STONE ENVIRONMENTAL

Decline and Conservation of the Rusty-Patched Bumble Bee (*Bombus affinis*)

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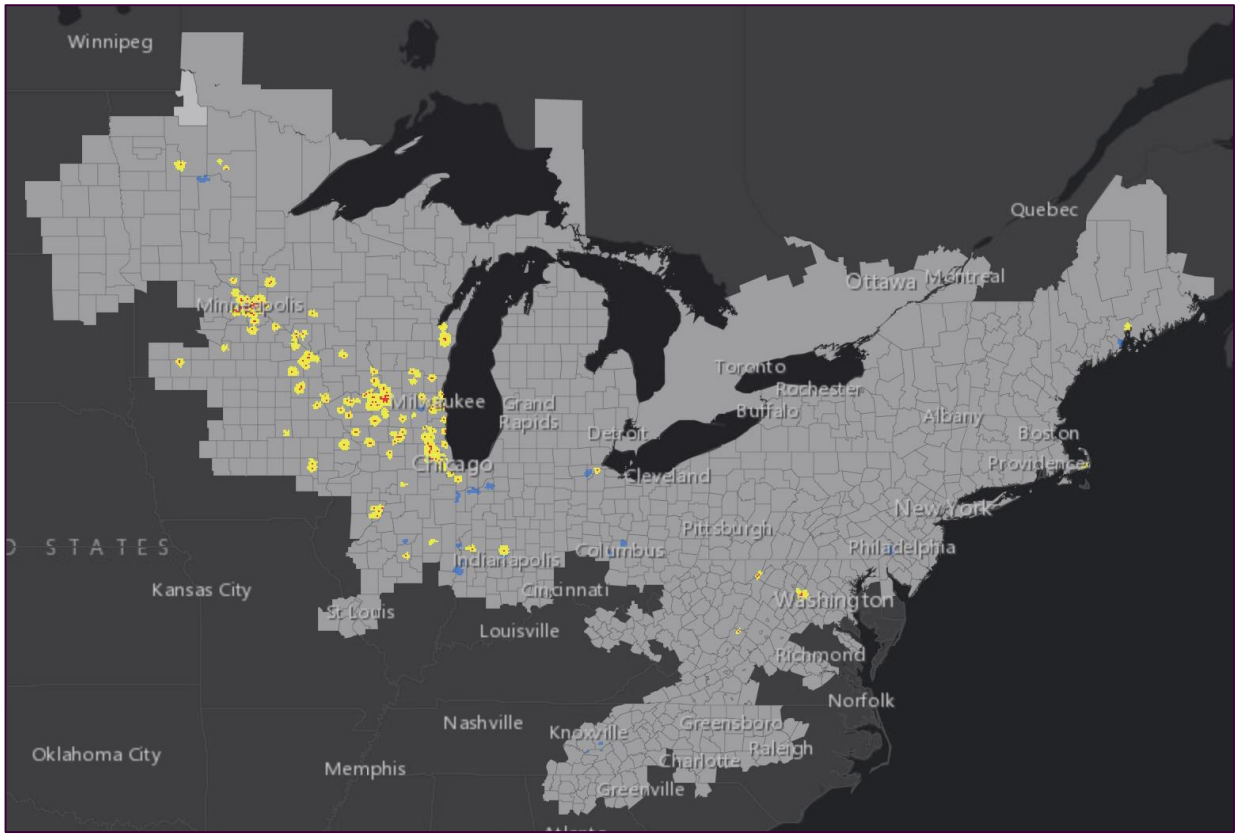
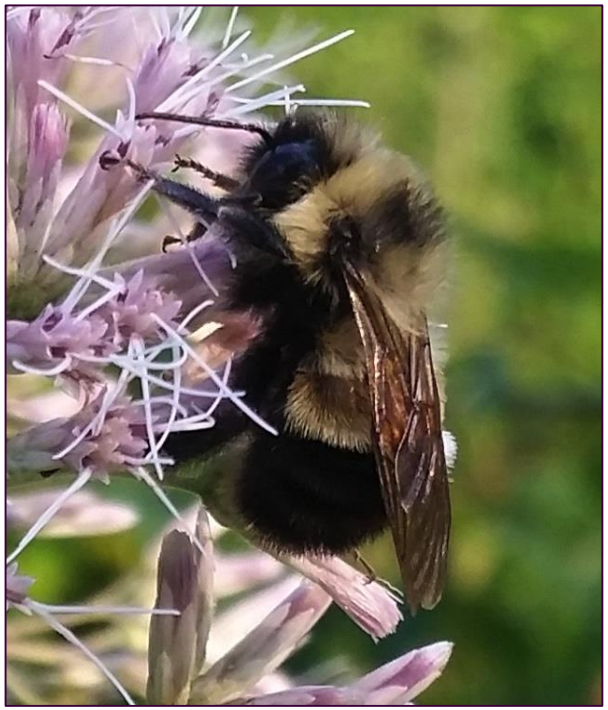
April 15, 2018

Rusty-Patched Bumble Bee (*Bombus affinis*)

