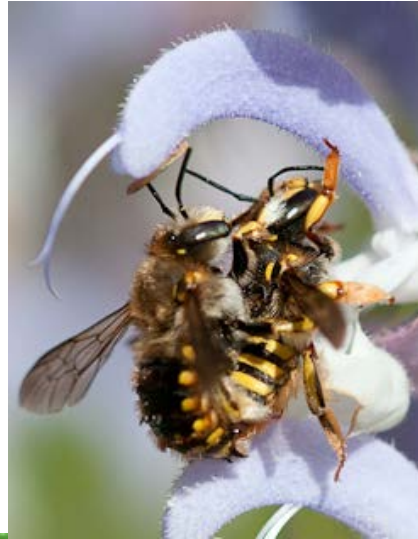
bee diversity

- Worldwide – 20,000 species
- U.S. – 2,500 species
- Florida, Arizona – 700 species
- New York – 450 species
- Maine – 267 species



how are the native bees?

- species declines
- invasives ?
- species shifts
- species rebounds



A. Dibble

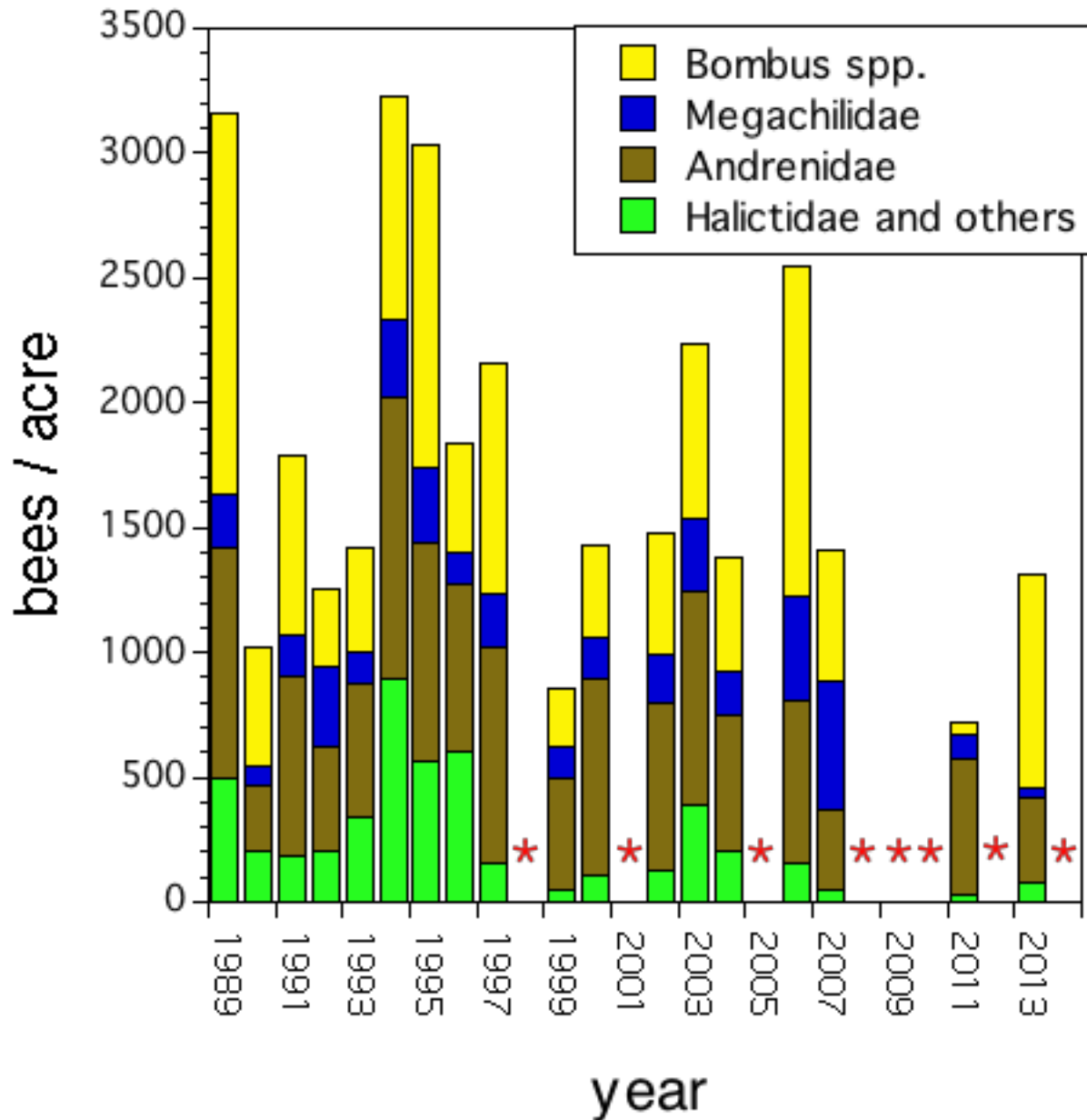
very, very
difficult to
measure !



almost no baseline data

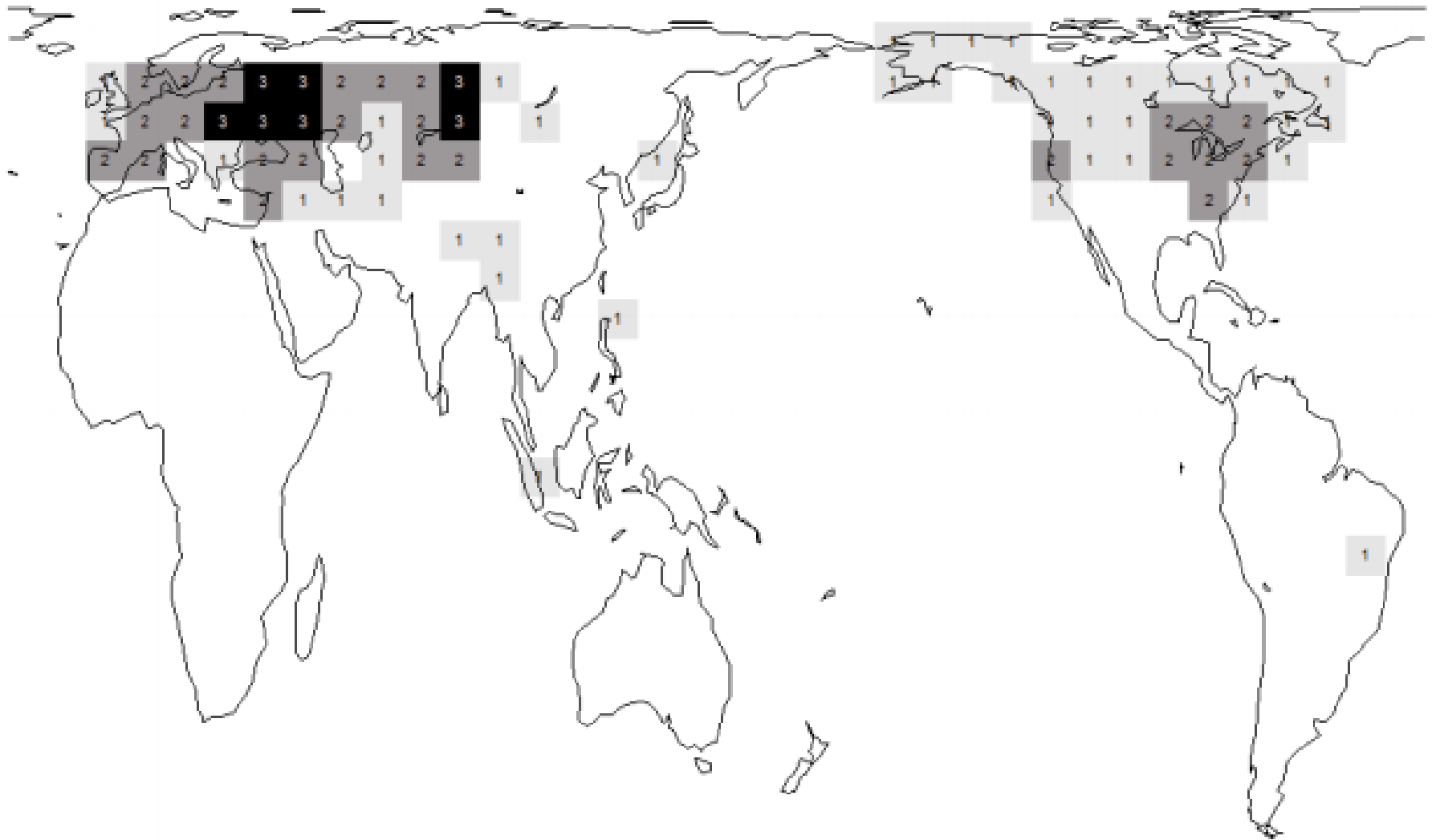
- scattered in space and time (28 surveys all together)
 - first survey in 1861...report to Maine Board of Agric., Packard
 - Mt Desert Island in 1930s...Proctor (1938)
- Blueberry, a little more consistent:
 - 1935-1939, 1962-1965, 1996-1997, 2000-2003, and 2010-2014 series of surveys

another factor that makes it difficult



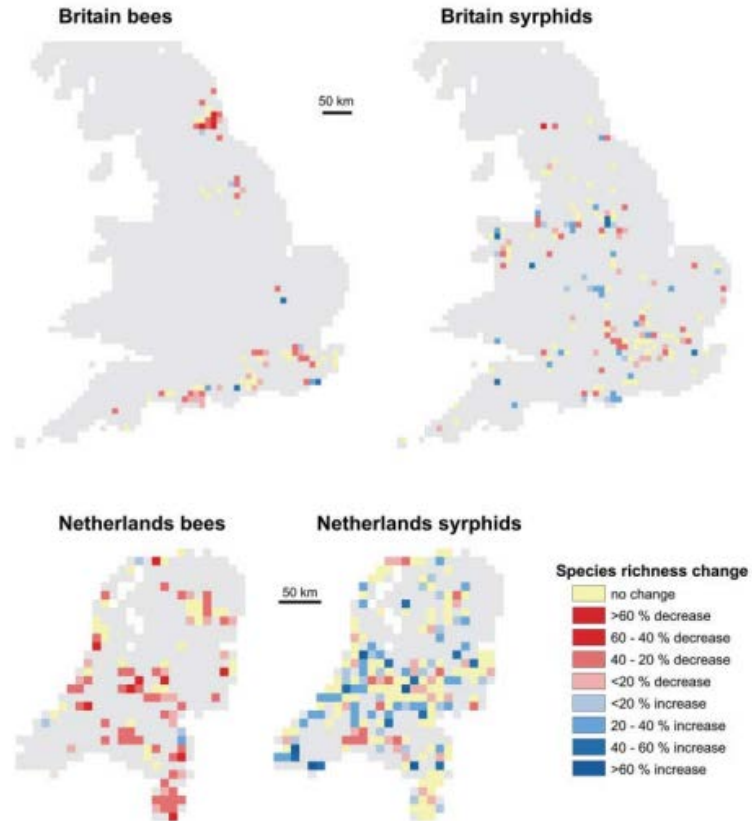
NOW, declines HAVE been documented around the globe





