Bumble Bee Ecology and Conservation

Rich Hatfield

Senior Conservation Biologist

NRCS Webinar

USDA NRCS East National Technology Support Center

Photo: Norm Barrett

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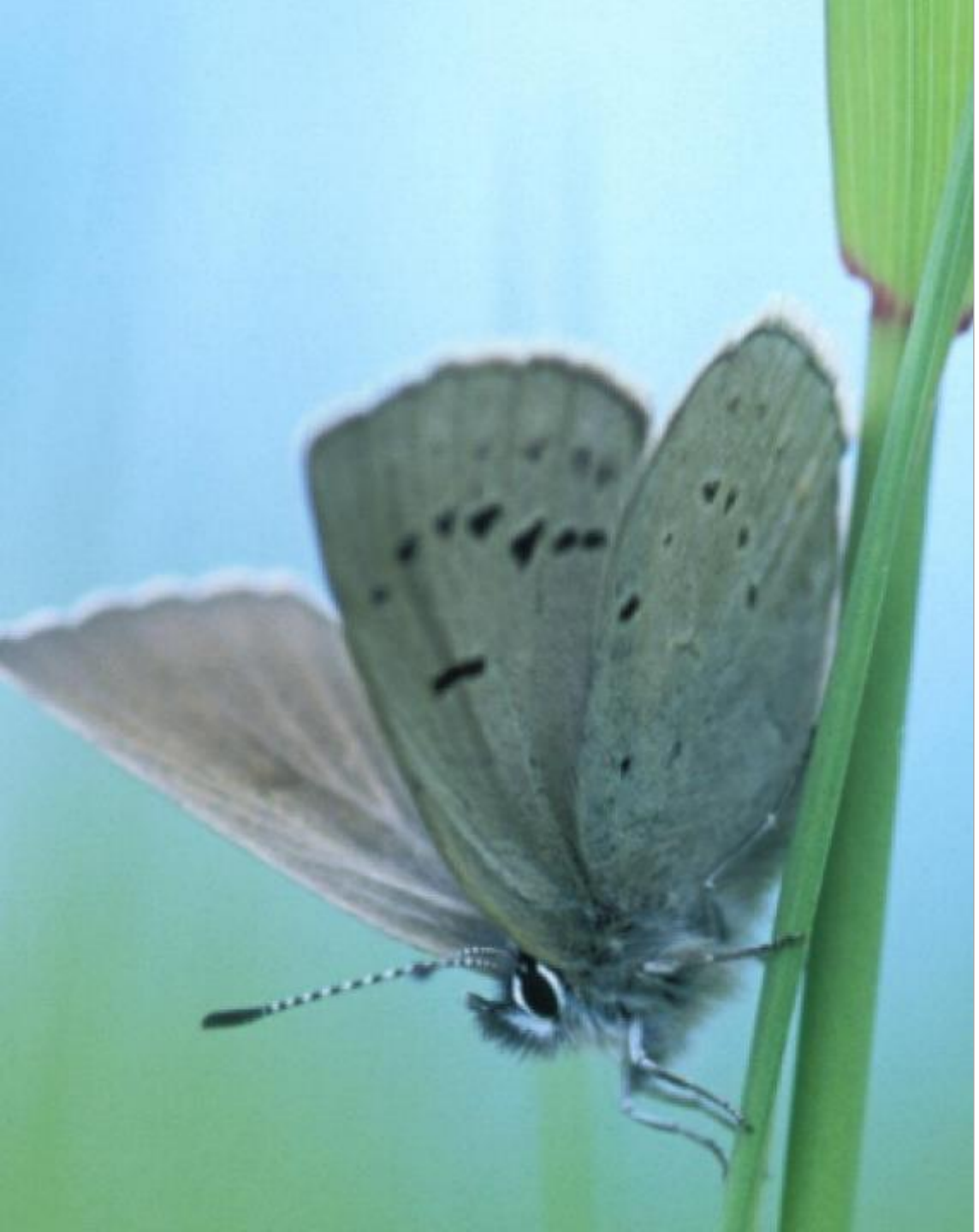

Photo: Endangered Fender's blue butterfly (*Icaricia icarioides fenderi*) by Dana Ross

The Xerces Society

For Invertebrate Conservation

We protect wildlife through the conservation of invertebrates and their habitat

Conservation programs:

- Native Pollinators
- Endangered Species
- Aquatic invertebrates
- Butterfly Conservation
- Pesticides

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Why Invertebrates?

"The fate of the world's insects is inseparable from our own"

Decomposition	Biocontrol	Base of the Food Chain	Pollination
			

Photos: Marc Barrison, A. Chappell, www.leifin.com, Alex Wild, Rollin Coville; Quote from NYT Editorial *Insect Armageddon* October 29, 2017

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Pollinators

Keystone Species: More than 85% of flowering plants require an animal, usually an insect, for pollination.

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Photo: Rich Hatfield

Main Groups of Insect Pollinators

Photos: Mace Vaughan, Bob Hammond, David Inouye, Bruce Newhouse

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Pollination 101

Bees are the only pollinators to consume pollen and nectar as larvae and adults

Photo: Nancy Adamson

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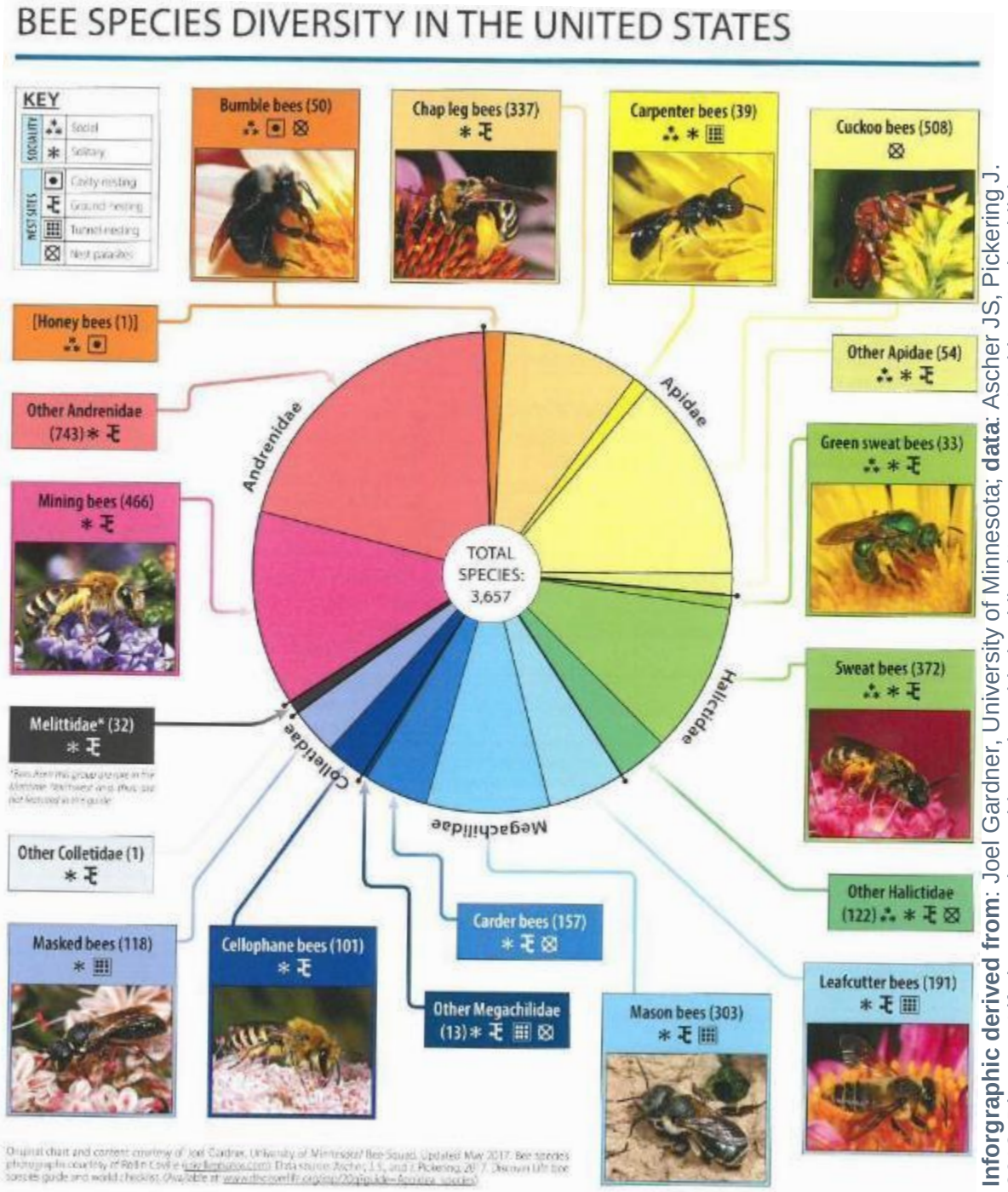

Inforgraphic derived from: Joel Gardner, University of Minnesota; **data**: Ascher JS, Pickering J. 2018. Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila)..

North American Bee Diversity

~3,600 species

- The majority of these species are solitary
- Only one of these species makes honey – and it is not native to the U.S.
- ~65% are ground nesting bees
- ~35% are above ground cavity nesting bees
- **Bumble bees only represent 1.4% of North America's bees!!**

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Value of Bumble Bees

Photo: Rich Hatfield

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Value of Bumble Bees

Physiology	Intelligence	Long-tongues	Innovation
Can fly in cold/wet conditions	Learn to access resources	Visit diverse flowers	Use their strength to their advantage




Photos: Bumble Bee Conservation Trust and Rich Hatfield

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Buzz Pollination

Photo: Smithsonian Channel

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Value of Bumble Bees

Pollination Services:

- Tomatoes
- Peppers
- Blueberry
- Cranberry
- Clover
- Squash
- Melon

Photo by R. Hatfield, the Xerces Society

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Photo: Walter Siegmund, Creative Commons license

Buzz Pollination

~ 8% of all flowers are primarily pollinated by buzz pollination

Shooting stars (Dodecatheon)

Sennas (Senna)

Pitcher plants (Heliamphora)

Flax lilies (Dianella)

Manzanita (Arctostaphylos)

Guinea flowers (Hibbertia)

Some members of solanaceae family (eggplant, tomato, potato)

Some members of genus Vaccinium (blueberry, cranberry)

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Bumble Bee Ecology

Photo: Marion Ellis

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Bumble Bee Species Richness

Highest in Western coastal and mountainous regions

PNW is a biodiveristy hotspot ~ 25 spp.