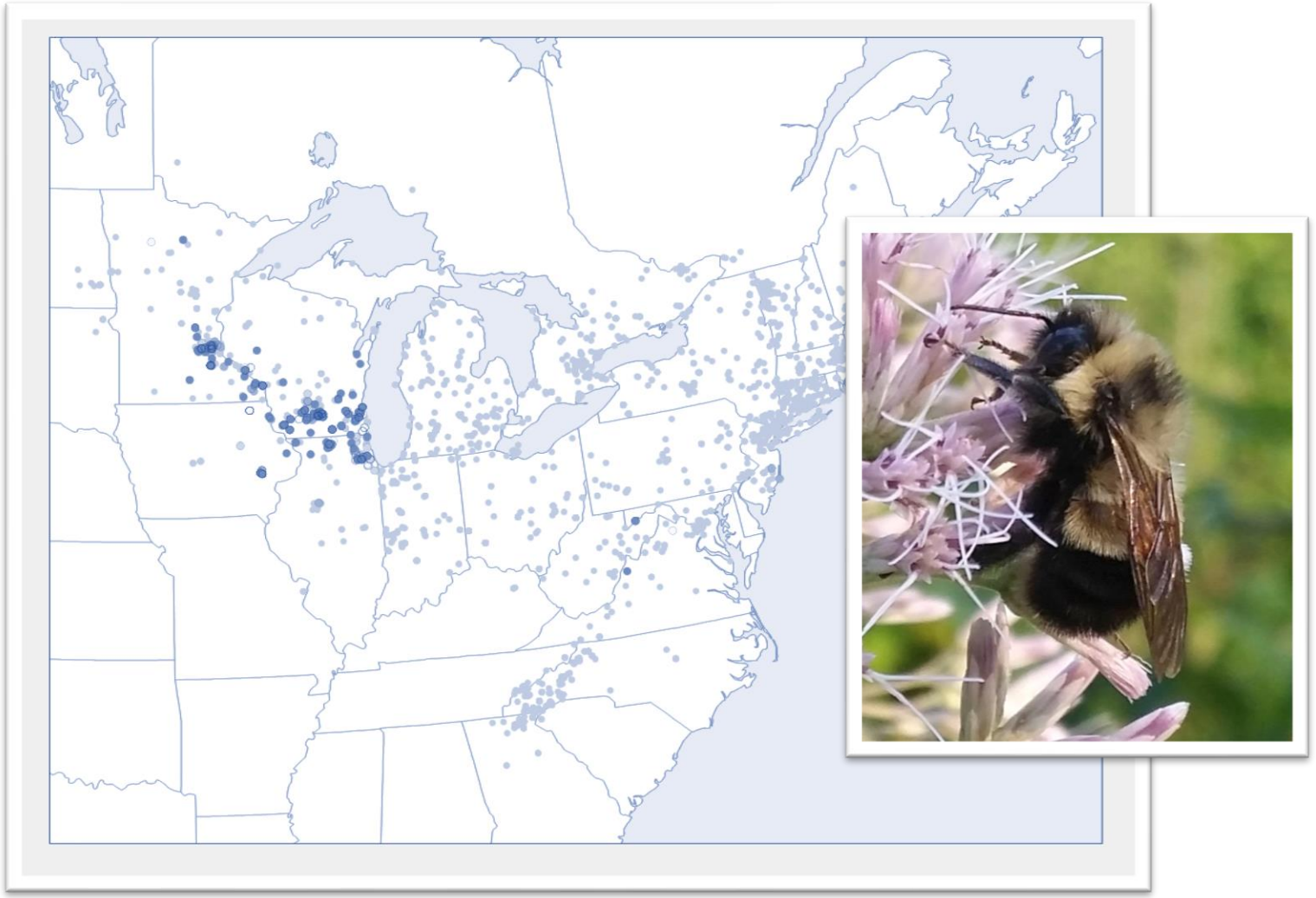
- Historically common species across eastern North America (light gray)
- Remaining populations centered in Midwestern US (yellow/red)
- Listed as Endangered by US Fish and Wildlife Service in 2017
  (https://www.fws.gov/midwest/endangered/insects/rpbb/)





Map: US Fish and Wildlife Service; Photo: R. Hatfield

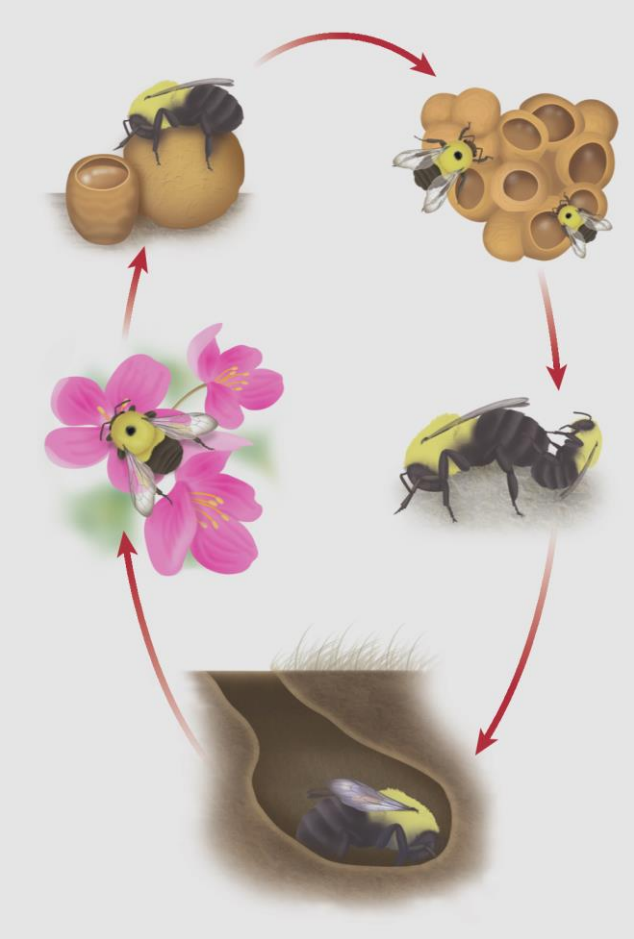
Rusty Patched Bumble Bee Natural History

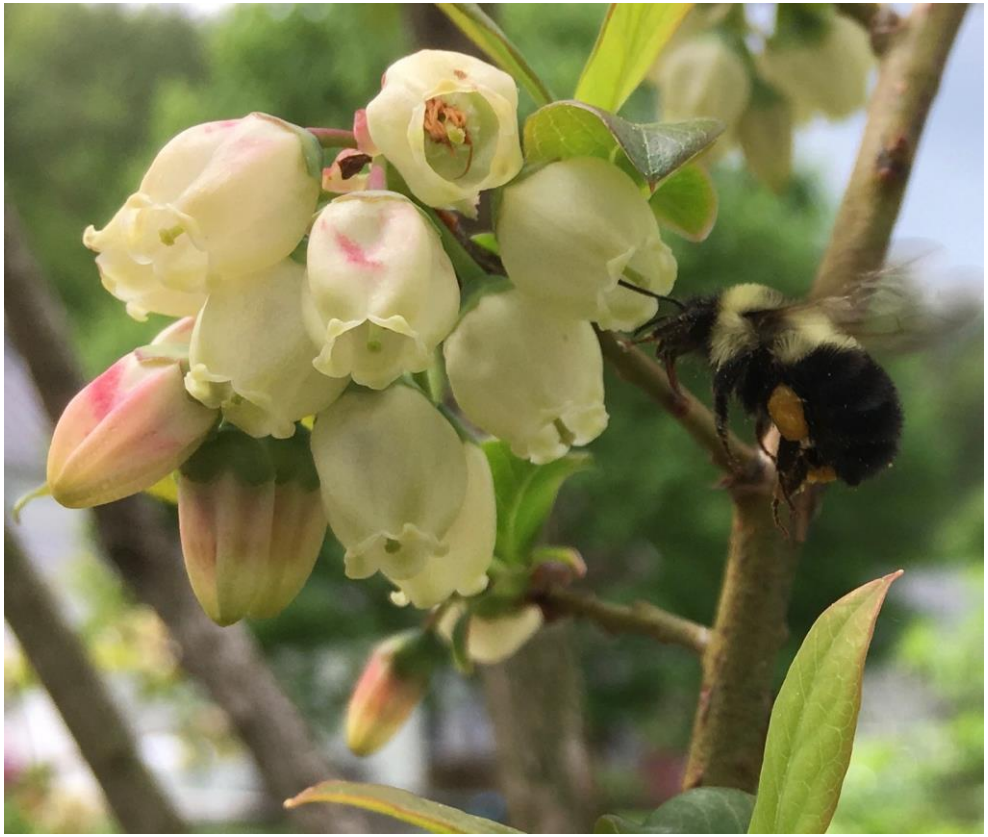


Stone Environmental *unpublished*; photo: R. Hatfield

Bumble Bees (*Bombus*)