bumble bees are best studied,
but representative of north

Europe has the best foundation for measuring decline



Putting numbers to the pollination crisis

44% of bee
species are
stable

27% of bee
species are
increasing

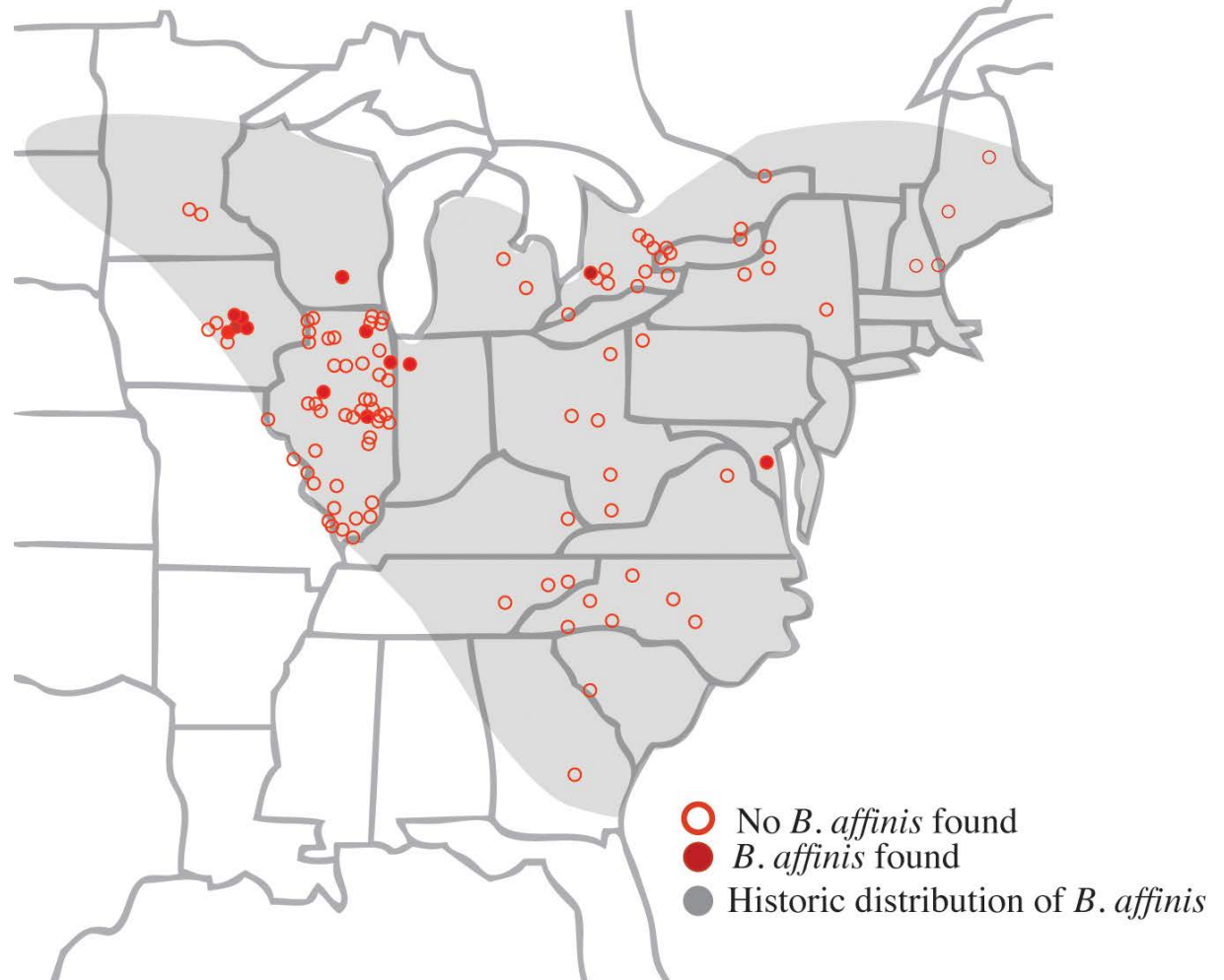
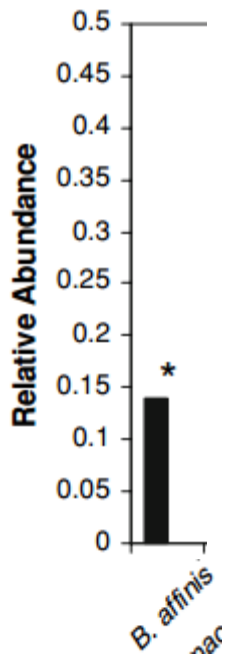


29% of bee
species are
declining

Only 4 out of 187
species analyzed show
dramatic declines

Bartomeus et al 2013 PNAS, In press.

Data reflects relative abundance changes in the northeastern US along the last 100 years



Colla and Packer 2008, images:
Xerces Society, Sam Droege



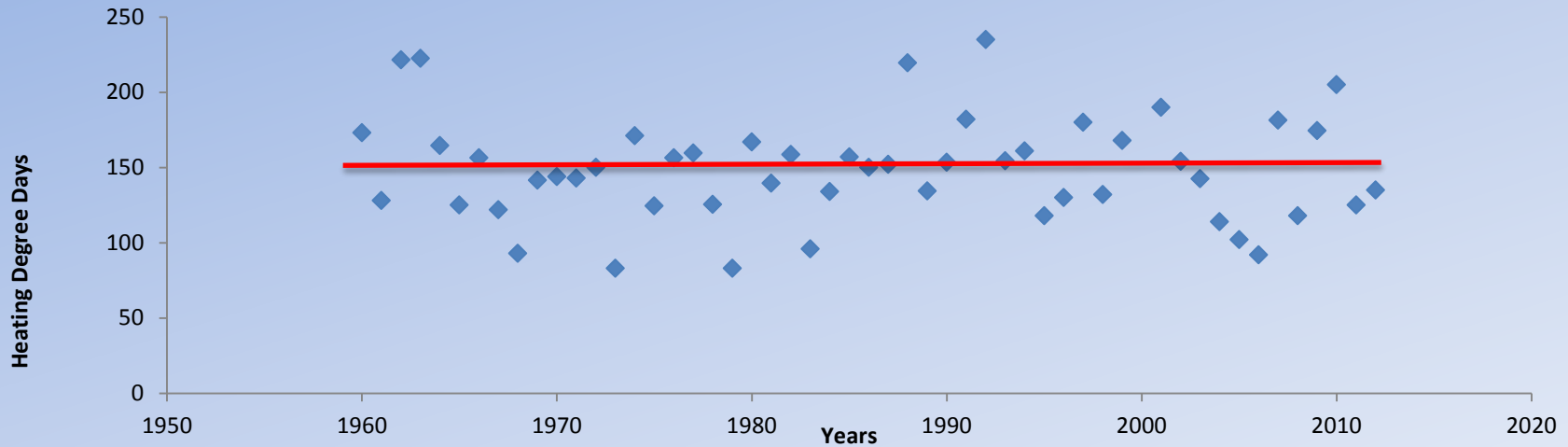
factors affecting declines

- climate change
- habitat fragmentation and shrinking habitat
- PESTICIDES
- pathogens
 - native pathogens and new stressors
 - exotic new pathogens
 - Bombus story
 - Honeybee spillover
- genetic diversity (bees sensitive to inbreeding combined with low genetic diversity due to breeding system)
- exotic bees – competition

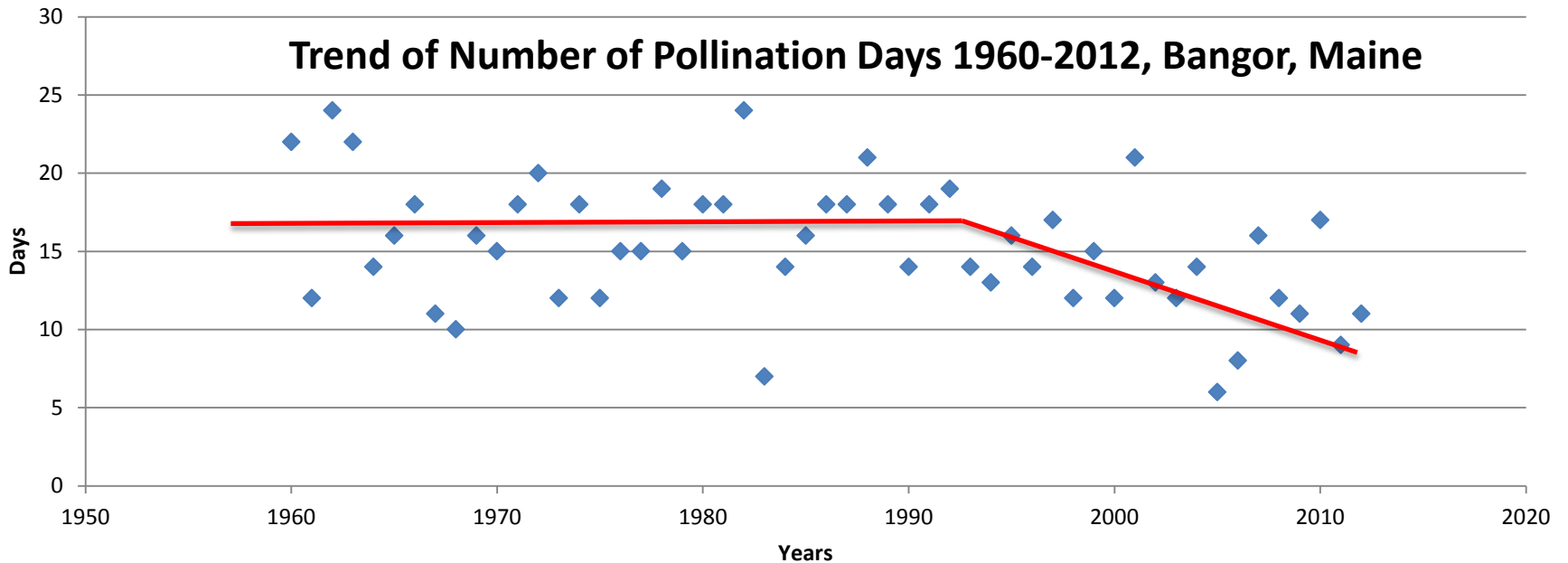
In Maine ?

a changing climate

Trend of Heating Degree Days in Bangor, Maine, 1960 - 2012



Trend of Number of Pollination Days 1960-2012, Bangor, Maine



landscape change ?

Colonization:

Native Americans
To
Early 1800s



Now: 94%

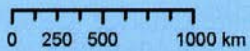


Climate change:

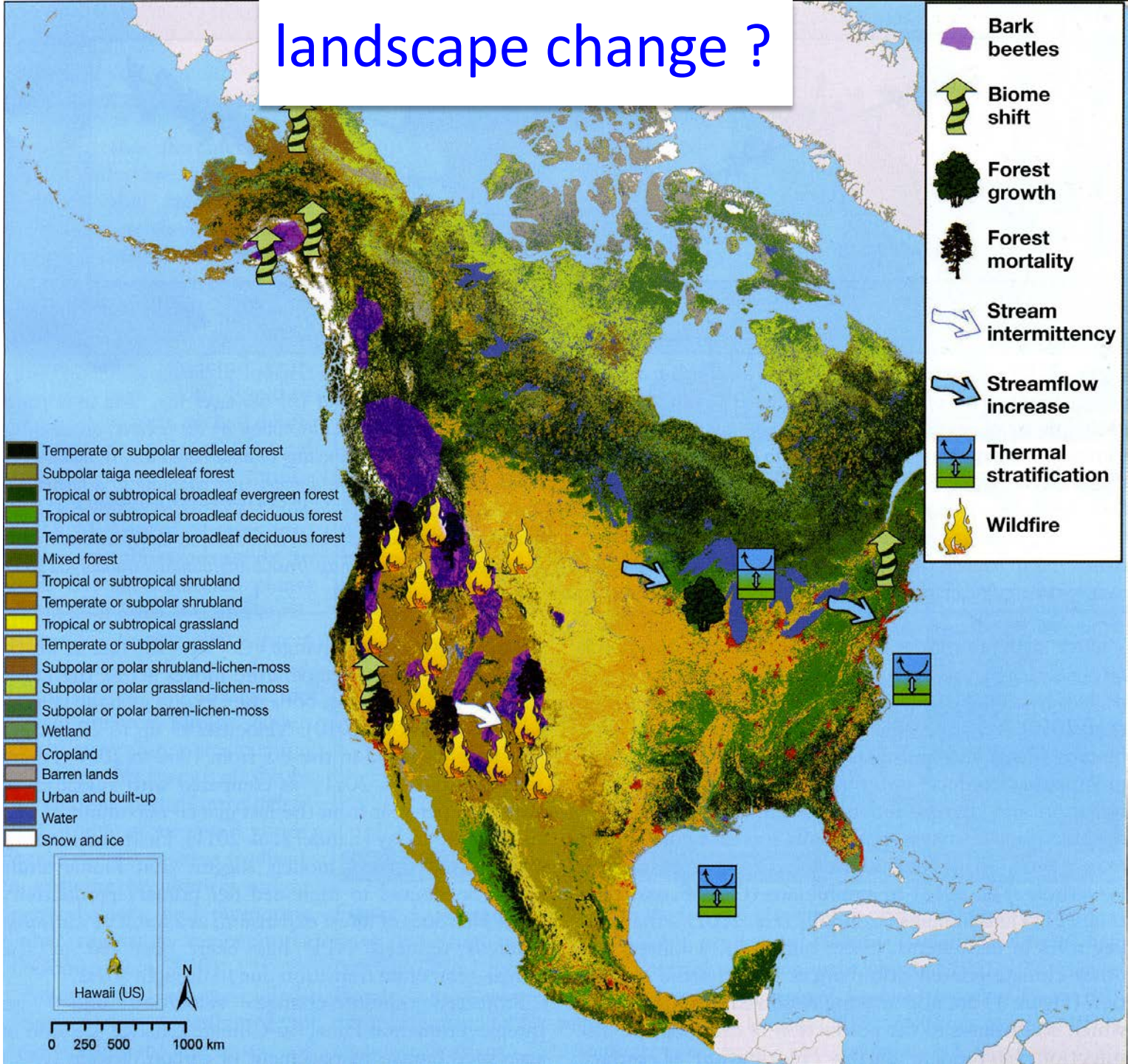
Biome shift



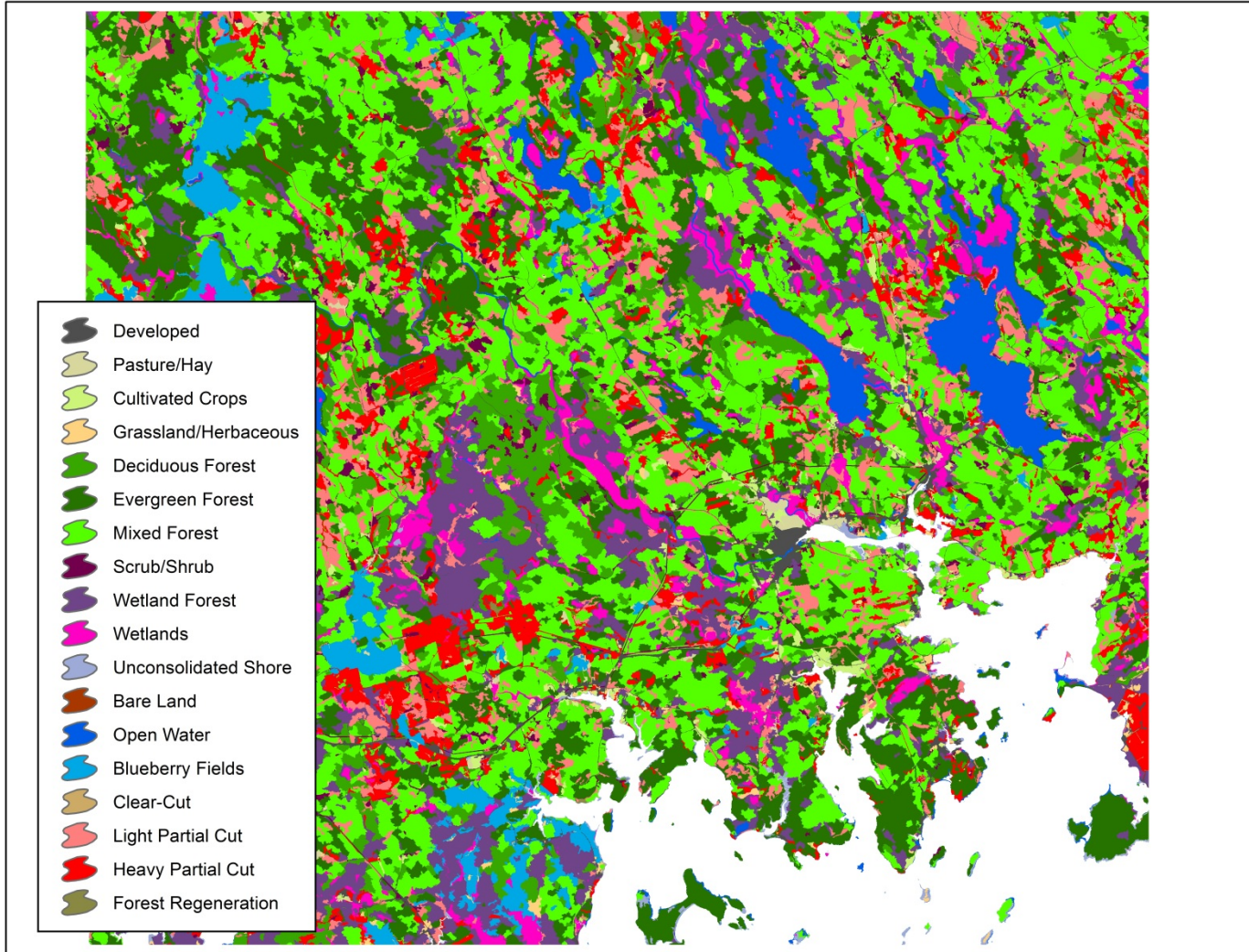
- Temperate or subpolar needleleaf forest
- Subpolar taiga needleleaf forest
- Tropical or subtropical broadleaf evergreen forest
- Tropical or subtropical broadleaf deciduous forest
- Temperate or subpolar broadleaf deciduous forest
- Mixed forest
- Tropical or subtropical shrubland
- Temperate or subpolar shrubland
- Tropical or subtropical grassland
- Temperate or subpolar grassland
- Subpolar or polar shrubland-lichen-moss
- Subpolar or polar grassland-lichen-moss
- Subpolar or polar barren-lichen-moss
- Wetland
- Cropland
- Barren lands
- Urban and built-up
- Water
- Snow and ice



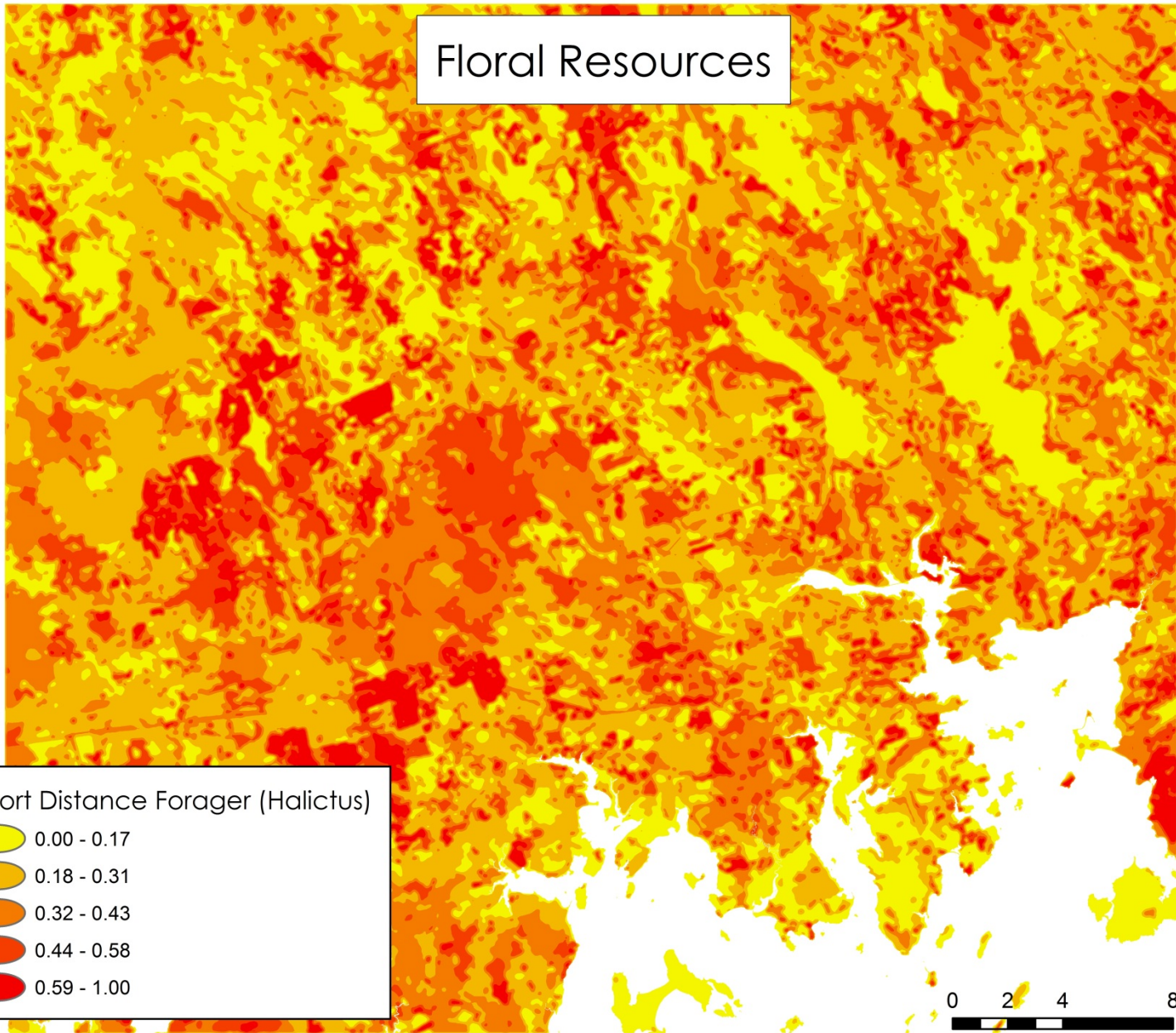
- Bark beetles
- Biome shift
- Forest growth
- Forest mortality
- Stream intermittency
- Streamflow increase
- Thermal stratification
- Wildfire