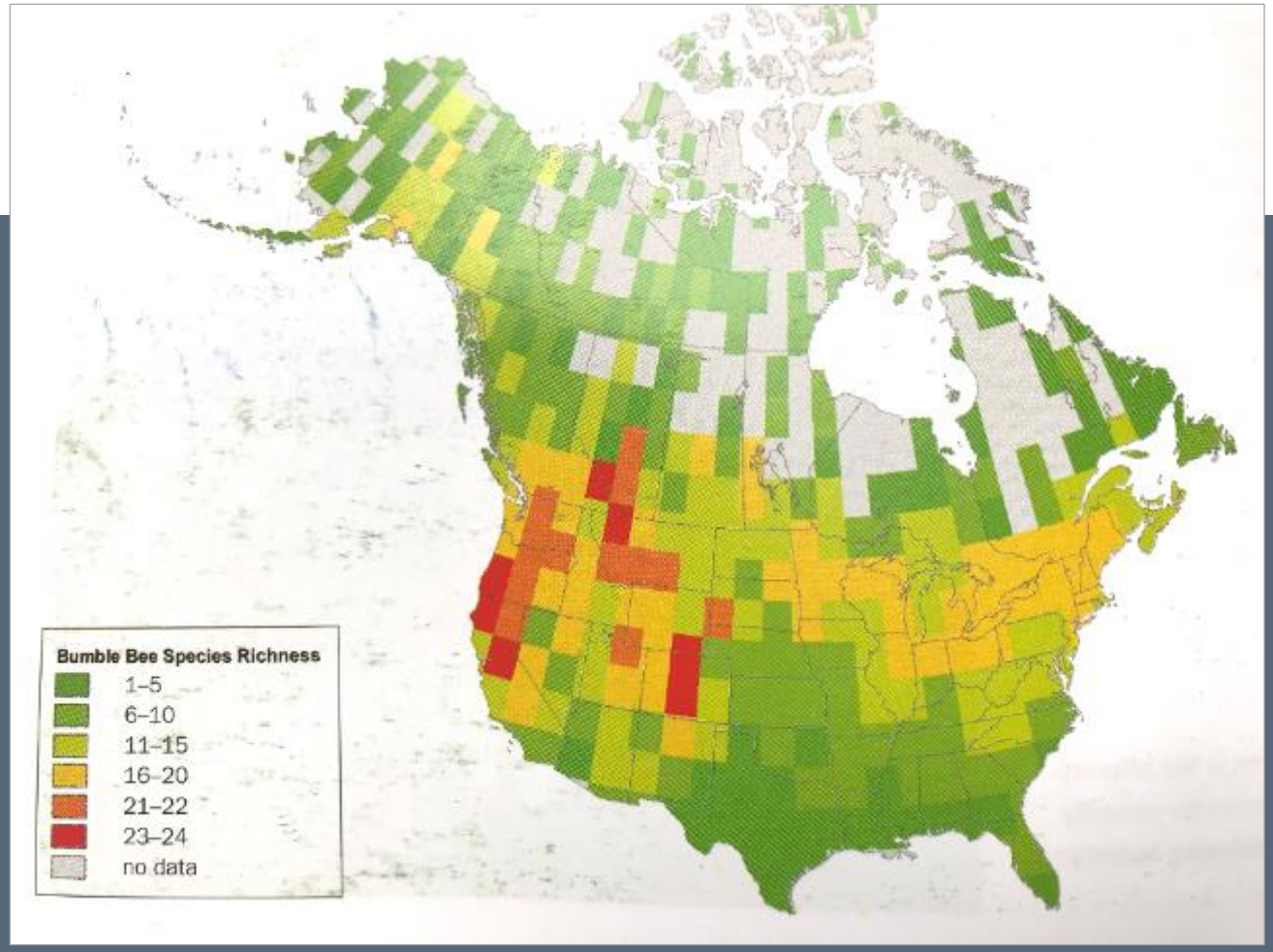

Illustration from: Bumble Bees of North America by Williams et al. 2014

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Ecology Overview

47 species in N. America

- Most are Social colonies founded by a single queen
- Colonies last only one season

Nests may contain 25-500+ workers

Nests are often in abandoned rodent burrows, under thatched grasses, brush piles, un-mowed areas, in rock walls, in building rubble, etc.

Photos: Rollin Coville, Elaine Evans

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Bumble Bee Life Cycle: Spring

Nests are established by the mated queen in spring

- Queens spend 2-3 weeks looking for suitable nest site
- Competition for best sites can be intense
- All nest sites, either above or below ground, need preexisting insulation
- Abandoned rodent dens are common nest sites
- Soil moisture, sun exposure play a role

Photos: Marion Ellis

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Bumble Bee Lifecycle: Summer

Egg

Laid by the queen on pollen “cakes”

Larva

Tended to by the queen and workers

Pupae

Colorless – transformation between larvae and adult

Colony

Can be 50-1,000 individuals

Photos: Marion Ellis, Elaine Evans

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Bumble Bee Lifecycle: Fall

Mated queens forage to build up reserves, and select an overwintering site

Hibernacula are short burrows in soil, on northern sloped areas, or under trees, in rotten wood, under leaf litter or in areas of bare ground

Photo: Marion Ellis

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Bumble Bee Life Cycle

Illustration by Alix Lukas

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Bumble Bee Lifecycle: Cuckoo Bumble Bees

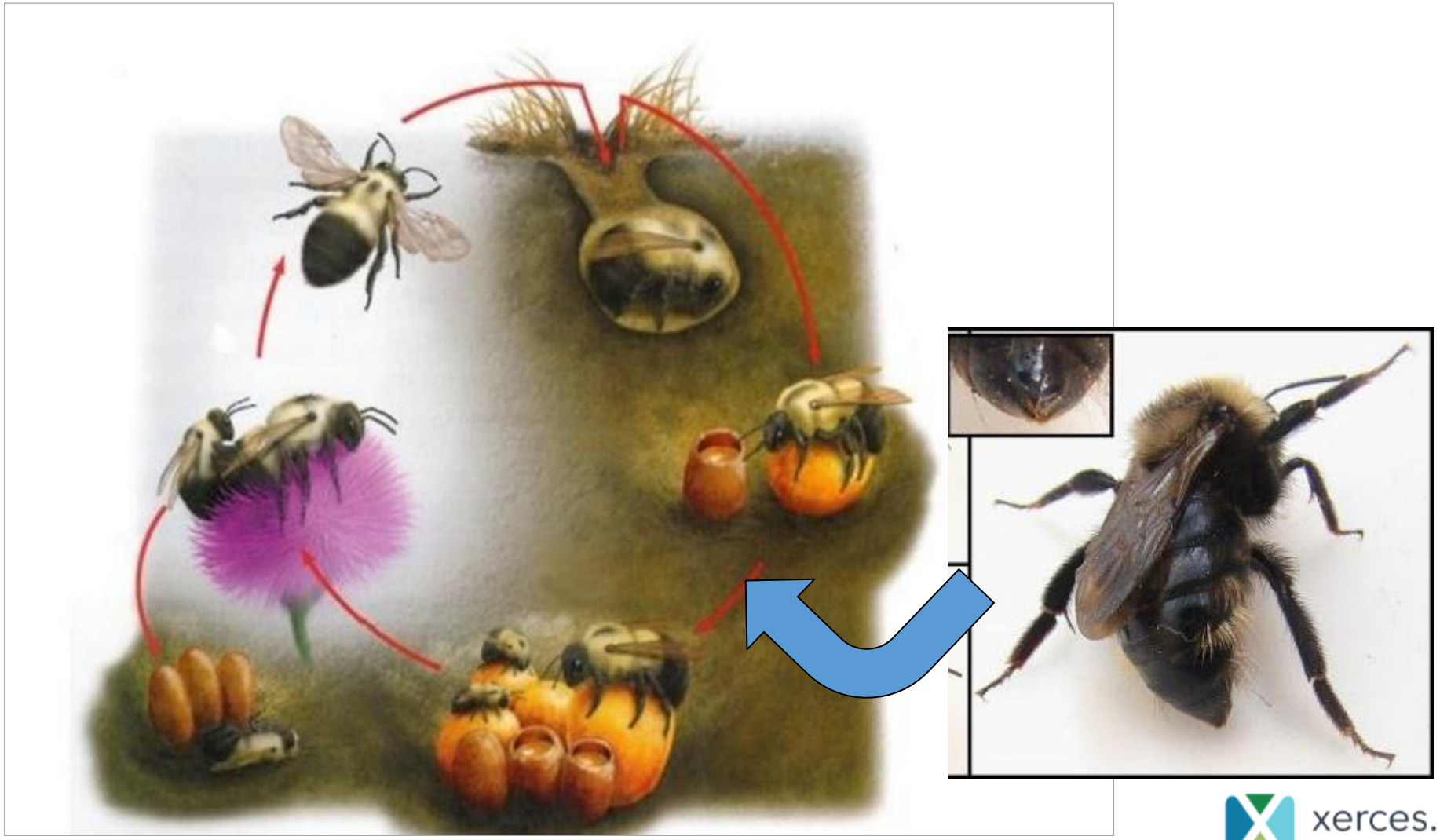

Illustration: David Wysotski

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Status of Bumble Bees

Photo: Rich Hatfield

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Bumble Bees in Decline

Four Closely Related Species of Bumble Bee

Western Bumble Bee	Franklin's Bumble Bee	Yellow-Banded Bumble Bee	Rusty Patched Bumble Bee
			

Photos: Pat Michaels, Pete Schroeder, Leif Richardson, Jen Knutson

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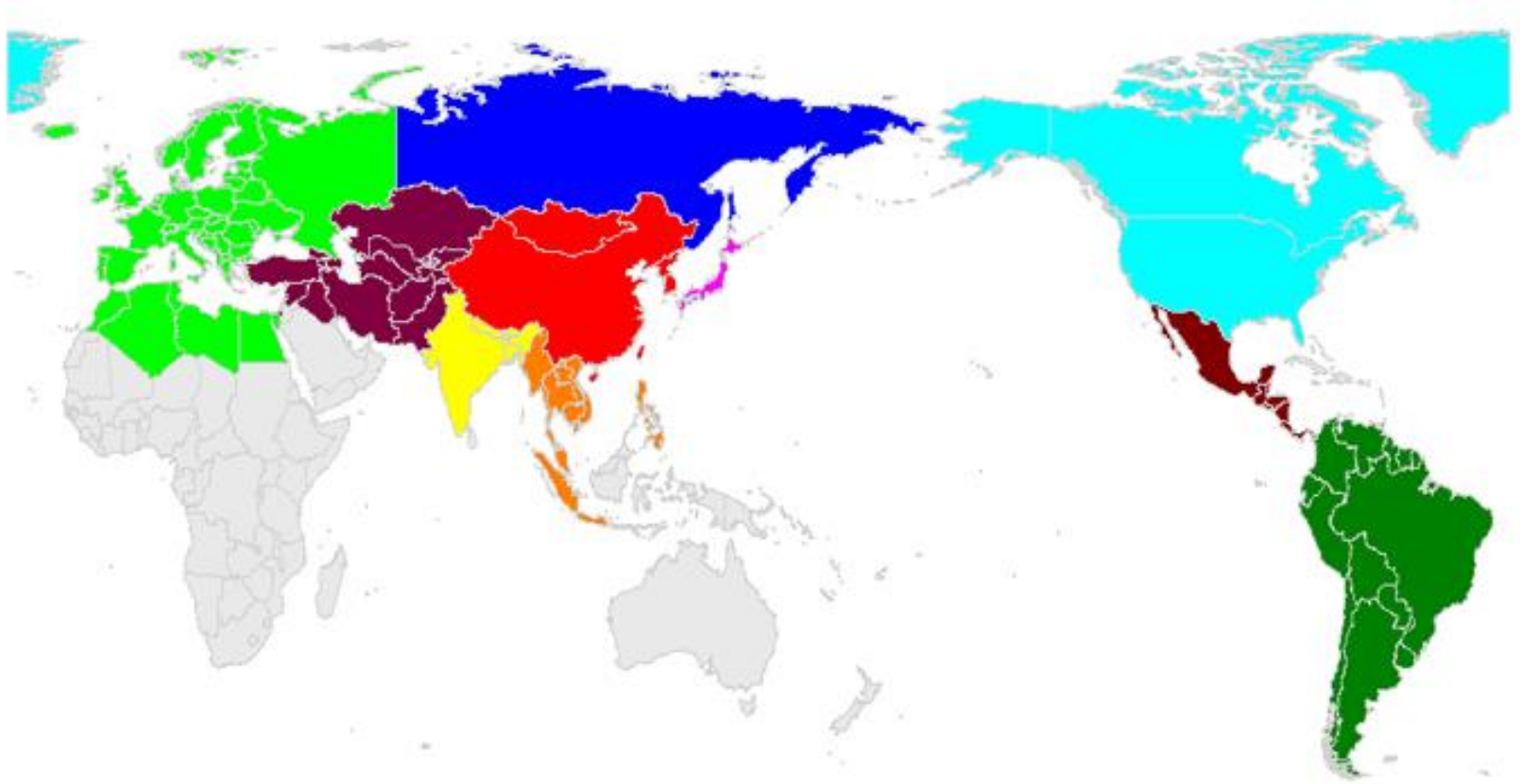
Bumble Bee Specialist Group