- Social species, but *annual* colony cycle
- Managed and wild bees important to pollination
- Global declines of many species





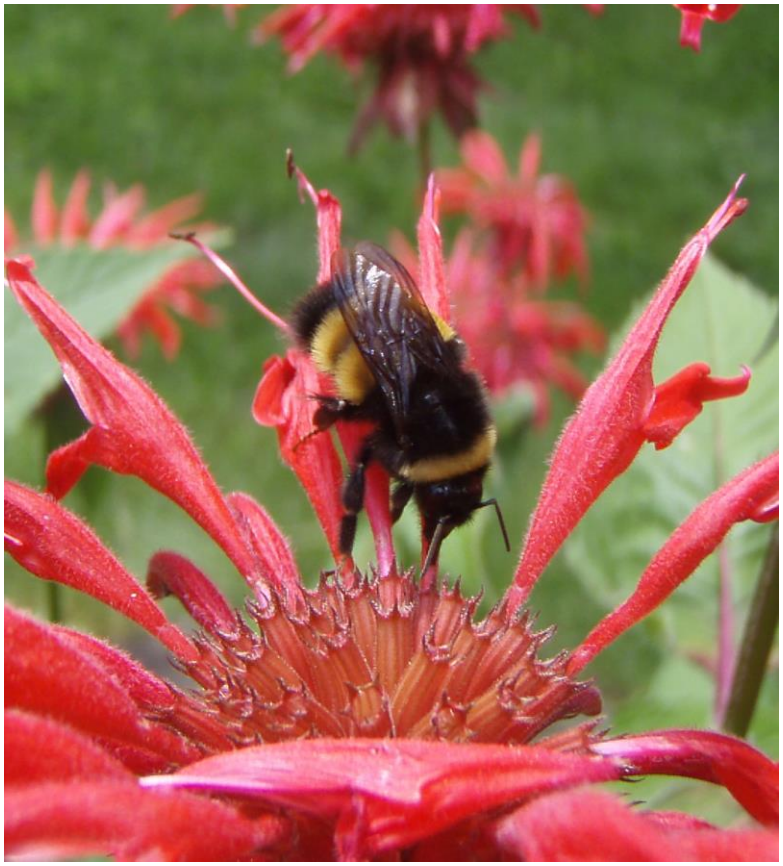
Graphic: Williams et al. 2014; Photo: L. Richardson

Food: Nectar and Pollen

- Widespread generalist forager: native plants, weeds, crops
- Short tongue: restricted to smaller flowers, or nectar robs larger flowers

RPBB Host Plants

Common name	Scientific name
Tall Blazing Star	*Liatris aspera*
Goldenrod species	*Solidago*
Wild Currant species	*Ribes*
Spotted Knapweed	*Centaurea maculosa*
Beebalm species	*Monarda*
Paradise Apple	*Malus pumila*
Aster species	*Aster*
Alfalfa	*Medicago sativa*
Fernleaf Yellow False Foxglove	*Aureolaria pedicularia*
Red Columbine	*Aquilegia canadensis*
Purplestem Angelica	*Angelica atropurpurea*
Blue Giant Hyssop	*Agastache foeniculum*
Calico Aster	*Symphyotrichum lateriflorum*
Jewelweed	*Impatiens capensis*
Cranberry	*Vaccinium macrocarpon*



Nectar robbing *(B. terricola)* photo: L. Richardson

Threats

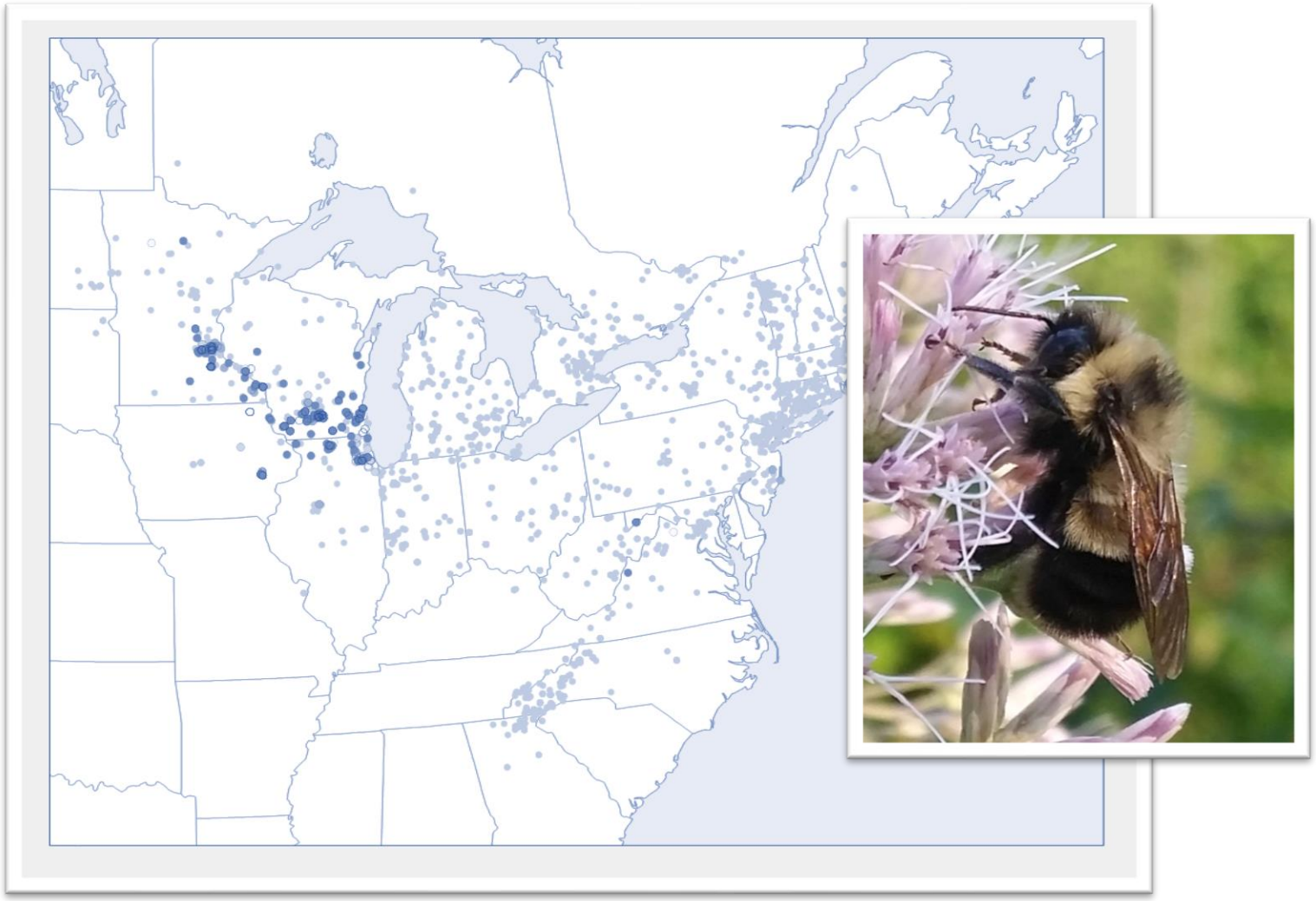
No smoking gun to explain the decline; likely multiple threats

- Pathogens (*Nosema bombi*)
- Pesticide exposure (insecticides and fungicides)
- Habitat/forage loss (development, herbicides)
- Climate change

Synergistic effects on bees of pathogens and pesticides?