landcover



Floral Resources

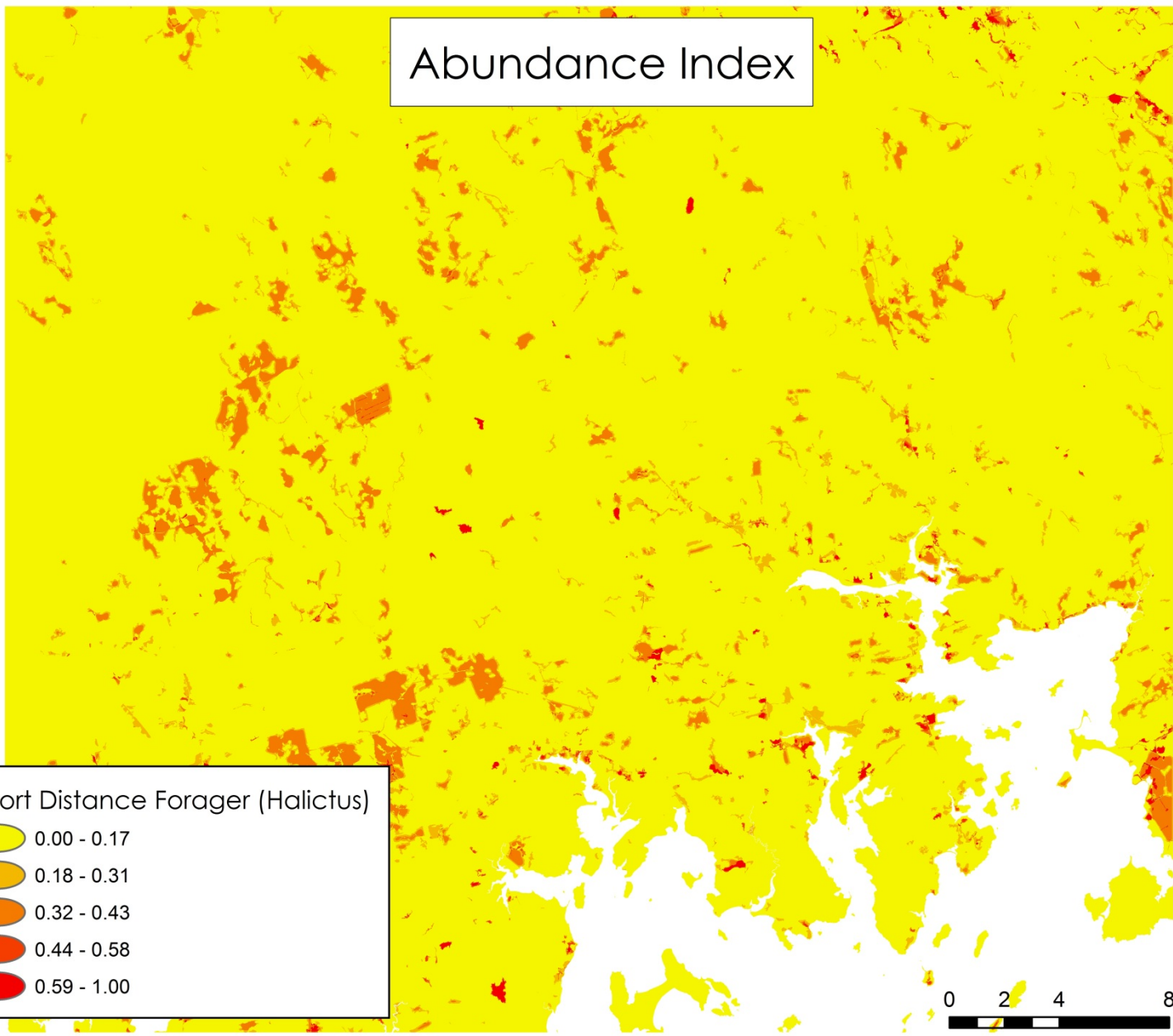


Short Distance Forager (Halictus)

- 0.00 - 0.17
- 0.18 - 0.31
- 0.32 - 0.43
- 0.44 - 0.58
- 0.59 - 1.00

0 2 4 8 Kilometers

Abundance Index



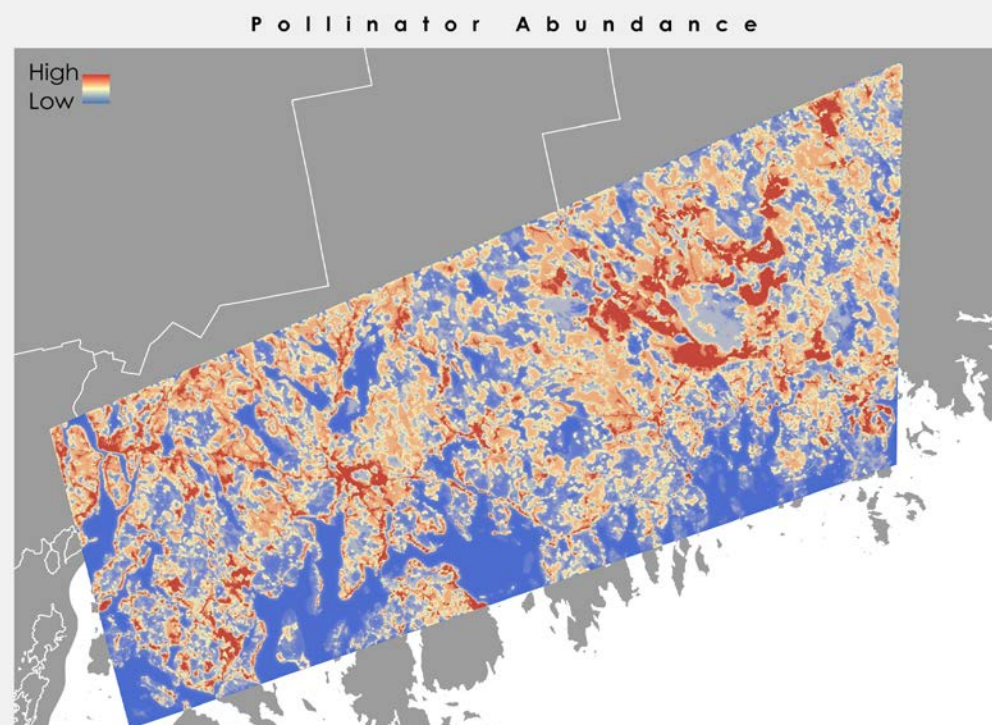
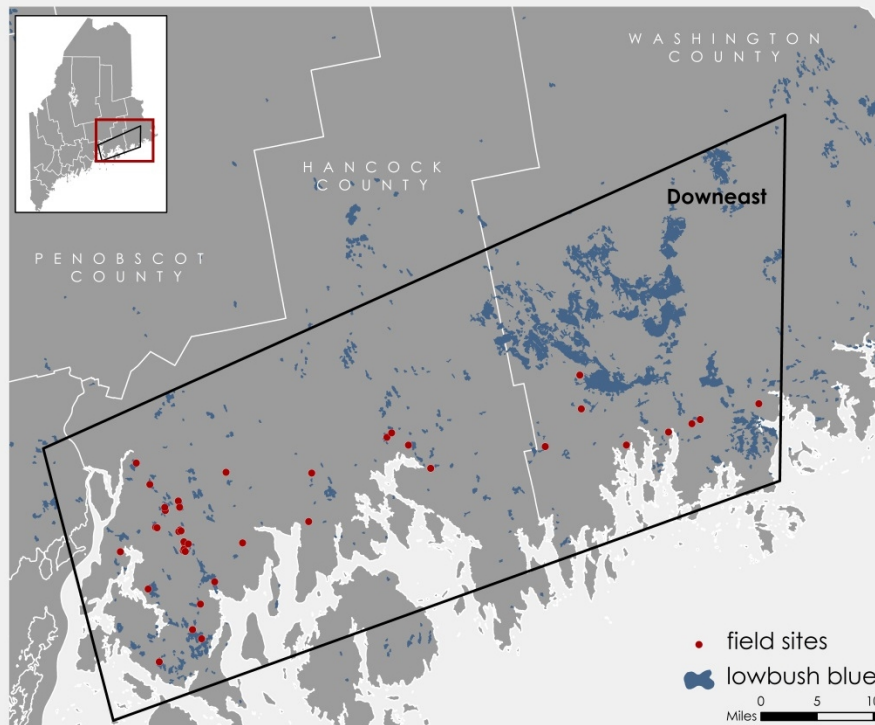
Short Distance Forager (Halictus)

- 0.00 - 0.17
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- 0.59 - 1.00

0 2 4 8 Kilometers

landscape fragmentation

- 94% forested !!!!
 - Conifer forest = POOR
 - Contiguous conventional blueberry = POOR
 - Deciduous forest edge = GOOD
 - Wetland = MODERATE
 - Old field and recent clearcut = GOOD



bee pasture as a solution

- How to design?
 - Season long coverage
 - Many species overlapping as bee species have different preferences, abilities, and nutritional needs
 - NO PESTICIDES

Developing a Seed Mix

H: Wild bees prefer the “Wildflower Mix” treatment



Common Name	Species
Annuals	
Plains Coreopsis	<i>Coreopsis tinctoria</i>
Indian Blanket	<i>Gaillardia pulchella</i>
Sunflower	<i>Helianthus annuus</i>
Perennials	
Lavender Hyssop	<i>Agastache foeniculum</i>
Lance-Lvd. Coreopsis	<i>Coreopsis lanceolata</i>
Canada Tick Trefoil	<i>Desmodium canadense</i>
Purple Coneflower	<i>Echinacea purpurea</i>
Common Boneset	<i>Eupatorium perfoliatum</i>
Bergamot	<i>Monarda fistulosa</i>
New-England Aster	<i>Symphyotrichum novae-angliae</i>