- Network of 75+ bumble bee experts & specialists worldwide
- Goal: global bumble bee status assessment using consistent criteria

IUCN

IUCN SSC BUMBLEBEE SPECIALIST GROUP



Source: IUCN

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Bumble Bee Status Assessment

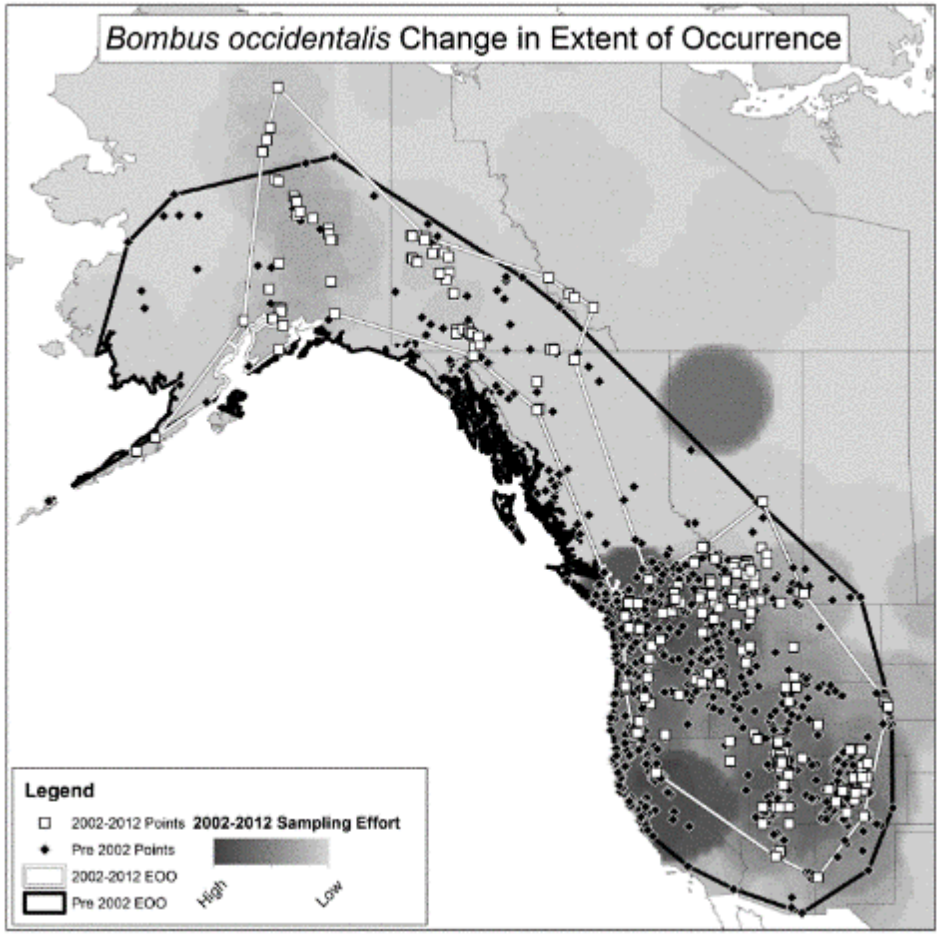
Bombus occidentalis
Western bumble bee

Range loss (adjusted by collection effort): **39%**

Relative abundance decline: **75%**

Persistence change: **28%**

IUCN Red List: **Vulnerable**



Source: Hatfield et al. 2015

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Bumble Bee Status Assessment

Bombus morrisoni
Morrison's bumble bee

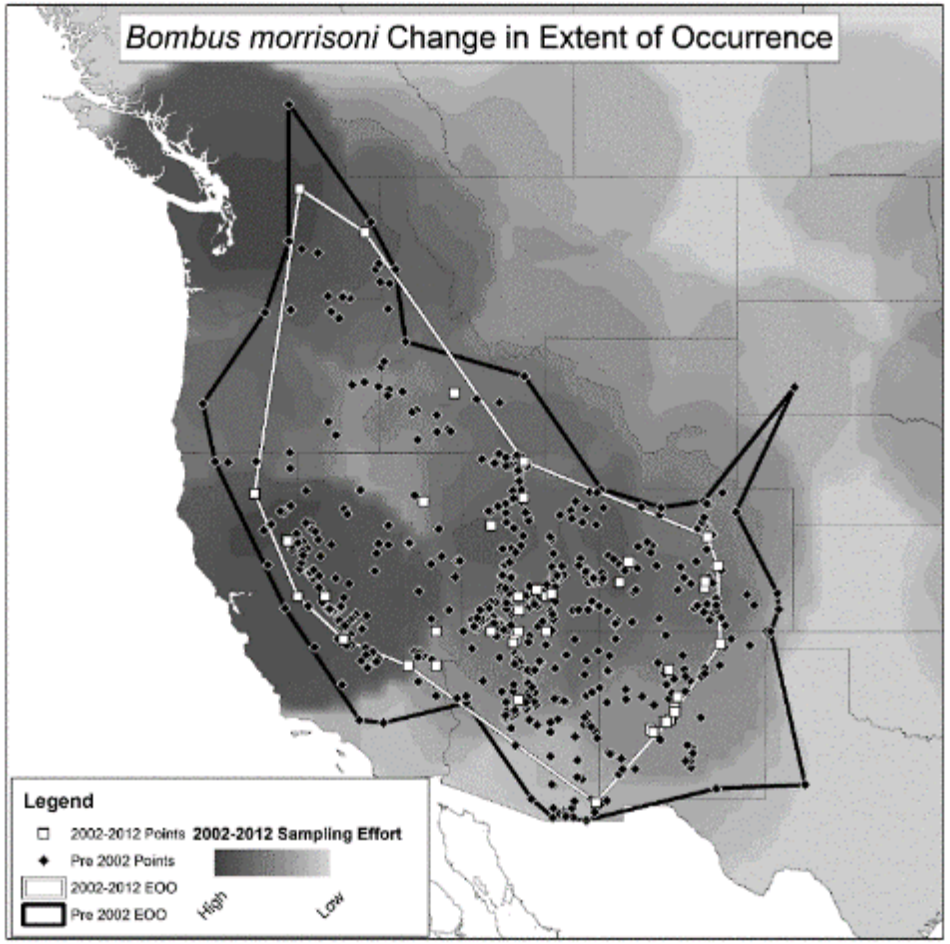
Range loss (adjusted by collection effort): **18%**

Relative abundance decline: **82%**

Persistence change: **72%**

Average Decline: **58%**

IUCN Red List: **Vulnerable**



Source: Hatfield et al. 2015

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Bumble Bee Status Assessment

Bombus suckleyi
Suckley cuckoo bumble bee

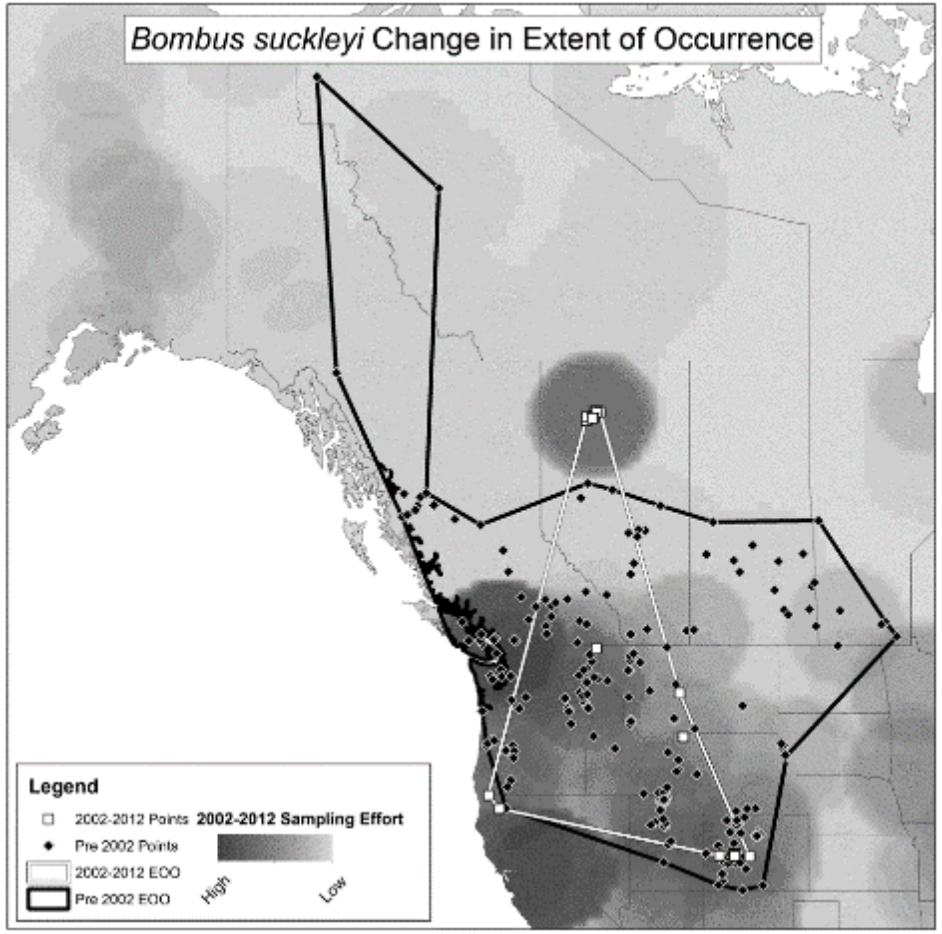
Range loss (adjusted by collection effort): **66%**

Relative abundance decline: **90%**

Change in Persistence: **83%**

IUCN Red List: **Critically Endangered**

Source: Hatfield et al. 2015



IUCN SSC BUMBLEBEE SPECIALIST GROUP

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Bumble Bee Status Assessment