Foraging bee *(B. impatiens)* photo: L. Richardson

The Rusty-Patched Bumble Bee Decline: How and Why?

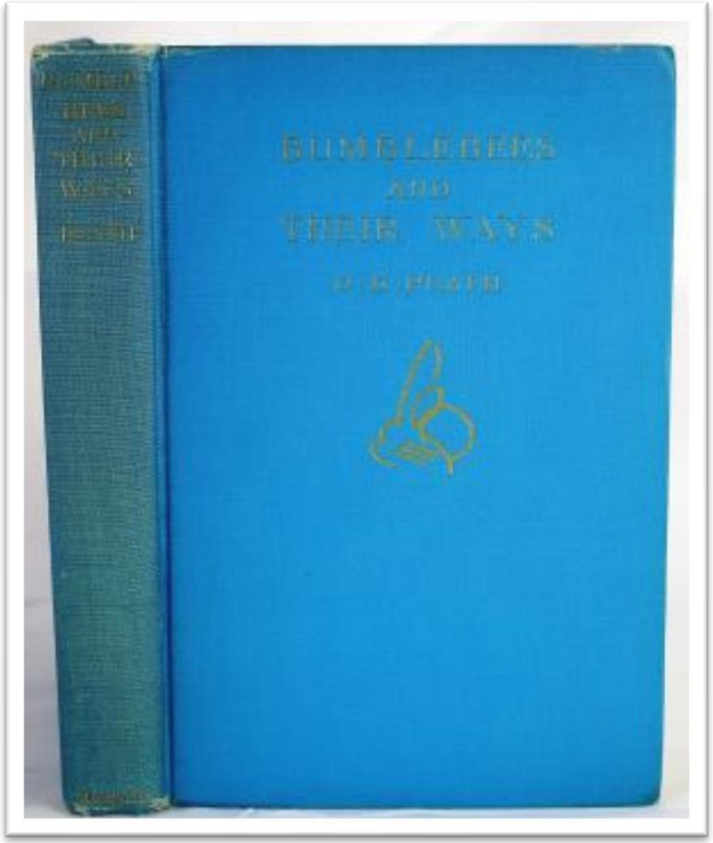


Stone Environmental *unpublished*; photo: R. Hatfield

Historically a Common Species!

Otto Plath, *Bumblebees and their Ways*, 1934:

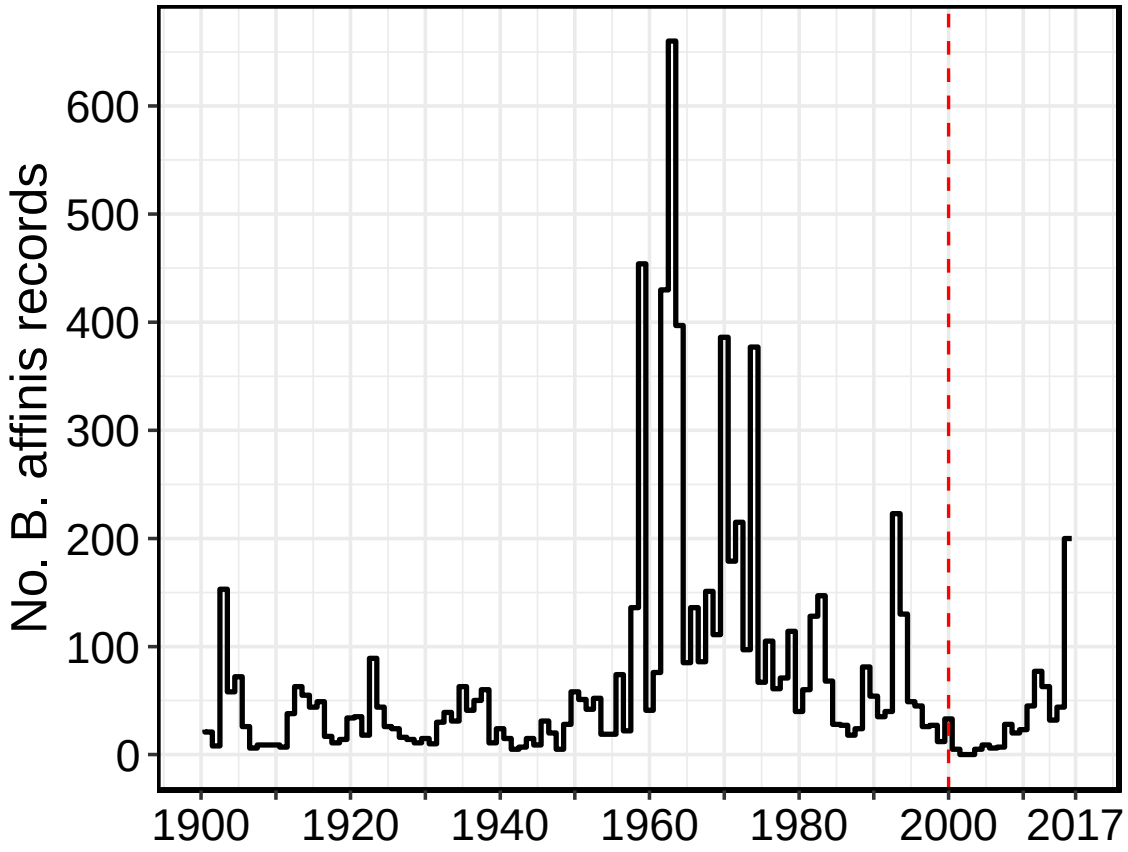
"In May, the queens [of RPBB] are exceedingly abundant, especially on Rhododendron."