Natural Regeneration

Wildflower

Clover

pesticides

bumble bees in Maine

Kalyn Bickerman

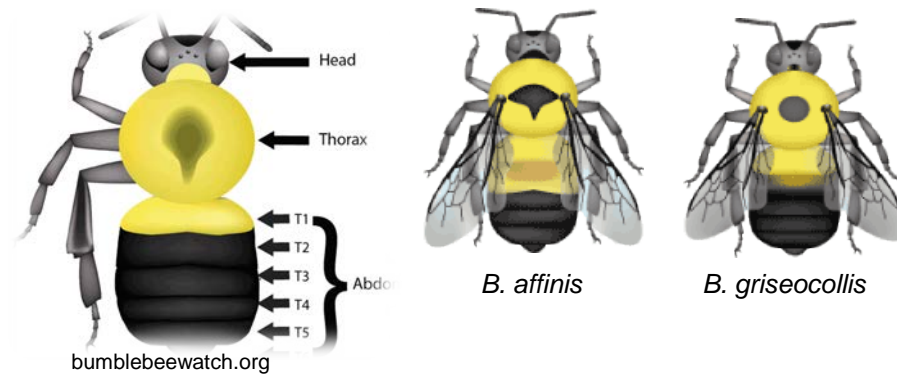
PhD Student

University of Maine School of Biology and
Ecology

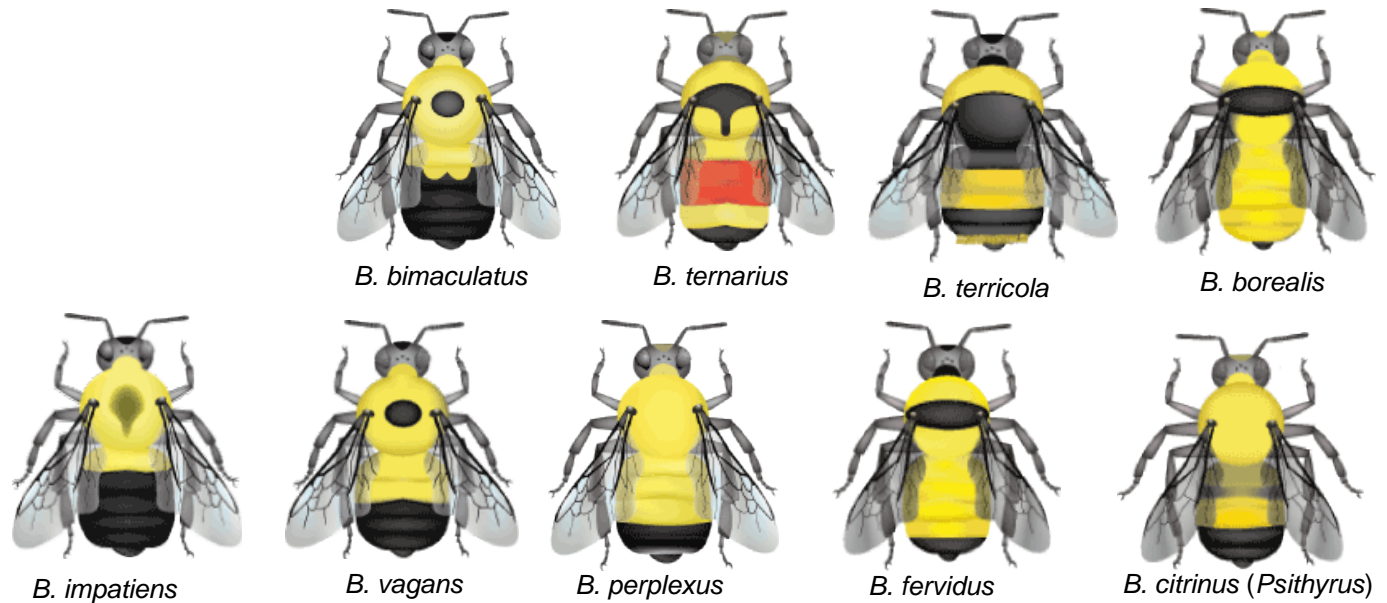


bumble bee species

- 250 species worldwide, 17 in Maine

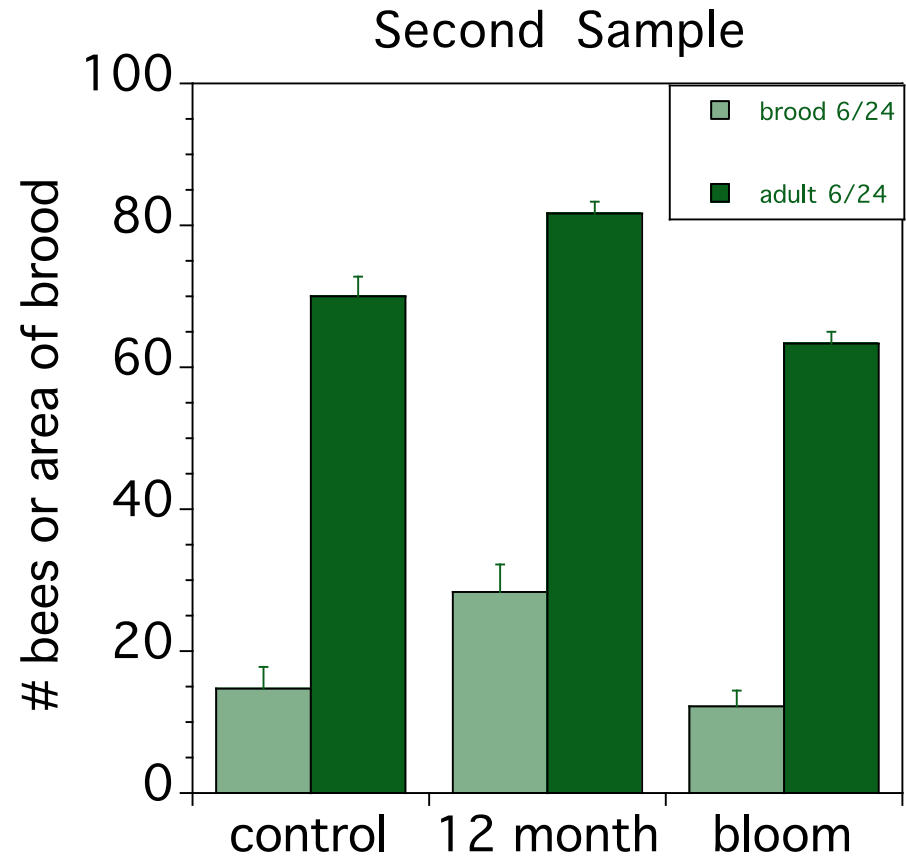
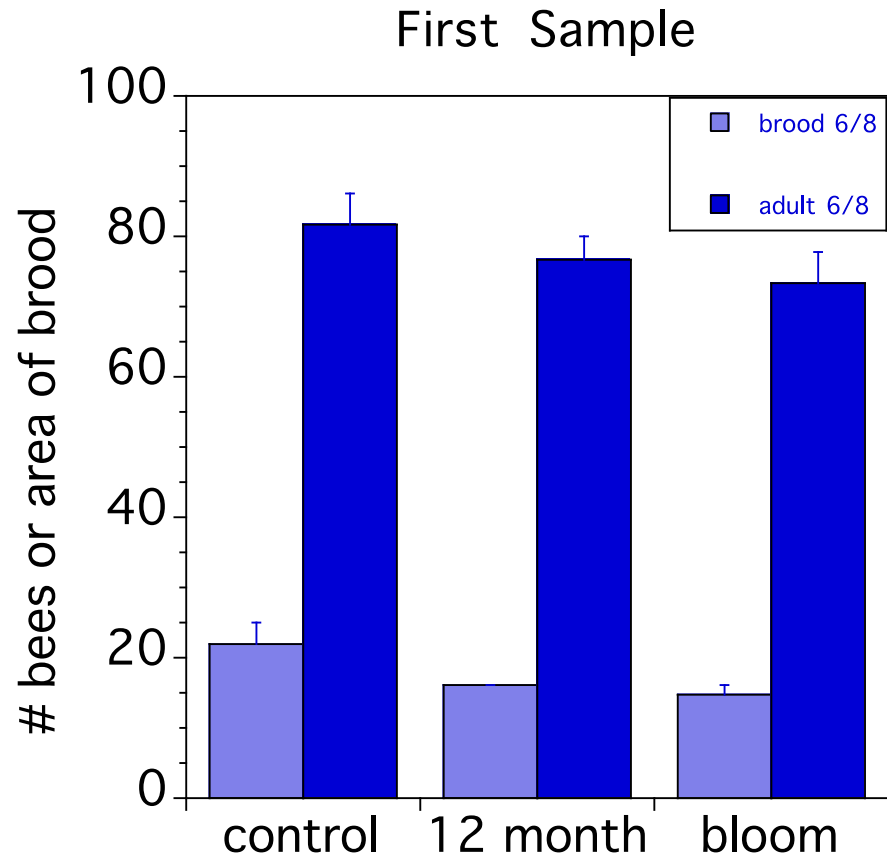


Cameron et al. 2007

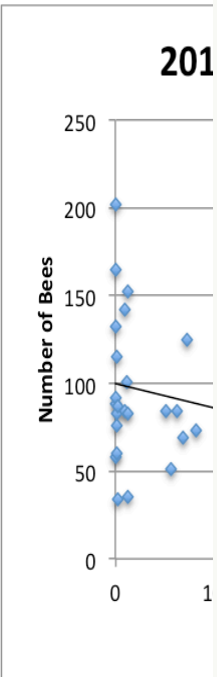




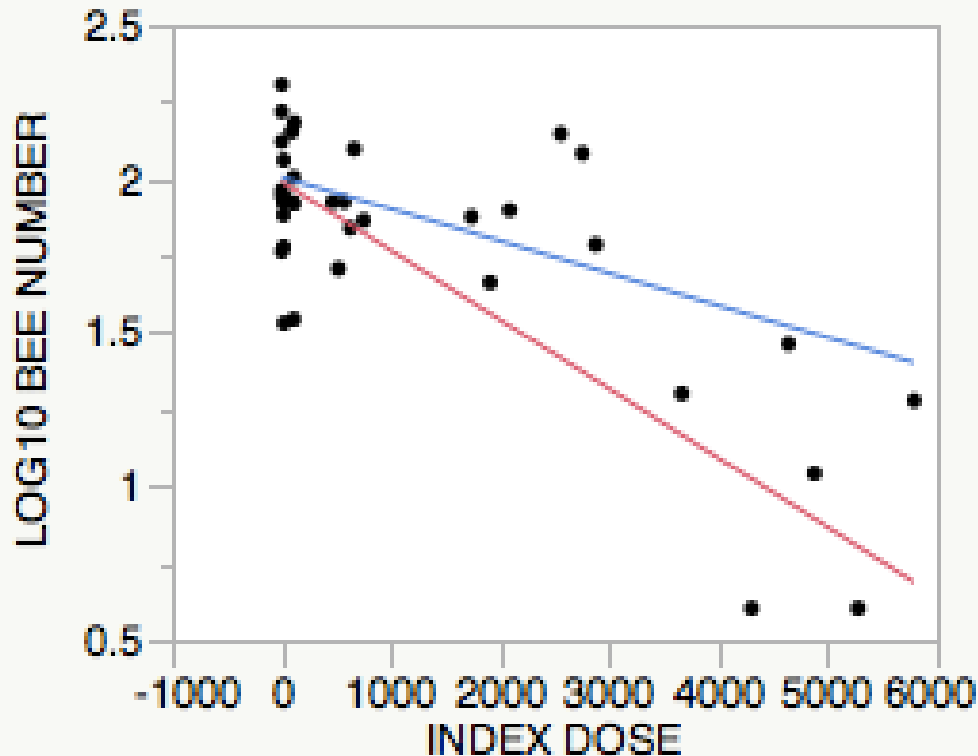
results from professor in 2009



bumble bees and imidacloprid revisited (2013 & 2014)

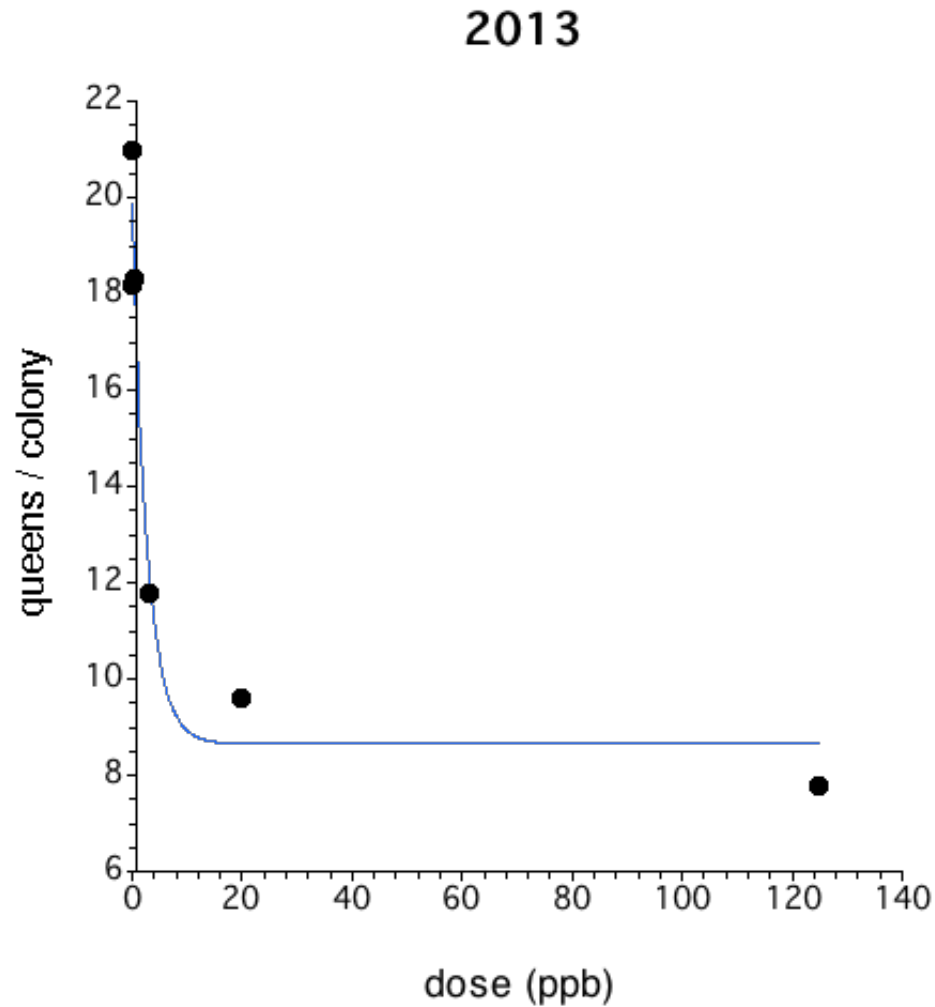


Regression Plot



4000

relevance to bee colony size ?