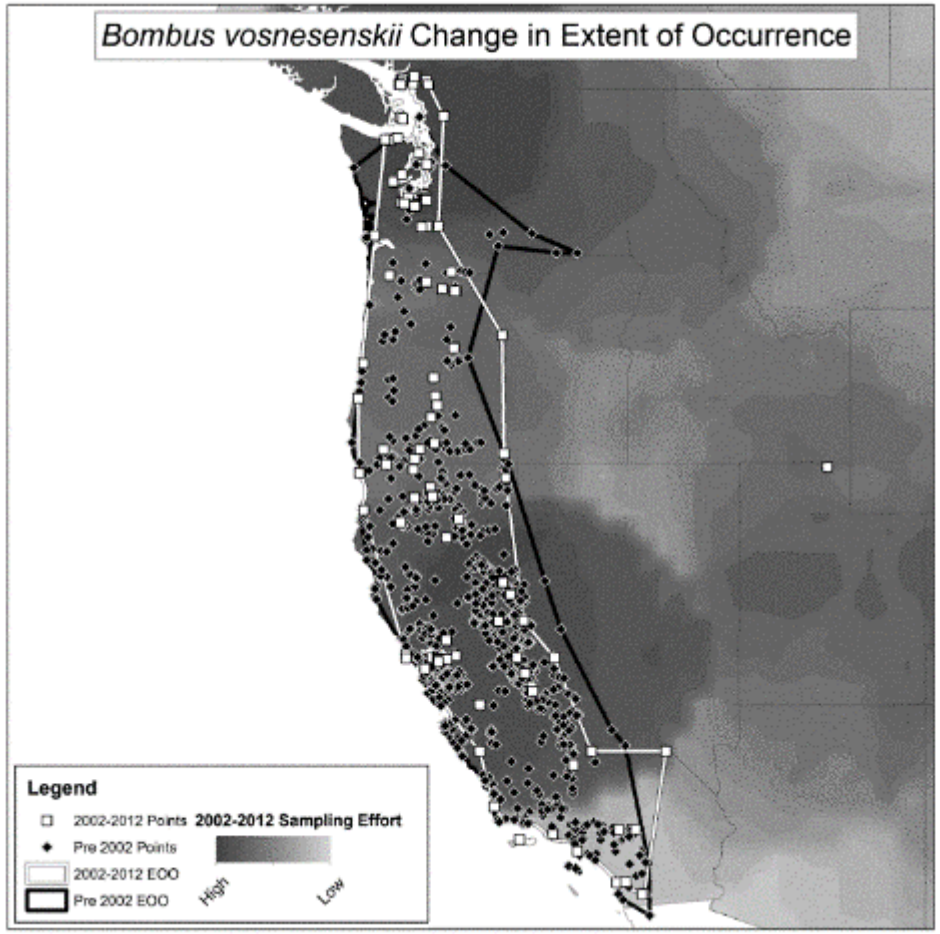
Bombus vosnesenskii **Vosnesensky bumble bee**

Range loss (adjusted by collection effort): **11%**

Relative abundance: **124%**

Change in Persistence: **20%**

IUCN Red List: **Least Concern**



IUCN SSC BUMBLEBEE SPECIALIST GROUP

Source: Hatfield et al. 2015

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Bumble Bee Status Assessment

Bombus affinis
Rusty patched bumble bee

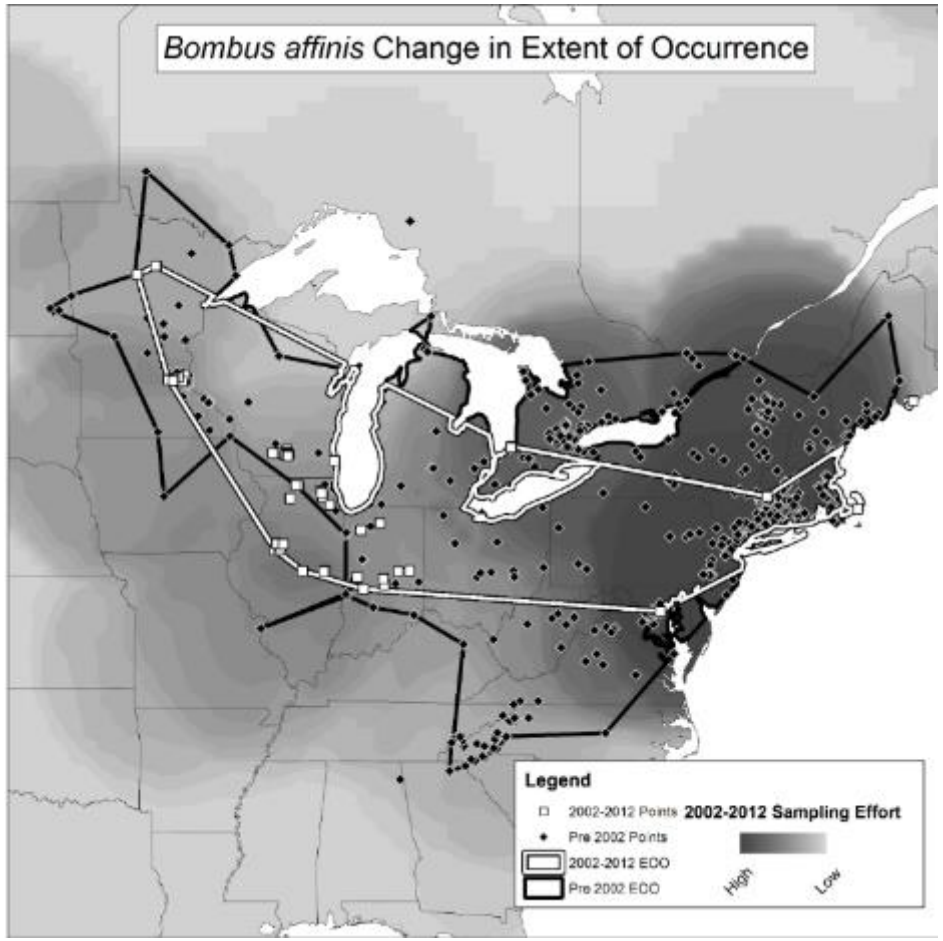
Range loss (adjusted by collection effort): **45%**

Relative Abundance (to historic value): **7%**

Persistence (relative to historic value): **30%**

Average Decline: 69%

IUCN Red List:
Critically Endangered



IUCN SSC BUMBLEBEE SPECIALIST GROUP

Source: Hatfield et al. 2015; Photo: Clay Bolt, Map: The Xerces Society

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Bumble Bee Status Assessment

Bombus terricola
Yellow banded bumble bee

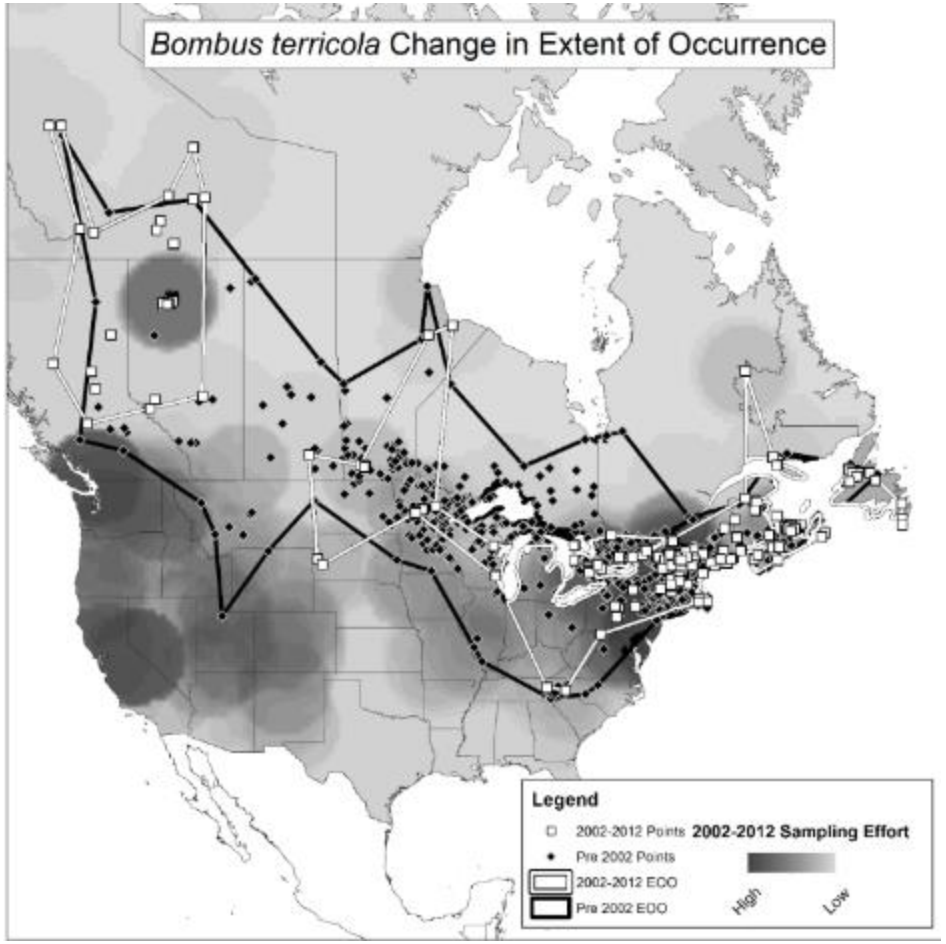
Range loss (adjusted by collection effort): **36%**