Rhododendron forager *(B. impatiens)* photo: L. Richardson

Temporal Patterns of Decline: Observations

- RPBB considered to have crashed in the late 1990s—do we see this pattern in collections data?
- Recent increase in sightings: population change or increased survey effort?
- (n = 11,261 RPBB records; 469,097 for ~50 North American species)



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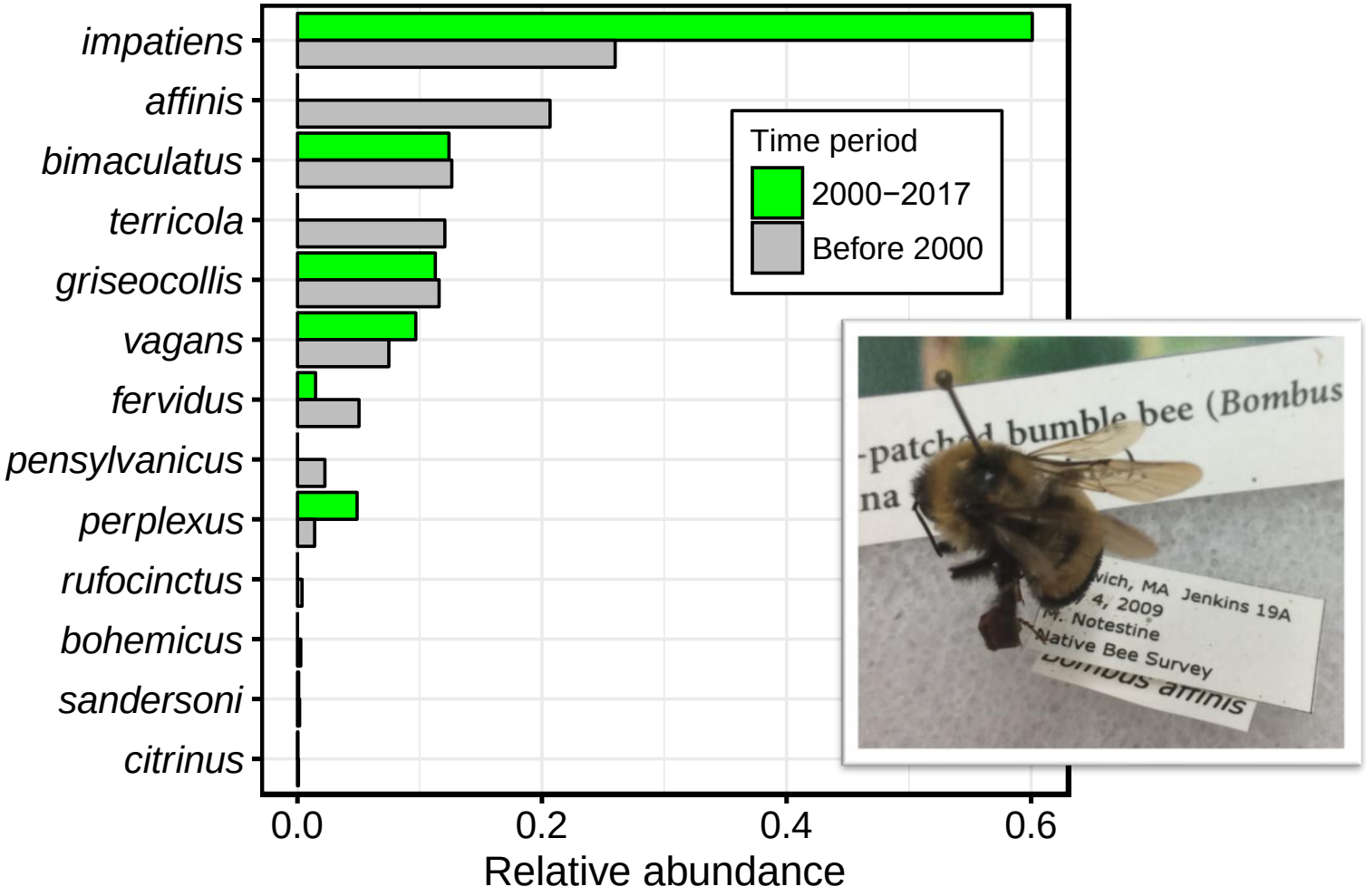
Temporal Patterns of Decline: Relative Abundance

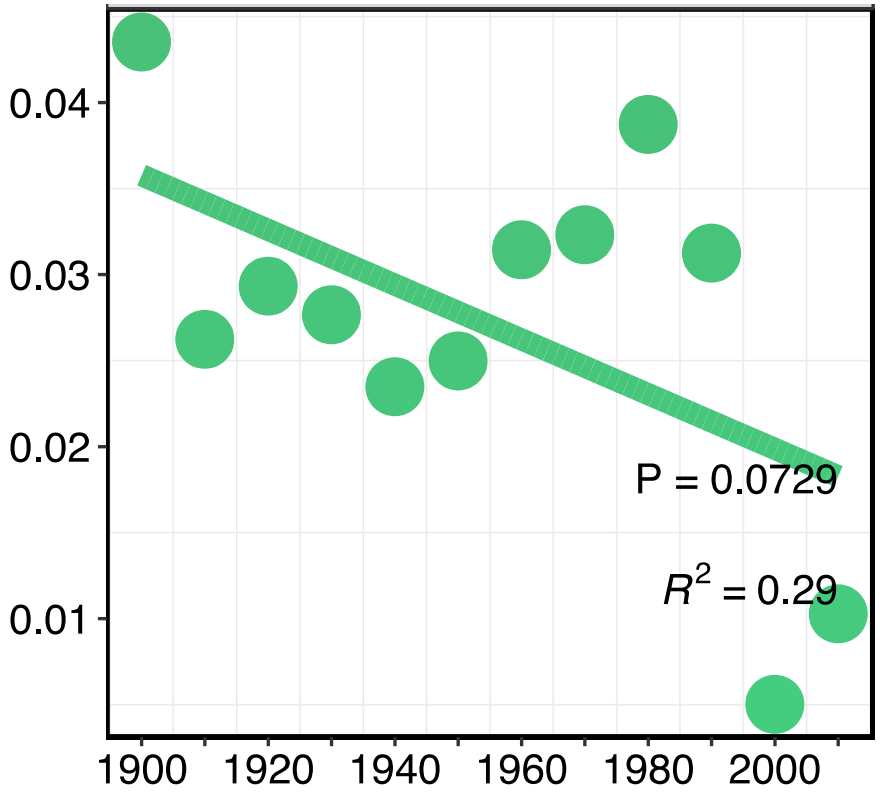
- In Massachusetts, RPBB was historically the 2nd most common bumble bee
- One recent (2009) observation, despite intensive survey efforts



Stone Environmental *unpublished*; photo: L. Richardson

Temporal Patterns of Decline: Relative Abundance

- Significant declines in RPBB relative abundance across 20th century
- Population crash before 2000s
- (Relative abundance = no. of RPBB records/total no. bumble bee records; calculation by decade)