nest sites for leafcutter bees



Dead wood with
spruce beetle exit
holes – leave a tree
where it died

bundle of
perennial
stem
sections



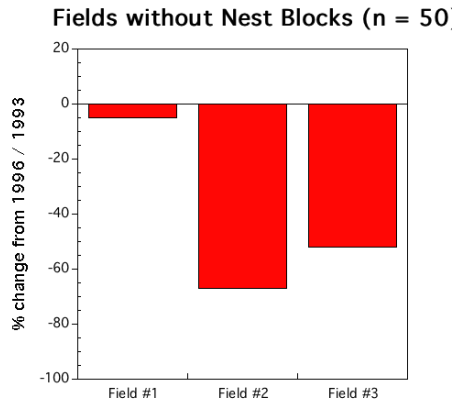
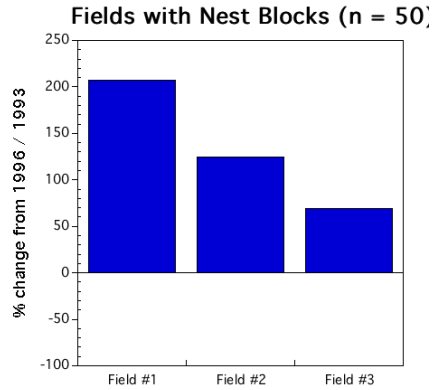
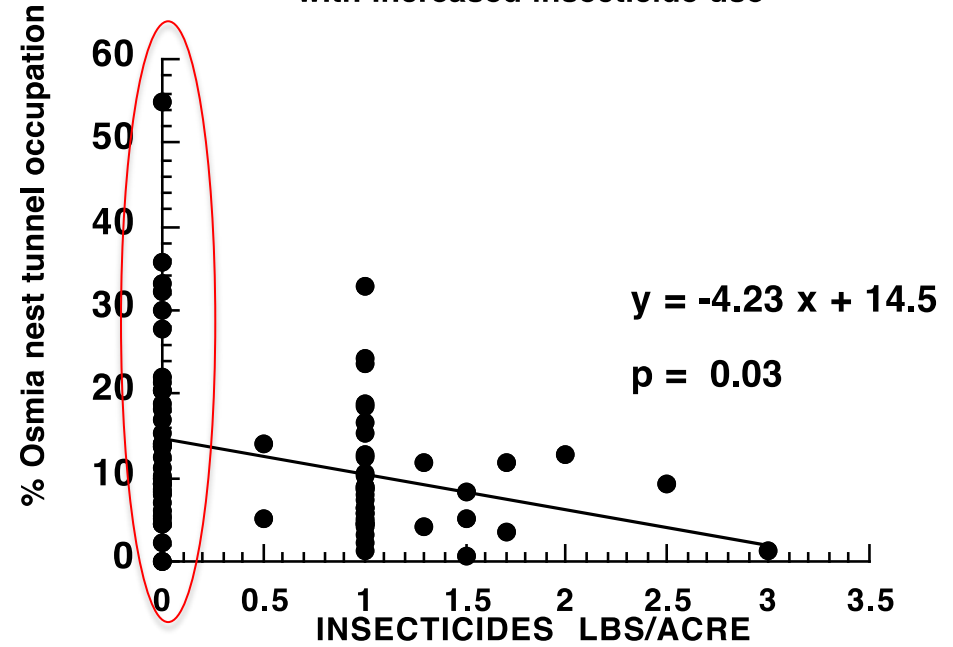
wooden nest
block --
holes of
several
diameters, 6-
7 inches
long



leafcutting bees

Osmia atriventris

Figure 1. *Osmia* nesting declines with increased insecticide use



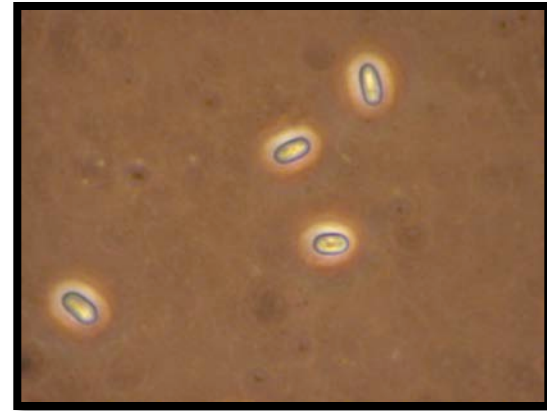
pathogens

- native
- exotic ... aka SPILLOVER

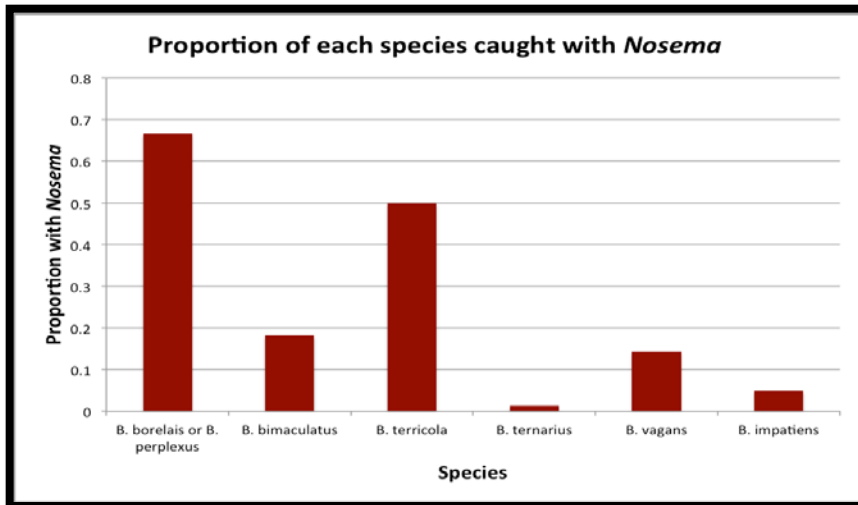


Nosema bombi ?

- Fungal pathogen
- Spread through spores
- Prevalence species-dependent



N. Bombi spores, 1000X. Bickerman, 2012



Bickerman and Drummond, unpublished data

No effect - commercial bumble bees
Bushmann et al. (2013)

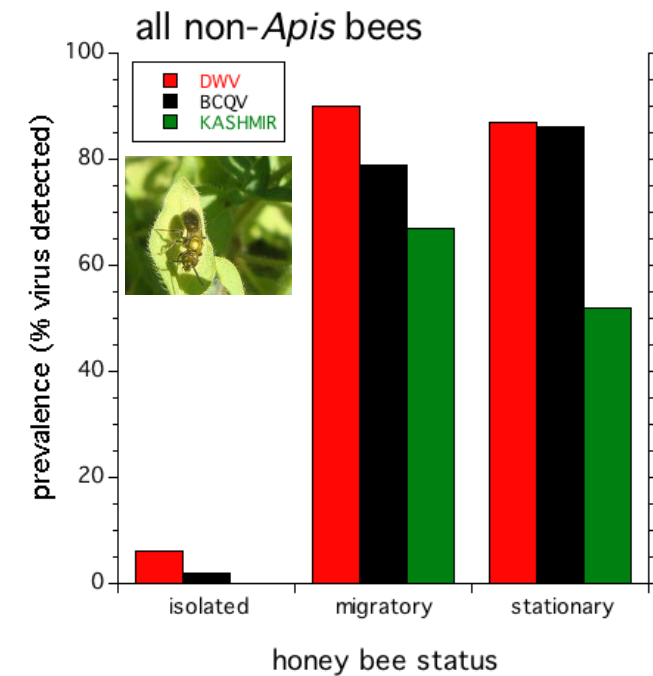
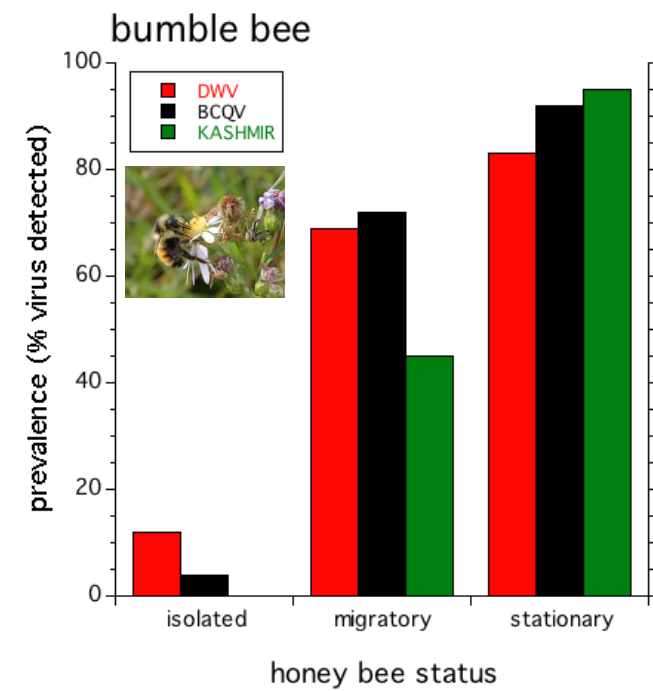
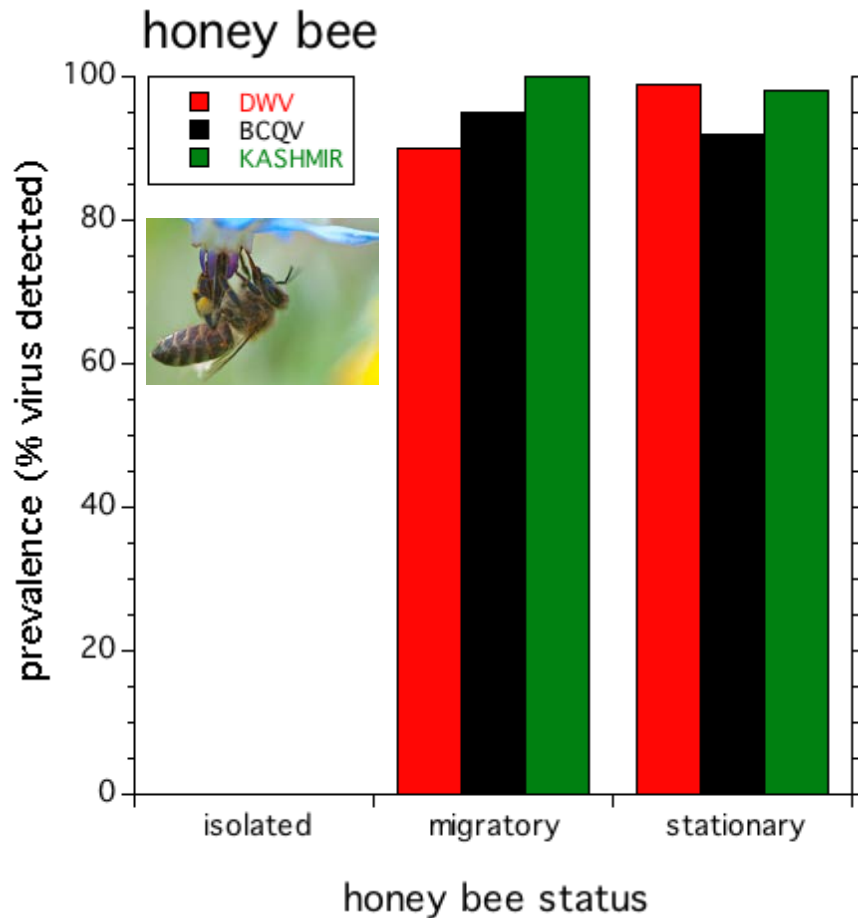
spill-over of pathogens from honey bees to native bees?

Table 5. Percentage of virus-positive *Bombus* sampled from flowers in the vicinity of Stationary Apiaries in Maine, Minnesota, and Washington. Samples were taken in July/August 2010. DWV = Deformed wing virus and BQCV = Black queen shared *Bombus* cell virus.