Relative Abundance (to historic value): **20%**

Persistence (relative to historic value): **67%**

Average Decline: 50%

IUCN Red List: **Vulnerable**



IUCN SSC BUMBLEBEE SPECIALIST GROUP

Source: Hatfield et al. 2015; Photo: Leif Richardson, Map: The Xerces Society

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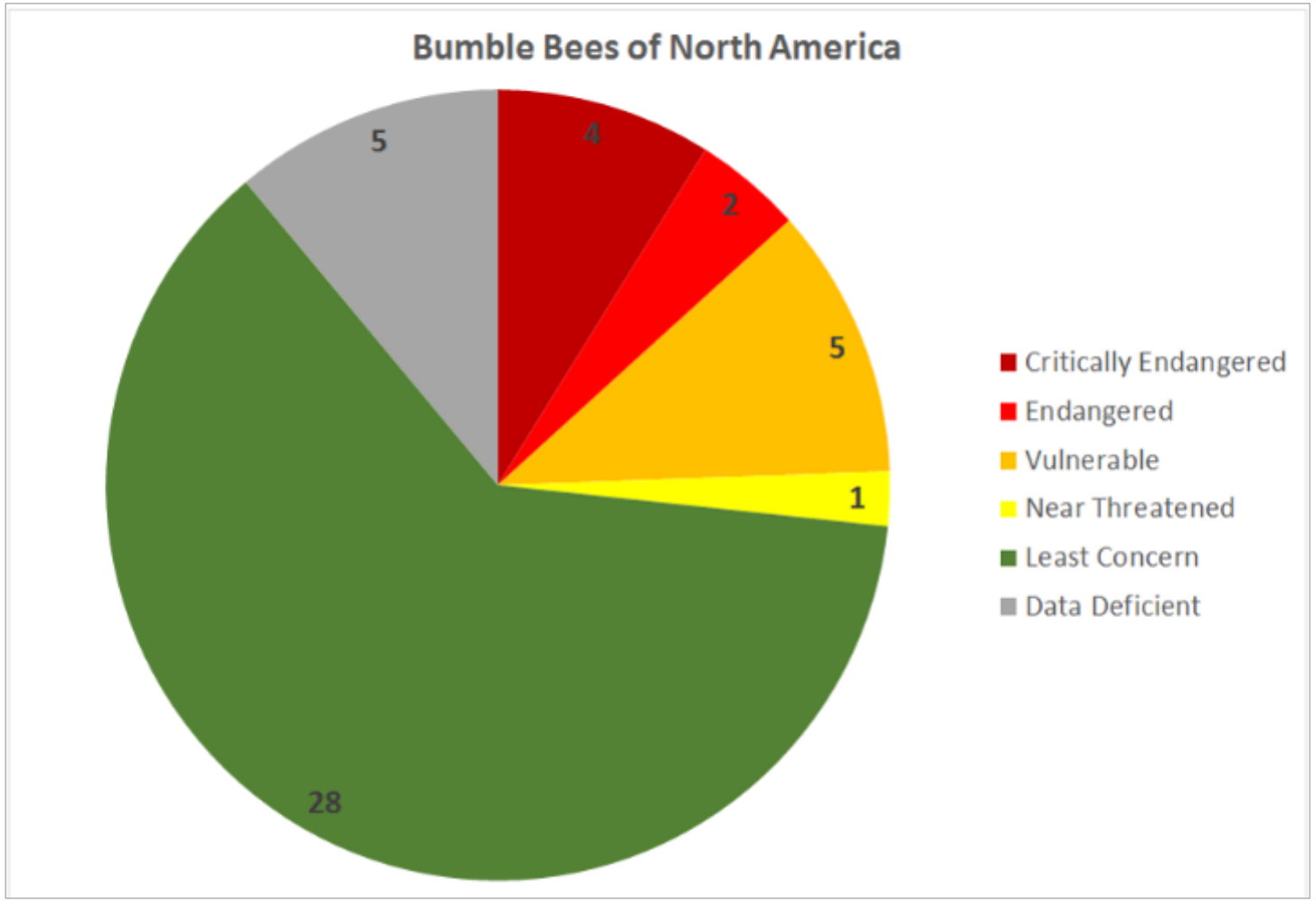
Bumble Bee Status Assessment



Source: IUCN Redlist

North America

One quarter of all bumble bee species are in a threatened or near threatened category.

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Threats

Photo: Rich Hatfield

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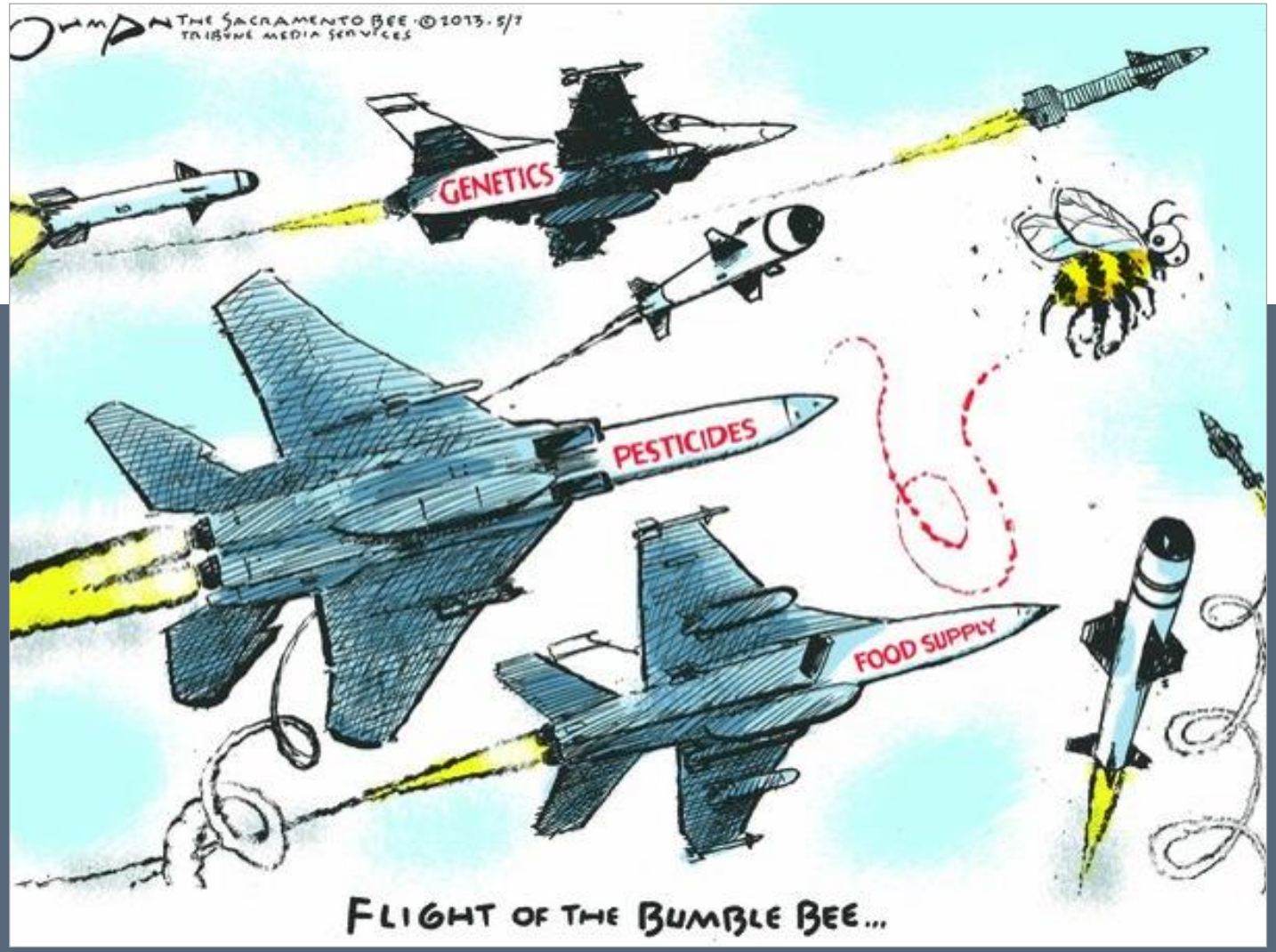
Causes of Decline



Source: Jack Ohman, The Sacramento Bee 5/7/2013

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Habitat Loss

Photo: Eric Mader

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Habitat Loss

Photo: Matthew Shepherd

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Habitat Loss

Photo: Matthew Shepherd

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Habitat Loss

Photo: Matthew Shepherd

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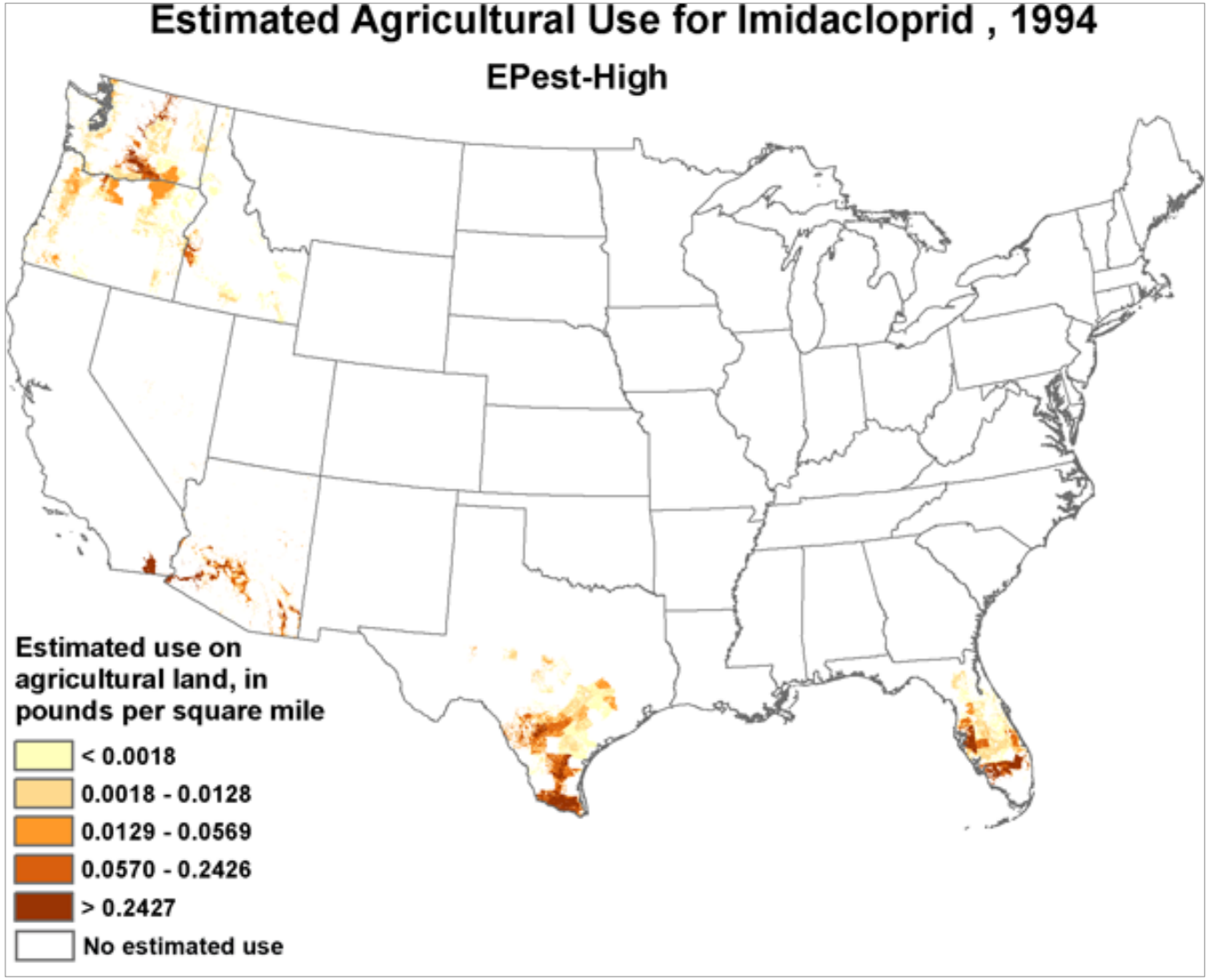
Insecticide Use