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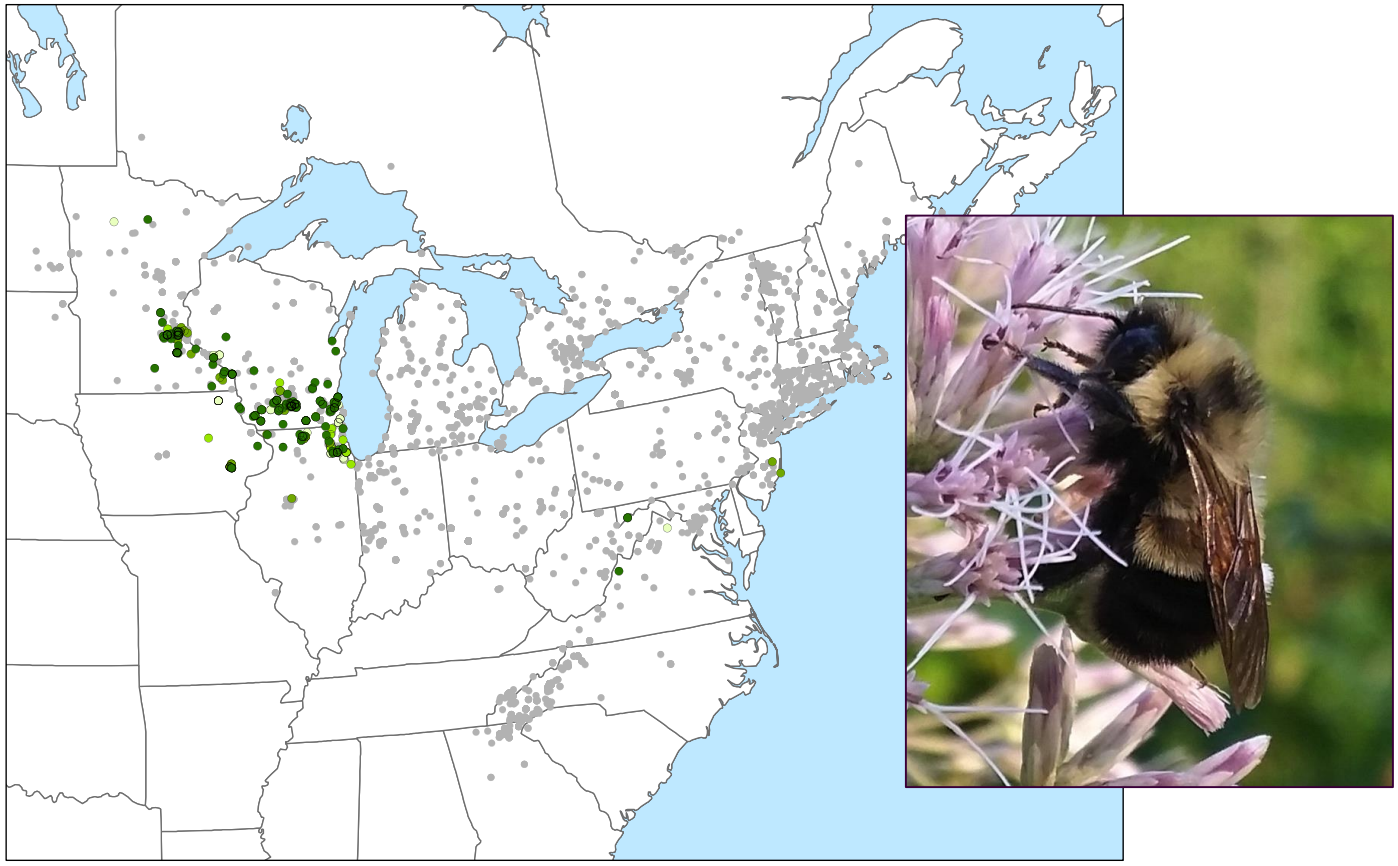
Spatial Patterns of Occurrence and Decline

- Species distribution modeling with Maxent (https://biodiversityinformatics.amnh.org/open_source/maxent/)
- Dependent variable: recent records of RPBB occurrence (in green; 1998-2017)



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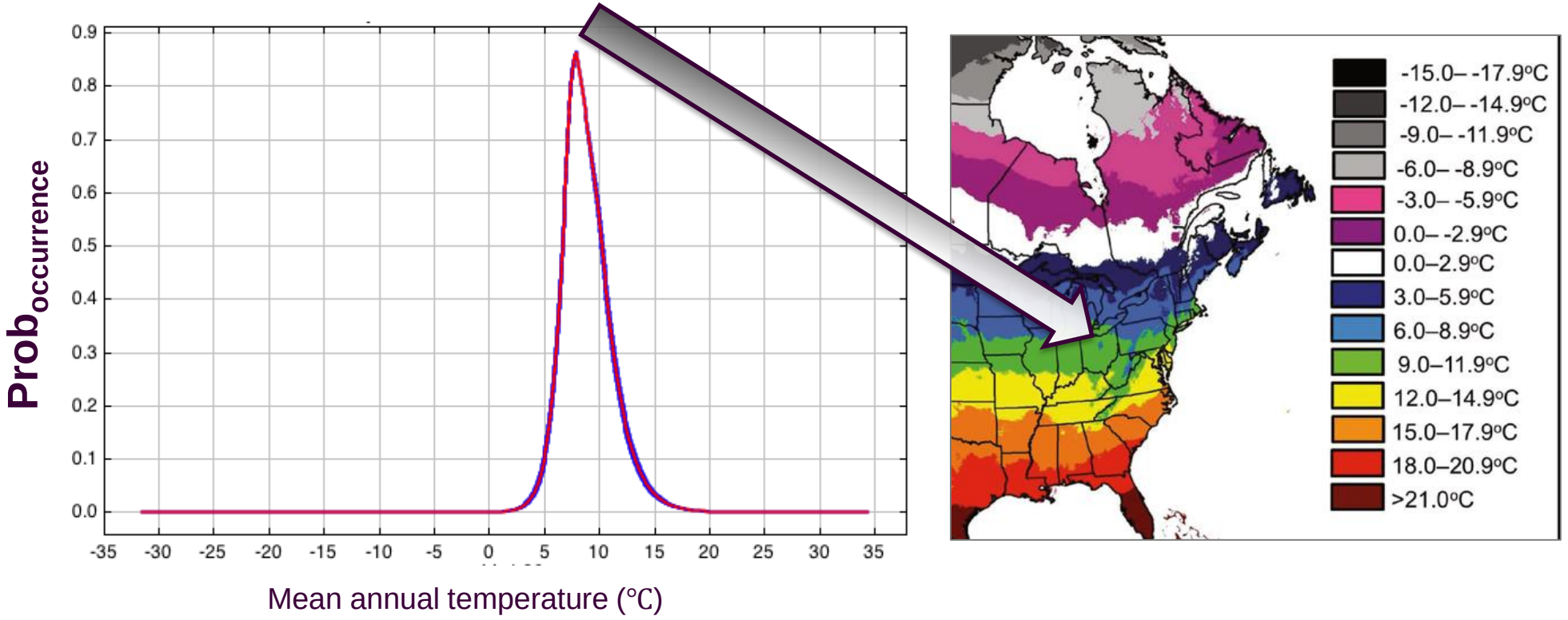
Spatial Patterns of Occurrence and Decline