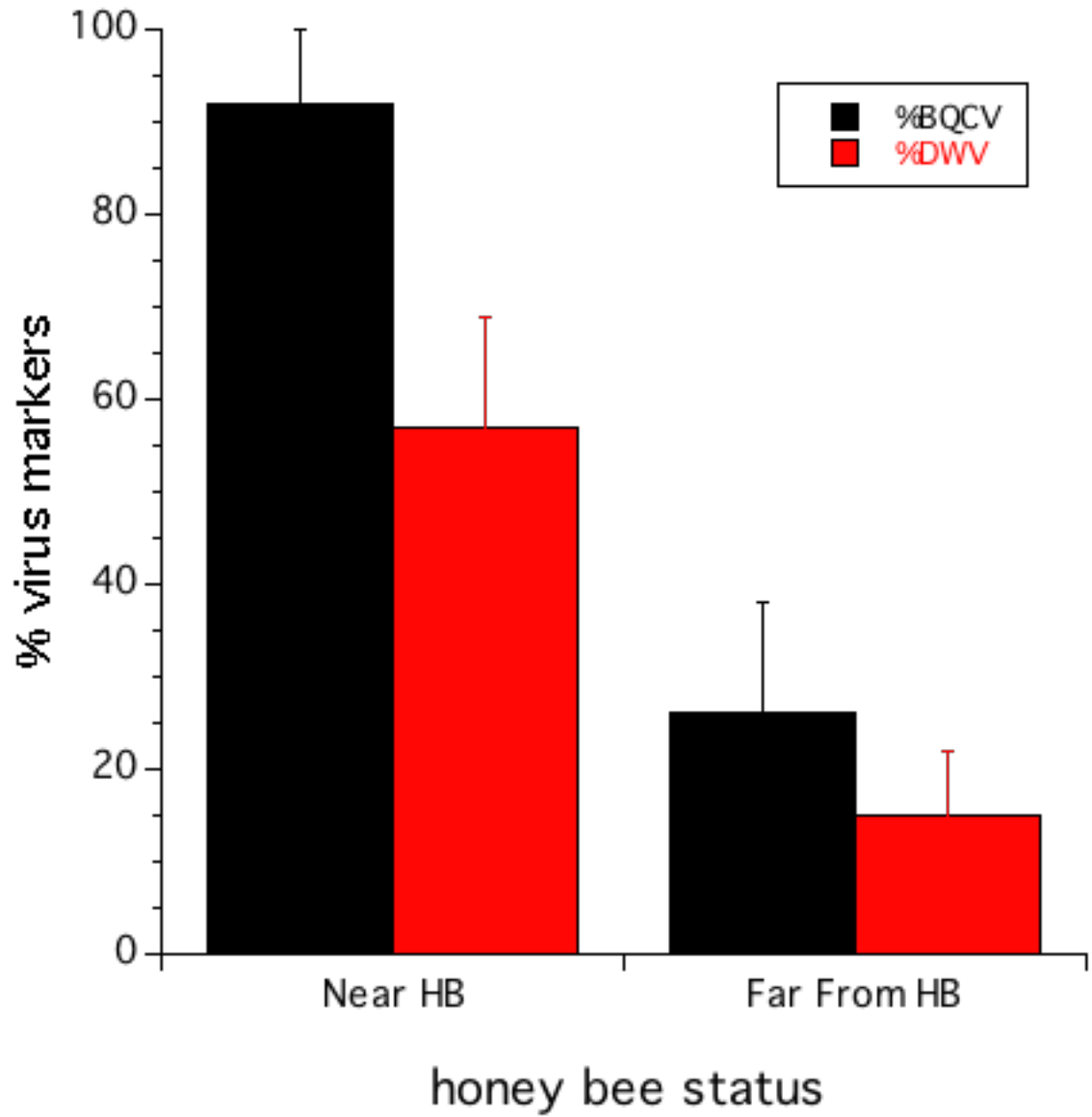
Apiary and Species	n	Single infection	Single infection	Dual infection
		DWV	BQCV	DWV + BQCV
MAINE				
<i>Bombus ternarius</i>	26	73.1	38.5	30.7
<i>Bombus vagans</i>	5	80.0	40.0	20.0
<i>Bombus</i> spp.	8	87.5	62.5	62.5
Mean		79.4	43.6	35.9
MINNESOTA				
<i>Bombus bimaculatus</i>	5	20.0	40.0	20.0
<i>Bombus impatiens</i>	7	85.7	85.7	71.4
<i>Bombus vagans</i>	5	80.0	100	80.0
Mean		64.7	76.5	58.8
WASHINGTON				
<i>Bombus mixtus</i>	11	81.8	90.9	72.7
<i>Bombus</i> spp.	18	72.2	94.4	72.2
Mean		75.9	93.1	72.5



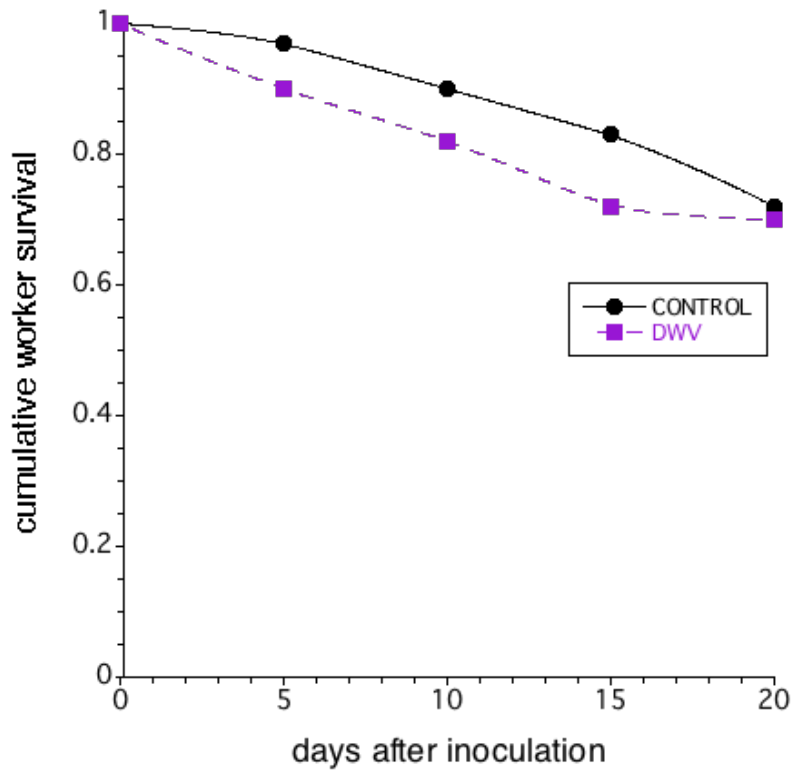
pathogen spill-over?



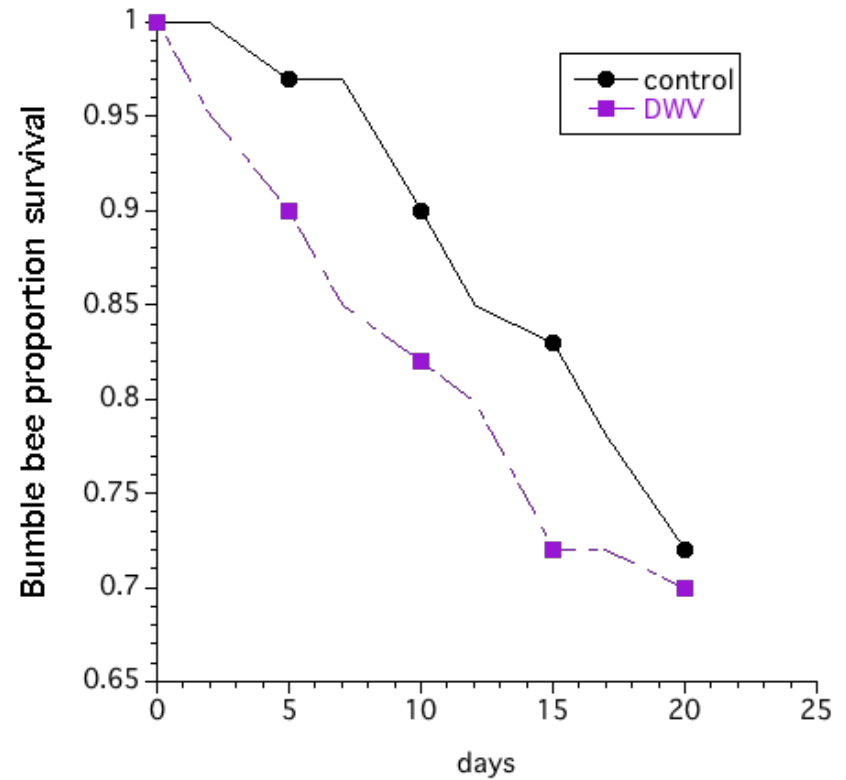
Washington Co 2013



Furst et al. 2014



Furst et al. 2014



Yes, this is statistically significant,

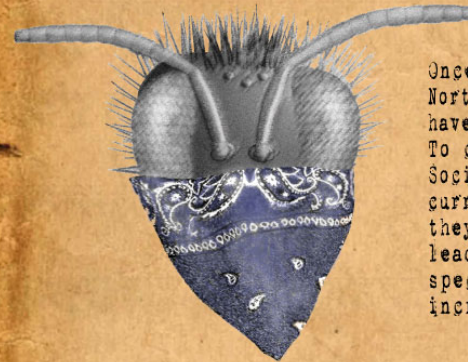
BUT....

the decline of the yellow banded bumble bee in Maine



WANTED

FOR POLLINATION OF CROPS AND WILDFLOWERS



Once common through most of Eastern North America, *Bombus terricola* numbers have steeply declined in recent years. To conserve *B. terricola*, the Xerces Society is documenting the former and current ranges of this bumble bee and they need your help. Any information leading to the conservation of this species will be duly rewarded with increased food security.

YELLOW BANDED BUMBLE BEE A.K.A. BOMBUS TERRICOLA

NOT TO BE CONFUSED WITH
BOMBUS PENSYLVANICUS OR BOMBUS AURICOMUS

Bombus terricola workers have black on the last three abdominal segments with a fringe of brownish yellow hairs near the tip of the abdomen.

B. pensylvanicus and *B. auricomus* have black only on the last two abdominal segments. Also, *B. terricola* workers have lighter colored wings, shorter faces, and tend to be smaller than *B. pensylvanicus* and *B. auricomus* workers.