Source: USGS Pesticide National Synthesis Project

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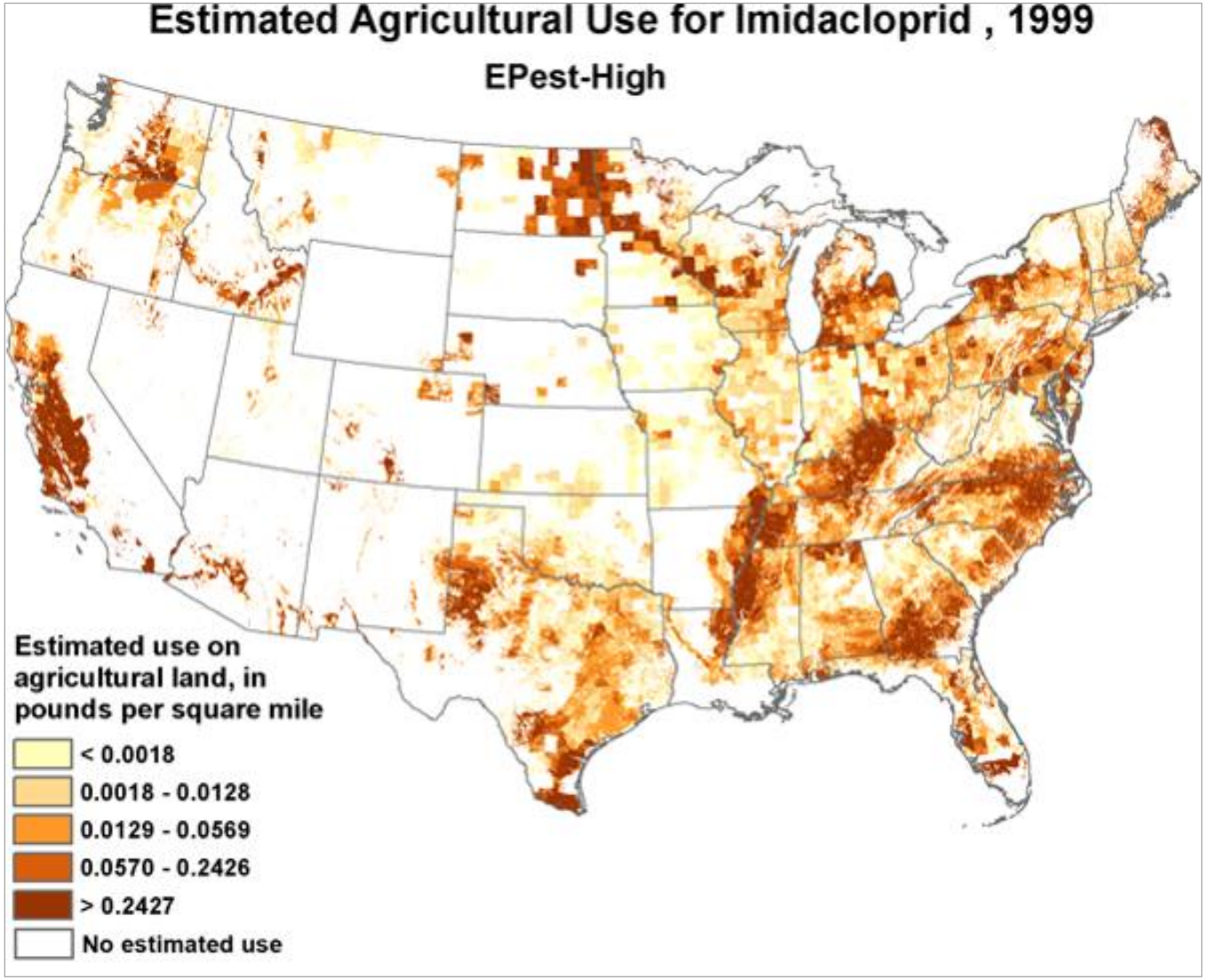
Insecticide Use



Source: USGS Pesticide National Synthesis Project

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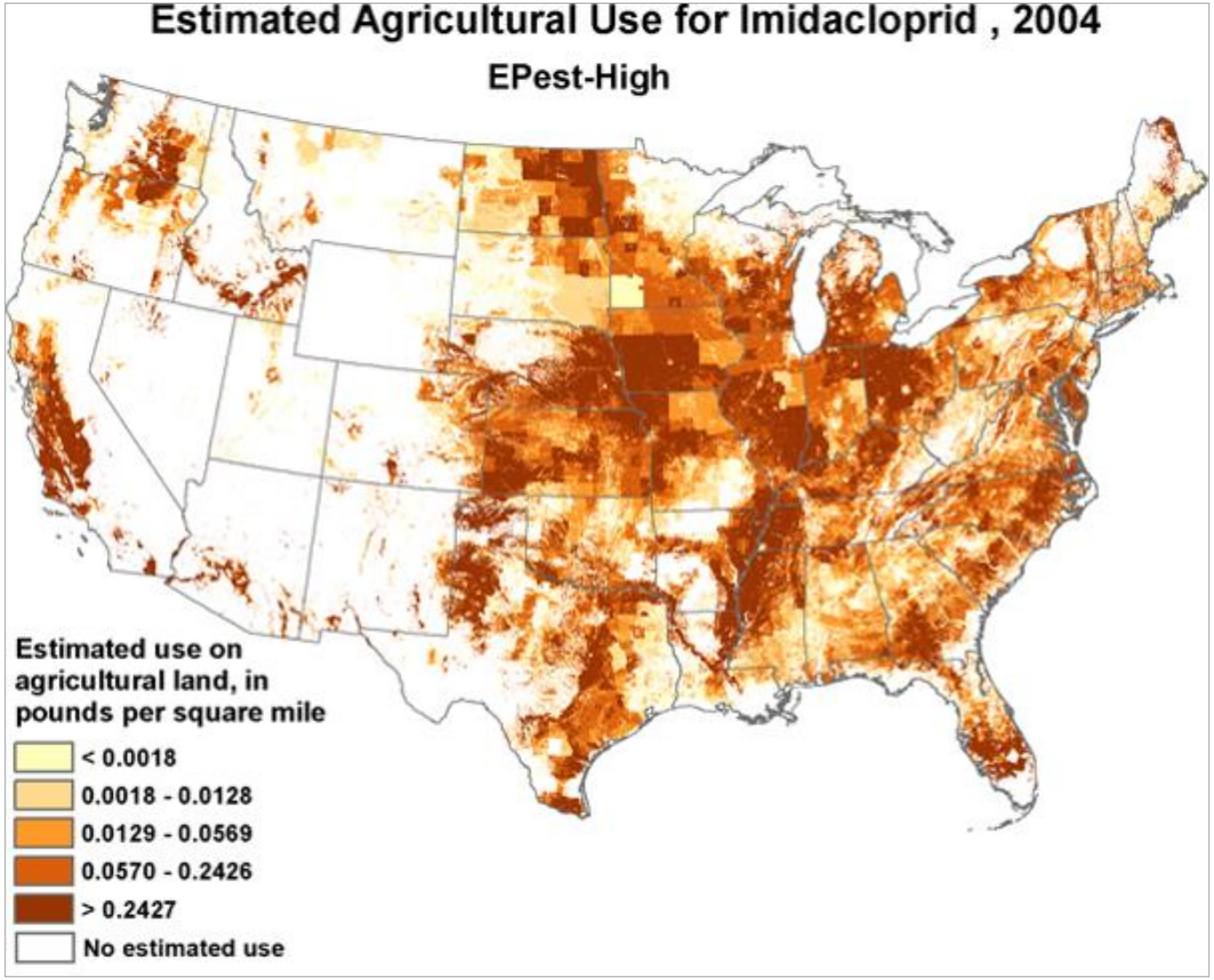
Insecticide Use



Source: USGS Pesticide National Synthesis Project

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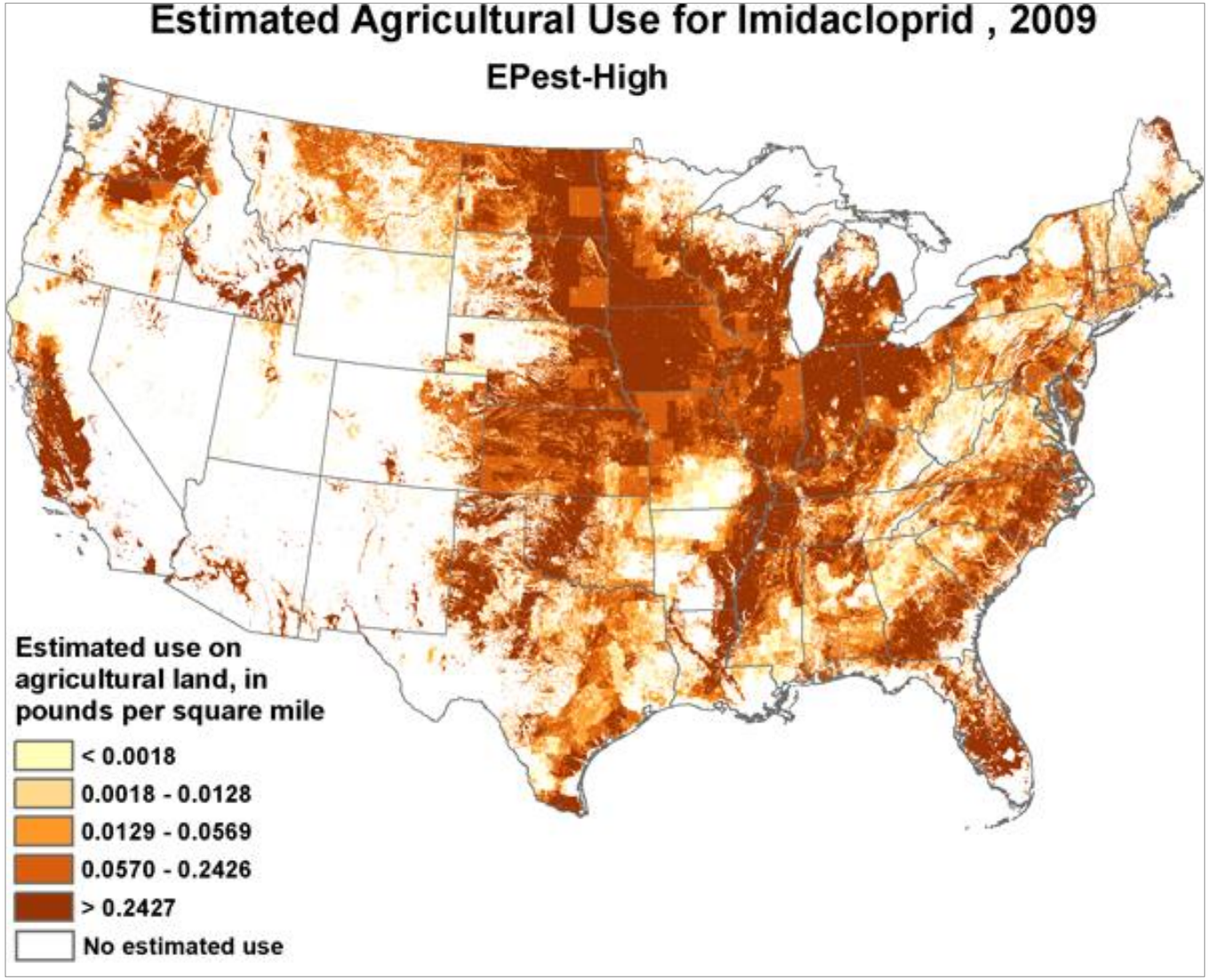
Insecticide Use