- Models of temperature, precipitation used as predictor variables



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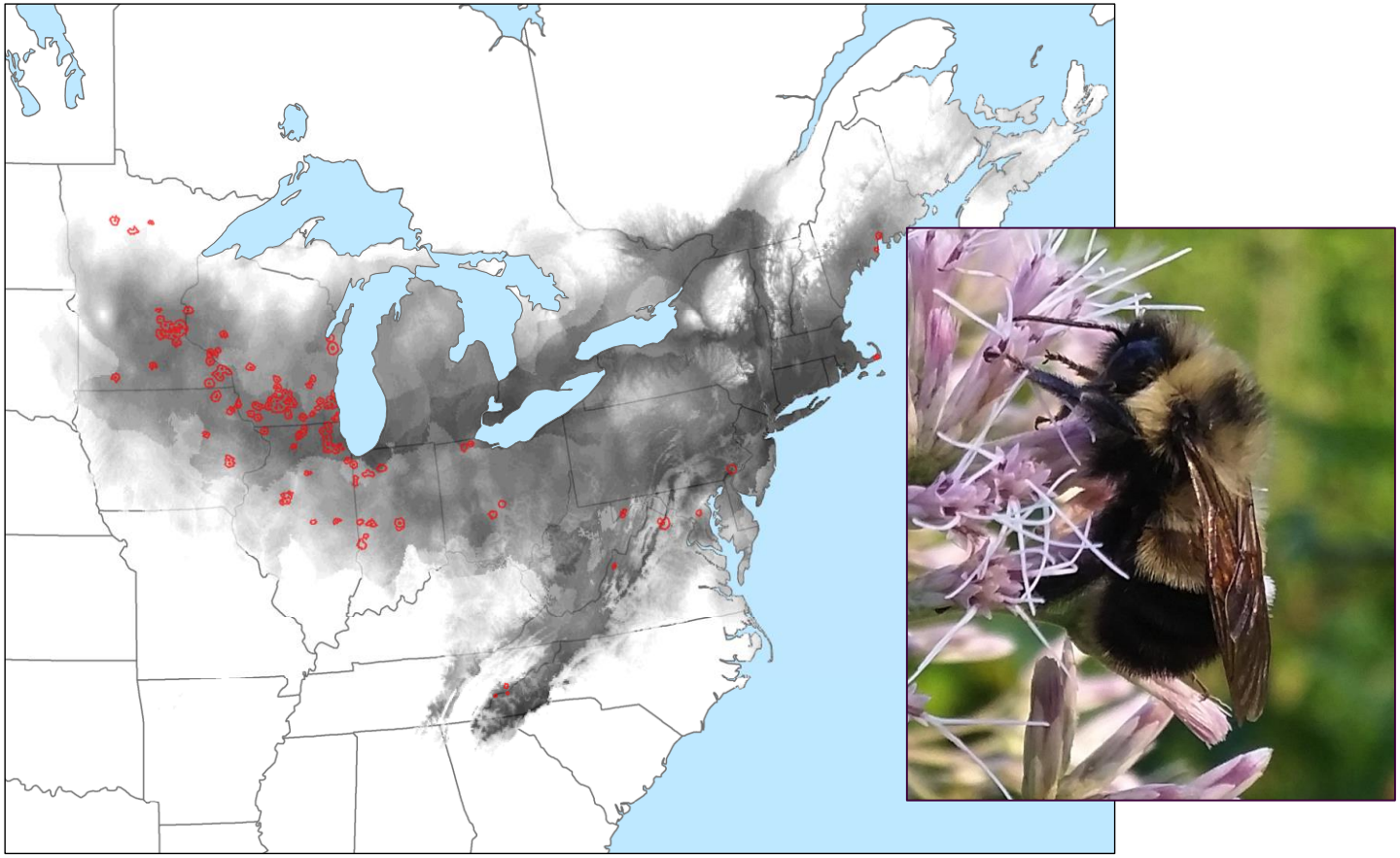
Spatial Patterns of Occurrence and Decline

- Most remaining populations in Midwest (red)
- But--suitable habitat (gray) occurs in historic range in e. North America



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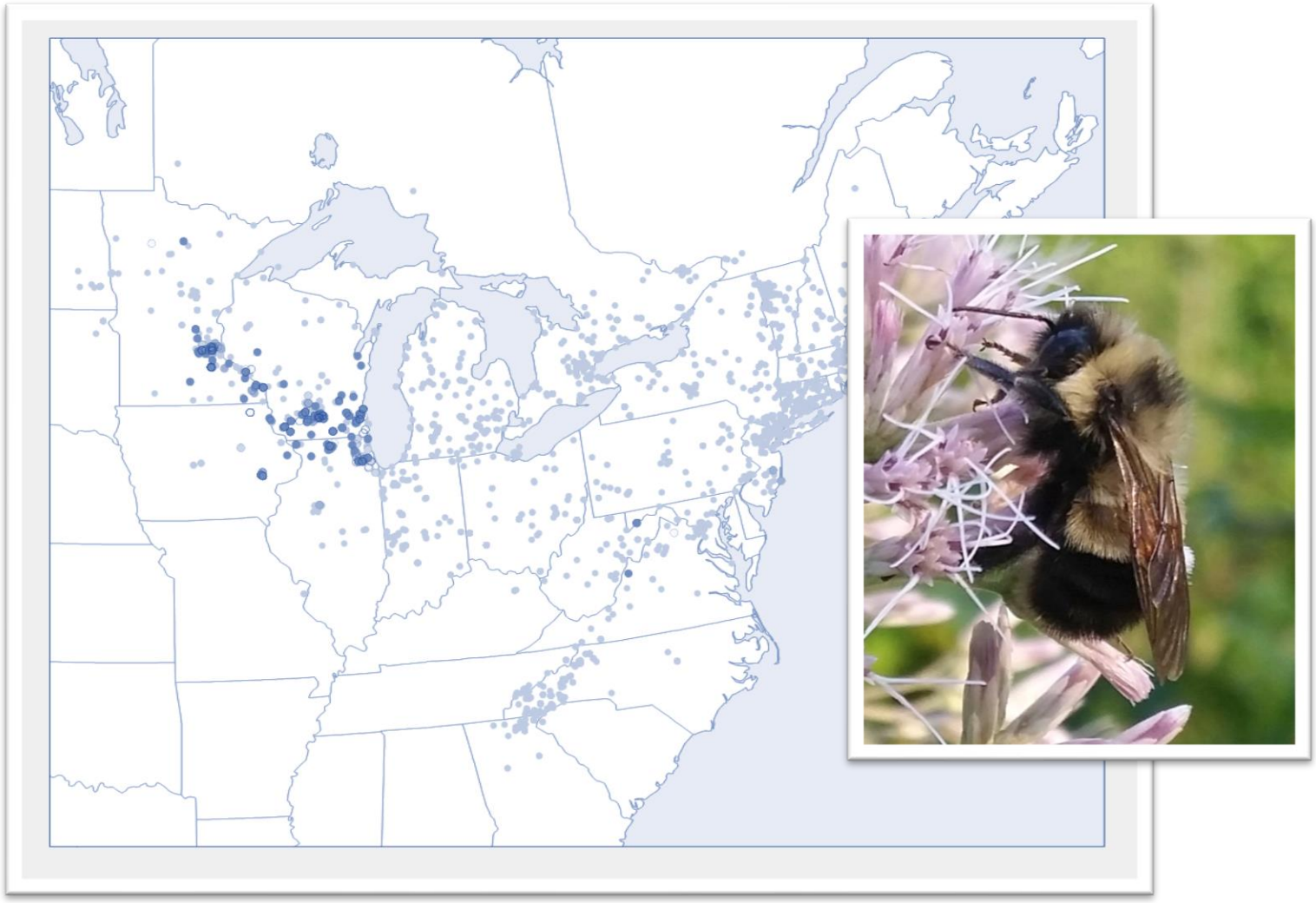
The Rusty-Patched Bumble Bee: Stewardship and Conservation