Bombus terricola



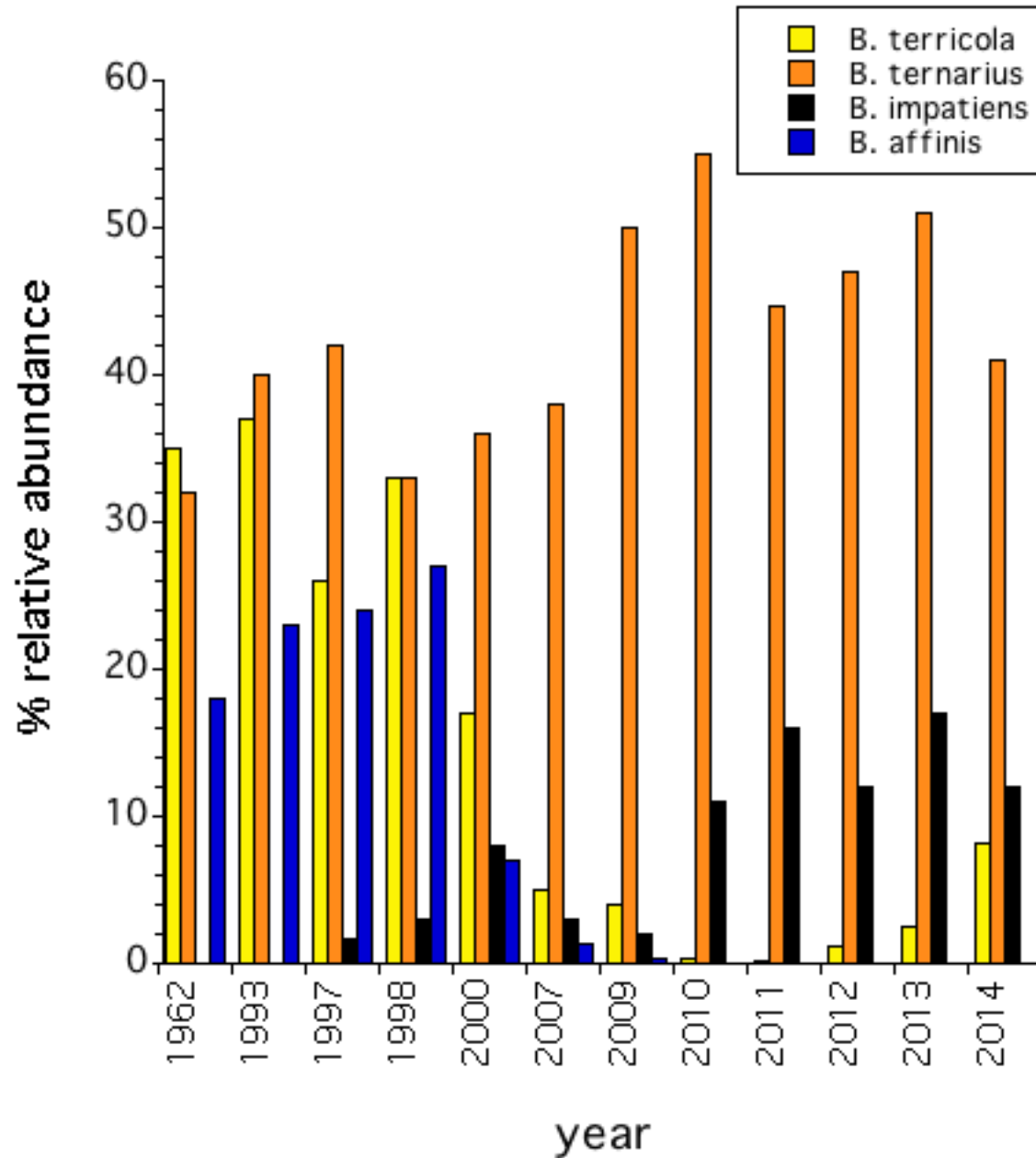
Bombus pensylvanicus



Bombus auricomus

If you have seen *Bombus terricola* please contact info@xerces.org
For more information on bumble bees in decline please visit www.xerces.org/bumblebees

historical trends in Maine



2013 survey for the yellow banded bumble bee, *Bombus terricola*

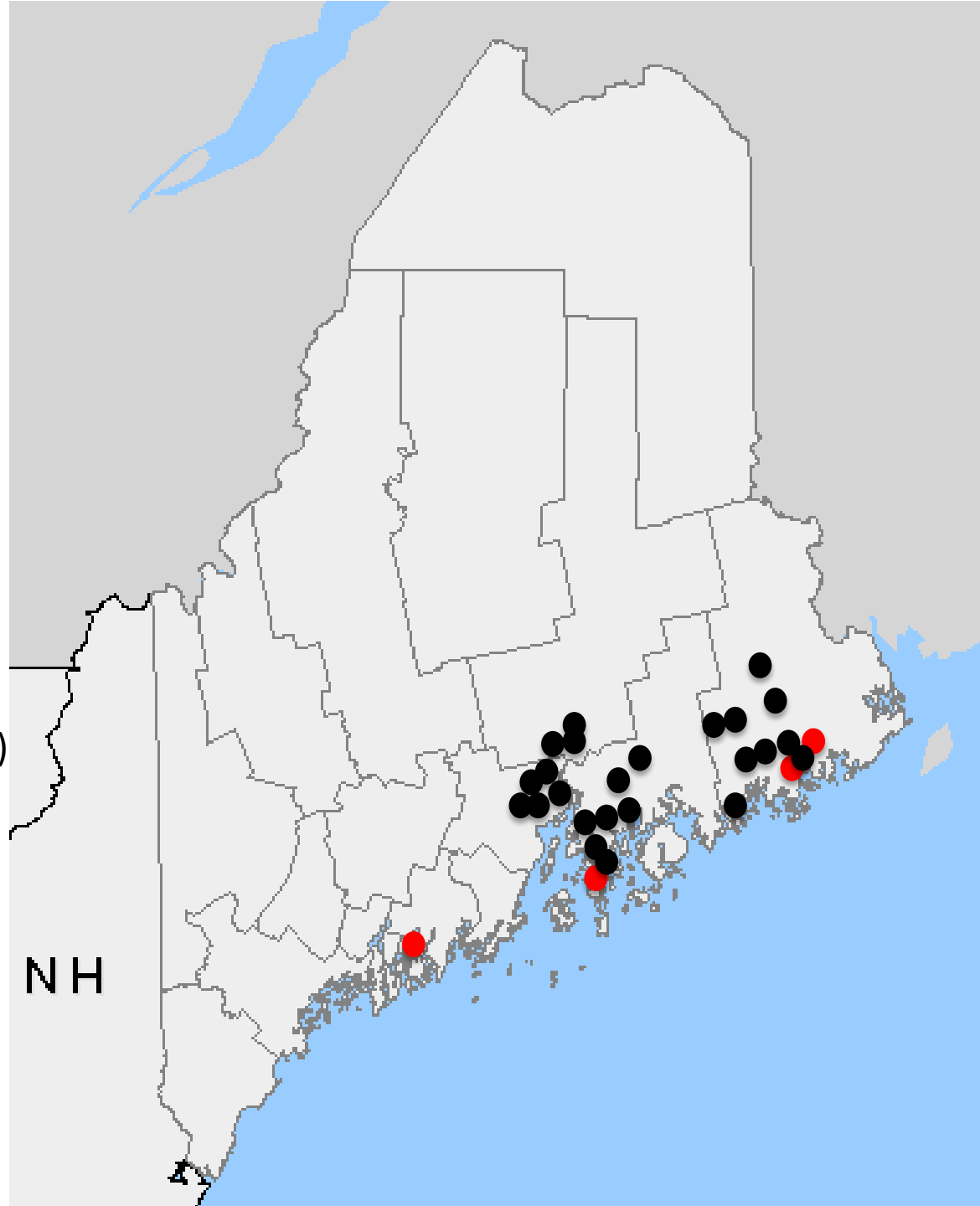
● Observed and confirmed

● **NOT** observed

1. survey sites in Maine and
New Brunswick (n=29 confirmed)

2. percent occurrence = 13.8 % (n=29)

3. relative abundance = 2.4% (n=18),
compared to 1-2% from 2009-2012.



2014 survey for the yellow banded bumble bee, *Bombus terricola*

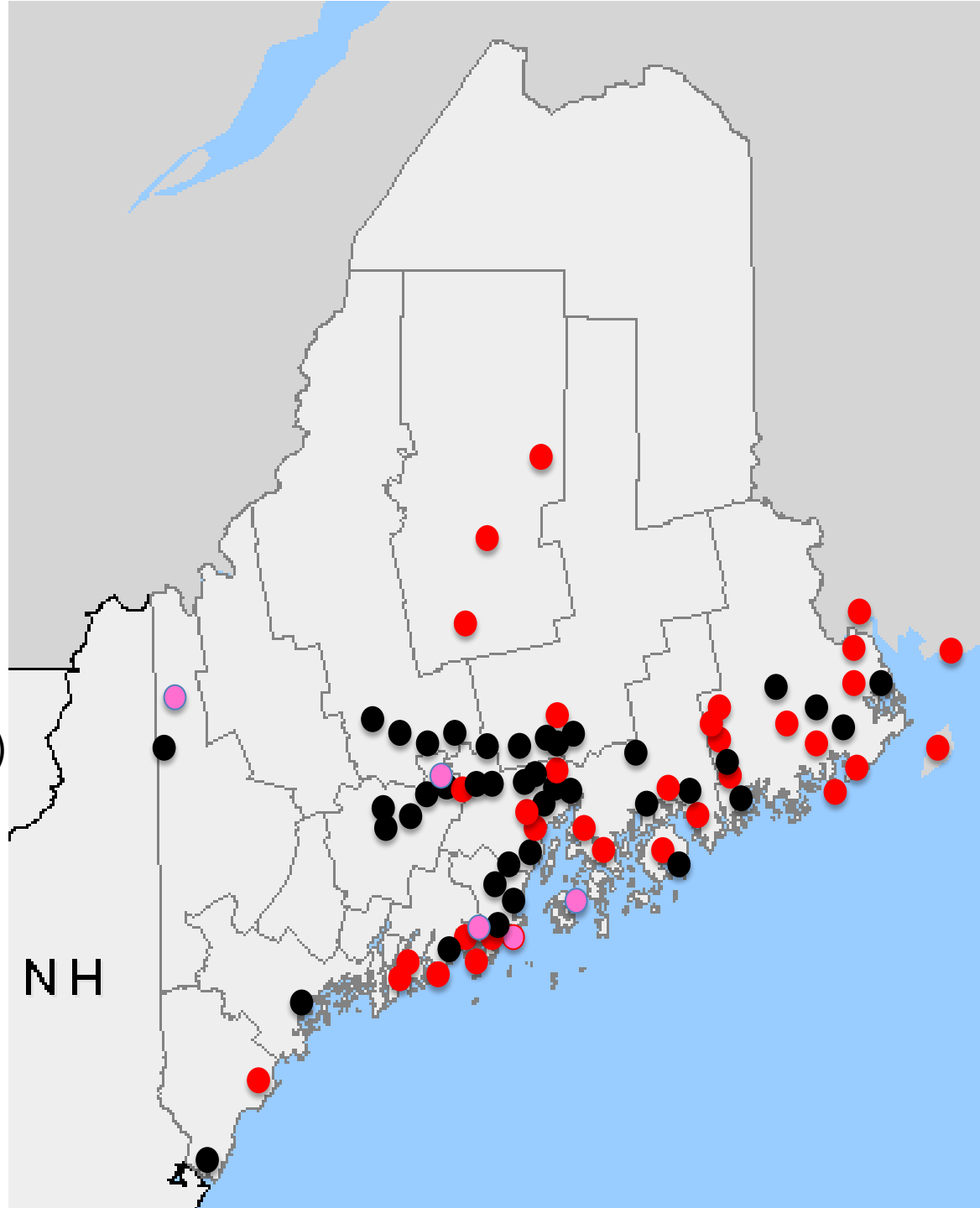
- Observed and confirmed
- Reported, but **NOT** confirmed
- **NOT** observed

1. survey sites in Maine and
New Brunswick (n=87 confirmed)

2. percent occurrence = 49.4 % (n=87)
0% in NH 2014 survey (9 locations,
n = 1349 bees collected, Rehan data)

3. relative abundance = 7.4% (n=18),
compared to 1-2% from 2009-2013.

4. occurrence vs *Bombus* richness, ns
($P = 0.13$, n=18)



so what is the status of native bees ?

1. Some are increasing, some decreasing, some appear to be at an oscillatory stability
2. But, the environment and habitats are changing ... bad news for some, good news for some
3. The pesticide environment can detrimentally affect some bees, but not necessarily all
4. Pathogens may play into native bee community health...time will tell

Under uncertainty, I believe erring on the side of caution
Is a good strategy



what YOU can do

- **TRY to enhance population growth of bees !**
 - **Minimize pesticide** use around the home
 - **Plant** pollinator gardens for bee food

what YOU can do

- *Help the research effort !*
 - Bumble bee survey just funded – need citizen scientists – **collection of bumble bees and their plants throughout Maine**
 - Pesticide exposure study – using honey bees to sample the environment – **pollen trapping**

And let's not demonize
a truly wonderful animal,
the honeybee