Source: USGS Pesticide National Synthesis Project

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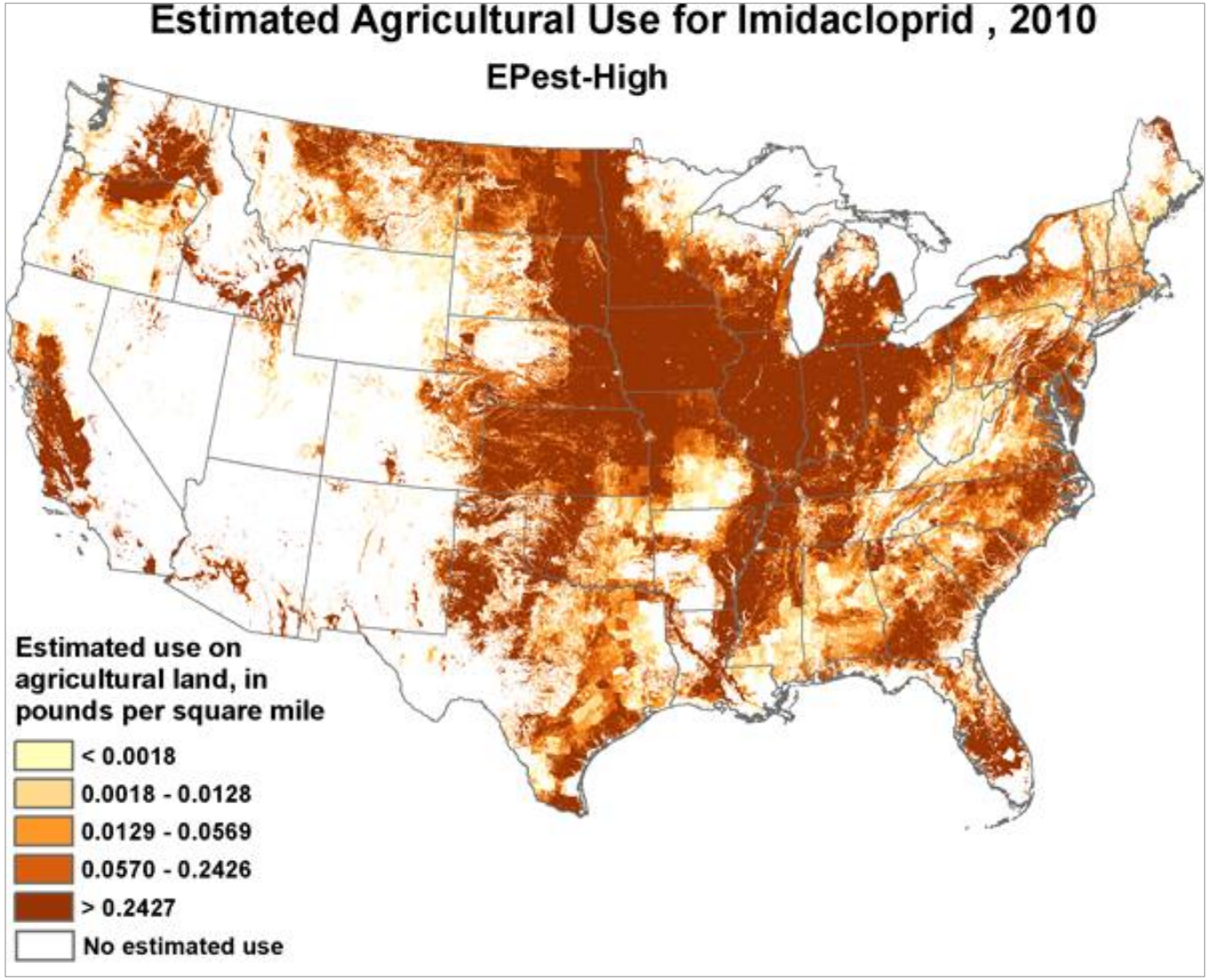
Insecticide Use



Source: USGS Pesticide National Synthesis Project

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Urban Insecticide Use

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Photos: The Xerces Society, Rich Hatfield

Urban Insecticide Use

Photos: The Xerces Society, Rich Hatfield

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Urban Insecticide Use

Photos: The Xerces Society, Rich Hatfield

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Urban Insecticide Use

Photos: The Xerces Society, Rich Hatfield, the Oregonian

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Climate Change

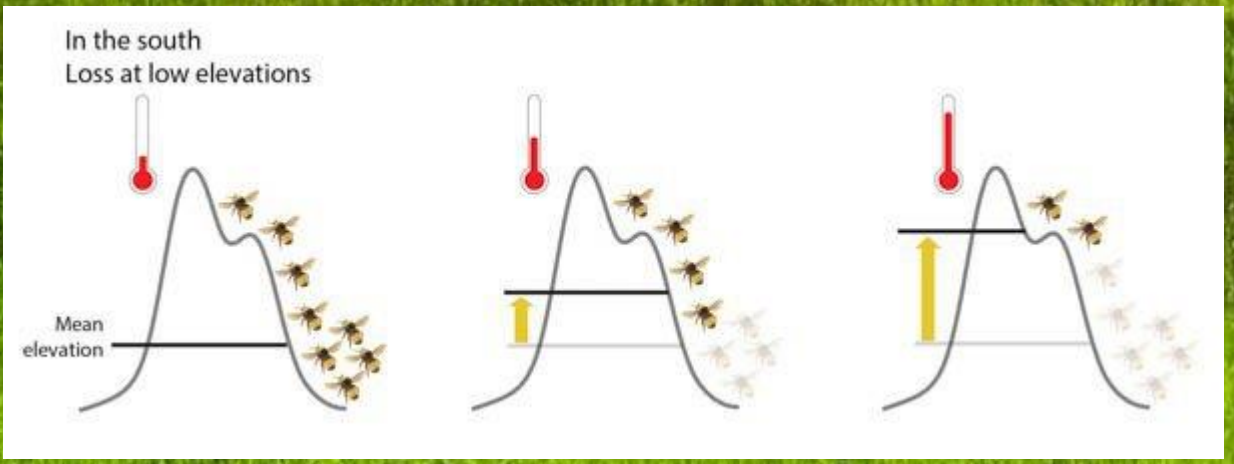

Photo: Sarina Jepsen, Xerces Society; Infographic: Ann Sanderson, Sheila Colla, and Paul Galpern

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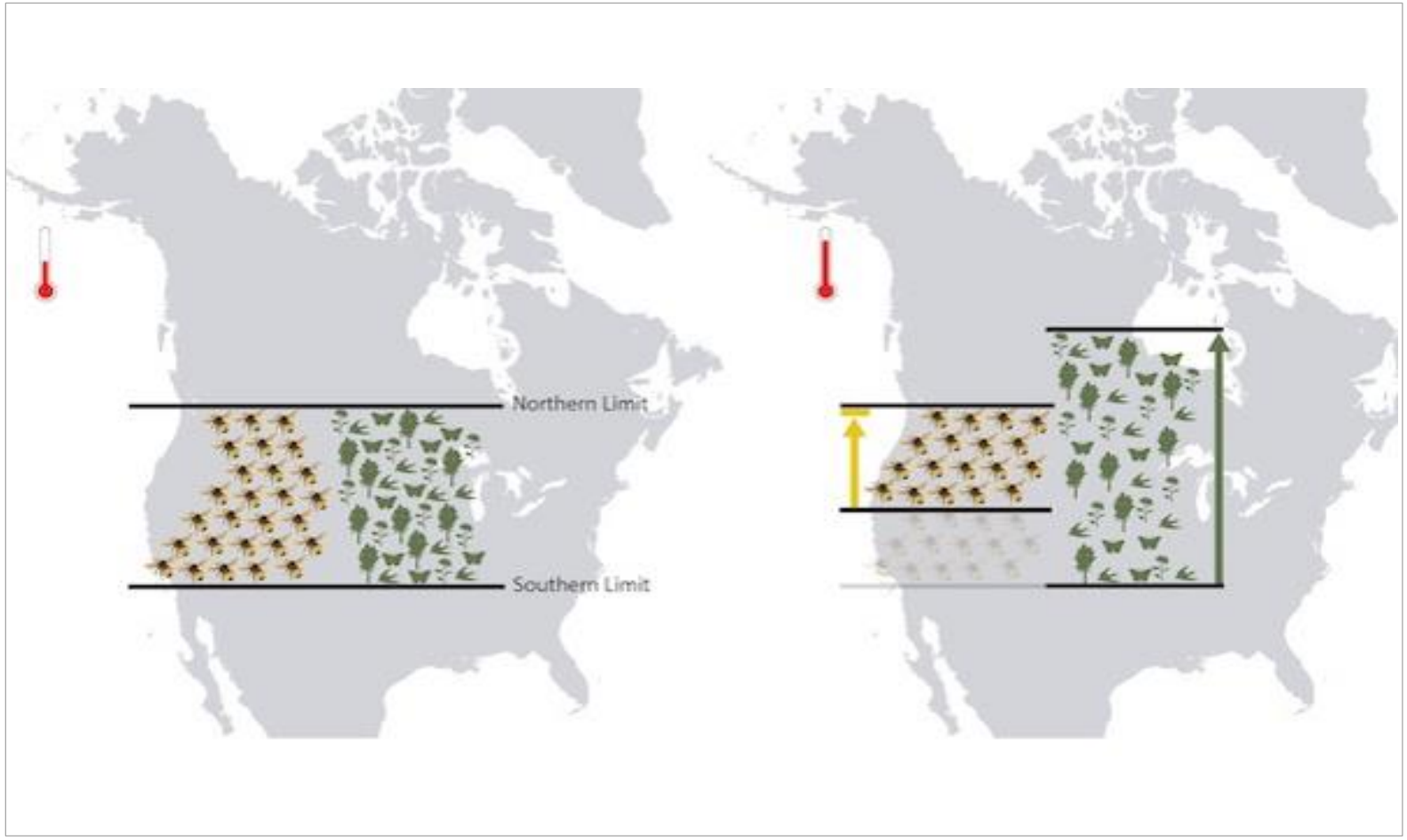
Climate Change



Infographic: Ann Sanderson, Sheila Colla, and Paul Galpern

Bumble Bees

- Not migrating northward
- Stuck in a climate vise
- Forced to higher elevations - islands

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Photos by Marshalpr at http://www.panoramio.com/photo/10391889, Koppert Biological Systems

Commercial Bumble Bees

Disease and Competition

- Moving non-native species around the globe
  - South America
  - Japan
  - North America
- Moving and amplifying pathogens
  - *Nosema bombi*
- Unregulated in 48 U.S. States
  - CA and OR exceptions