Stone Environmental *unpublished*; photo: R. Hatfield

Stewardship Needs

- Research on ecology, pathogen exposure, and pesticide risk
- Habitat restoration or creation (i.e., through plantings)
- Inventory and monitoring for remaining populations

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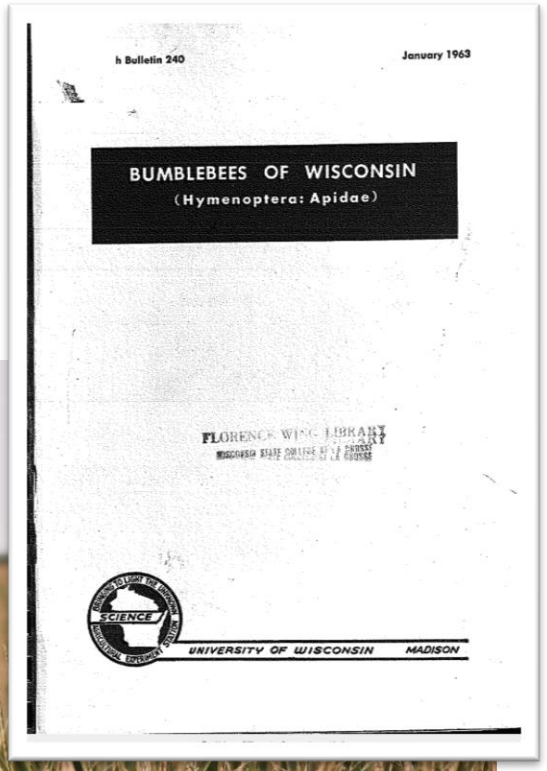
What is a Suitable Habitat for this Species?

- Many remaining populations found in urban, suburban areas
- Are these sites high quality habitat, or refugia from threats in natural land, agricultural habitats?

"This species nests commonly in urban areas, utilizing subterranean spaces in the rubble fill beside the concrete walls of houses."

- Medler and Carney, Bumblebees of Wisconsin, 1963:



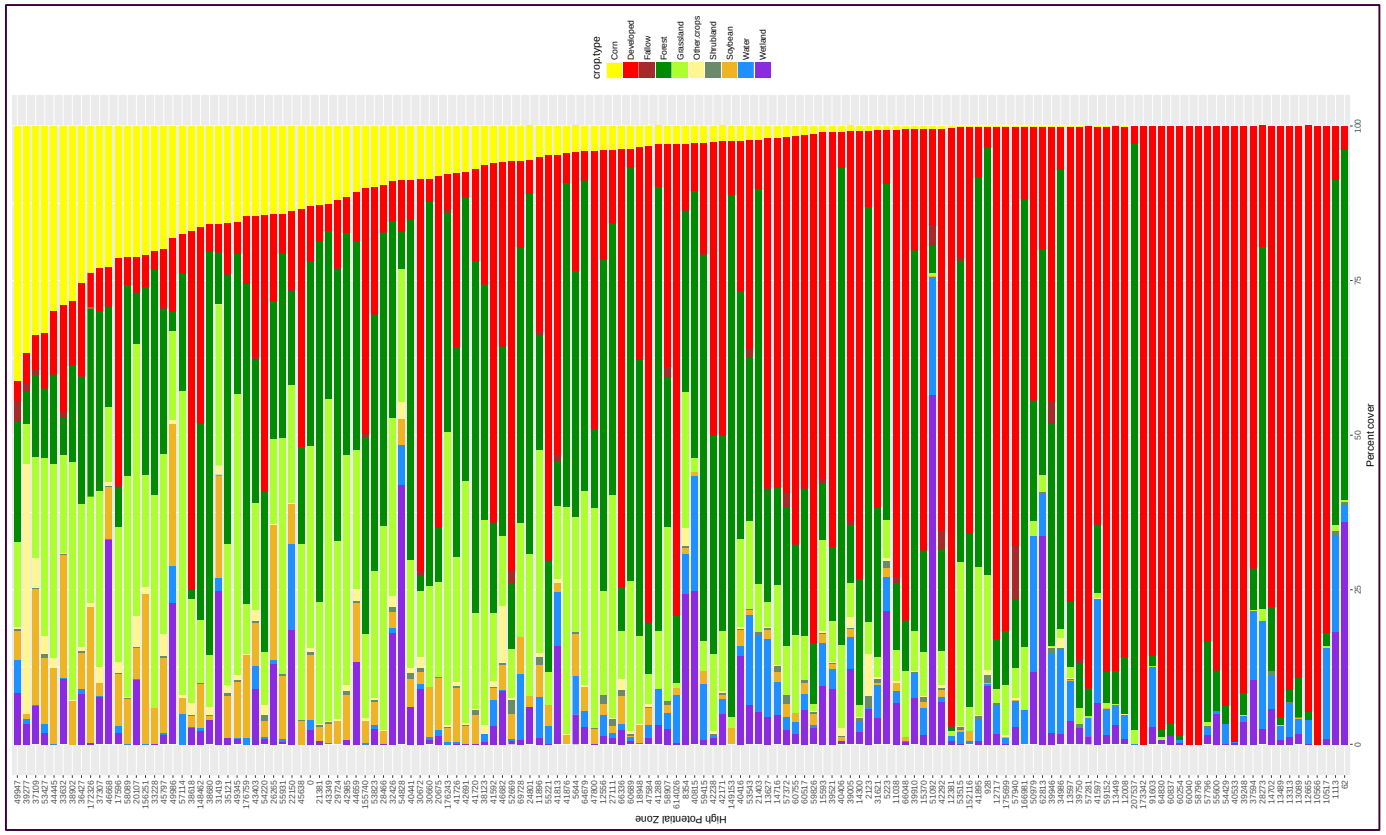
Photos: unsplash.com

What is a Suitable Habitat for this Species?

Areas of recent occurrence (USFWS “High Potential Zones”) are highly variable

Dominant land cover types:

- Agriculture (yellow)
- Development (red)
- Grasslands (light green)
- Forests (dark green)



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Thank you.

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