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Conservation Efforts

Photo by Rich Hatfield

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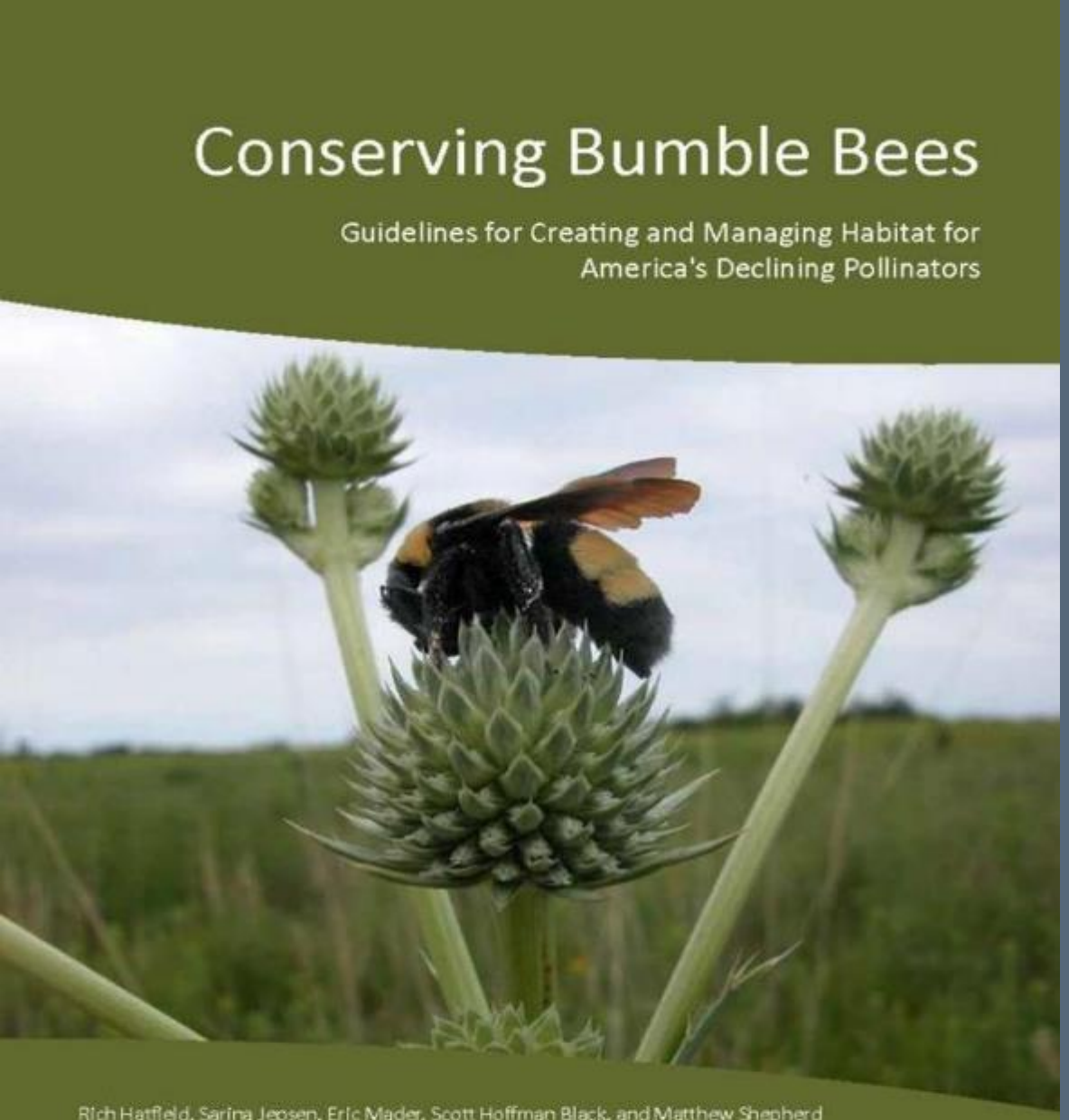

Land Management

Conservation Guidelines for Landowners and Managers

- Outlines Threats
  - Habitat Fragmentation
  - Pesticides
  - Grazing
  - Pests and Diseases
- Provides clear management recommendations to create high quality bumble bee habitat
- Gives regionally specific plant recommendations for bumble bees
- Contains regional bumble bee ID guides

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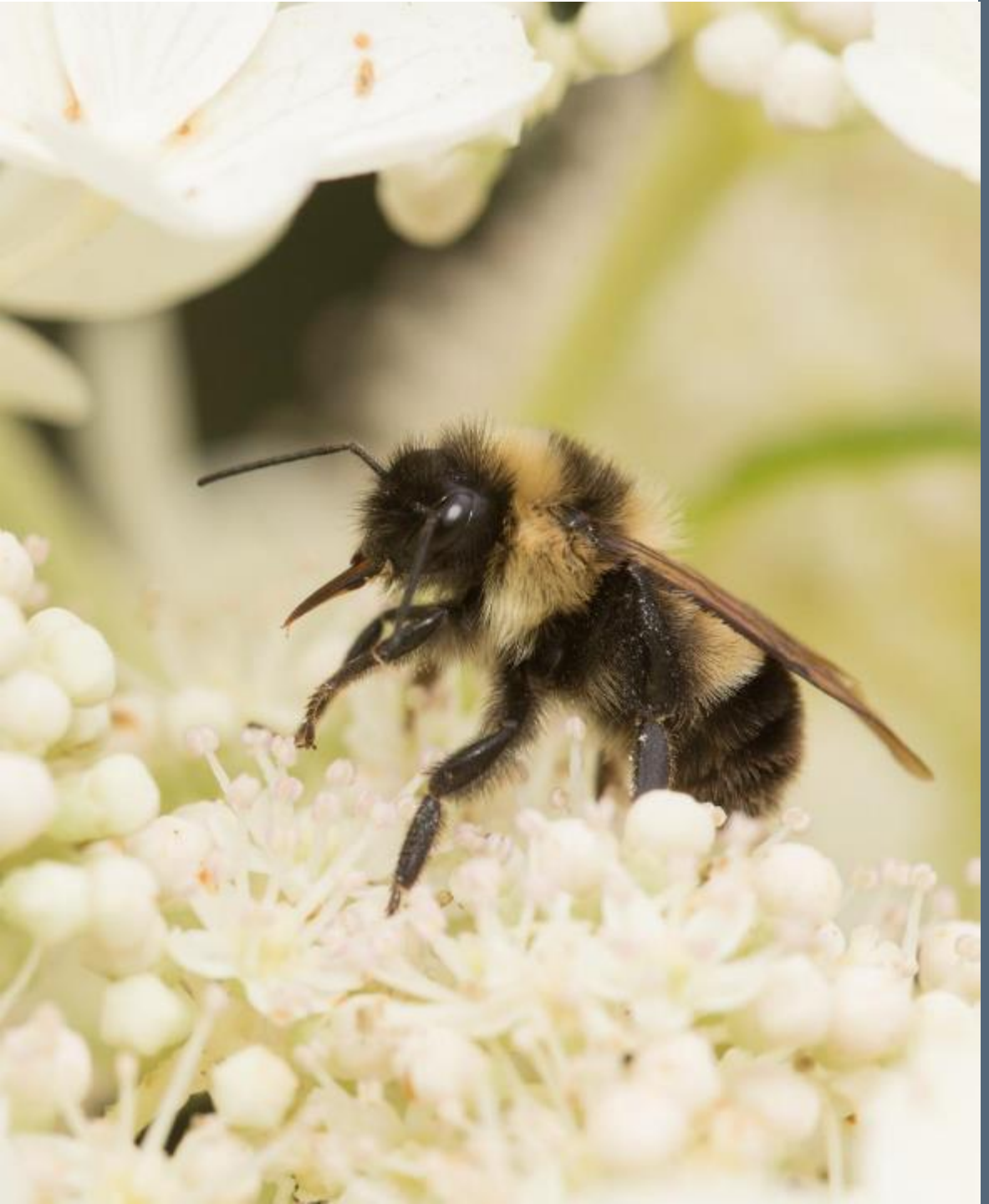

Photo by Clay Bolt

Rusty Patched Bumble Bee

Implications

- Critical Habitat
- Protection from adverse effects of federal activities (through Section 7 consultation)
- FWS will have the authority to develop and carry out recovery plans, to purchase important habitat, and give financial aid to state wildlife agencies to work toward species recovery
- Restrictions on ‘Take’ (through Section 9) will apply

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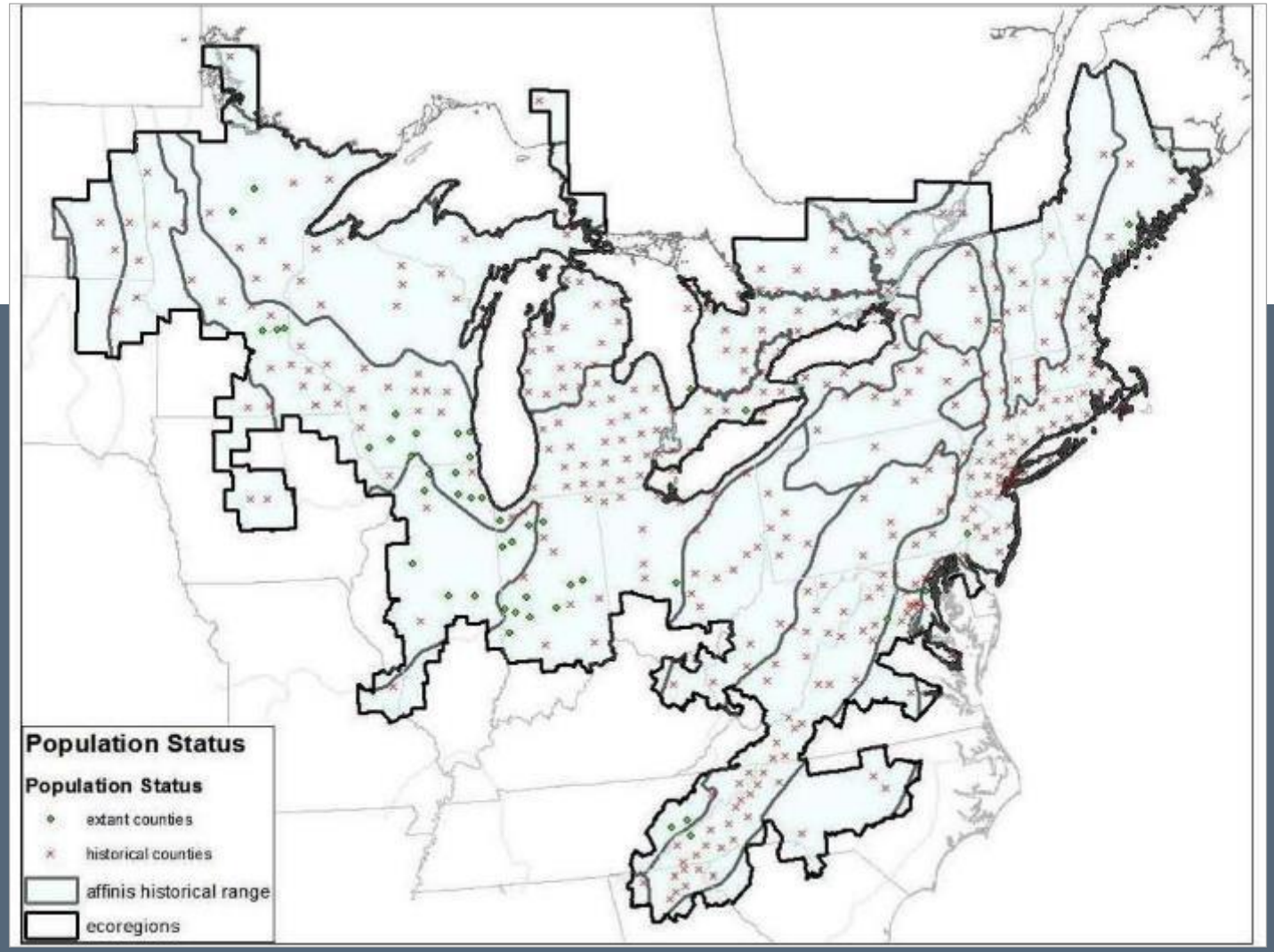
Rusty Patched Bumble Bee - ESA



Source: USFWS

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Proposal: NE Working Lands for Pollinators

A proposal recently submitted to the USDA-NRCS, WLFW Program

Proposal authors: Eric Venturini (Xerces), Jeremy Markuson (ME-NRCS), and Mark McCollough (ME -USFWS)

XERCES SOCIETY for Invertebrate Conservation

Provide pollinator conservation expertise

Coordination and leadership

Facilitate partnerships in research and outreach

USDA United States Department of Agriculture

Natural Resources Conservation Service

Set and achieve acreage goals

Provide WLFW leadership

Facilitate staff training on implementation

U.S. FISH & WILDLIFE SERVICE

ESA consultation

Regulatory predictability

Develop conservation measures

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Proposed Framework

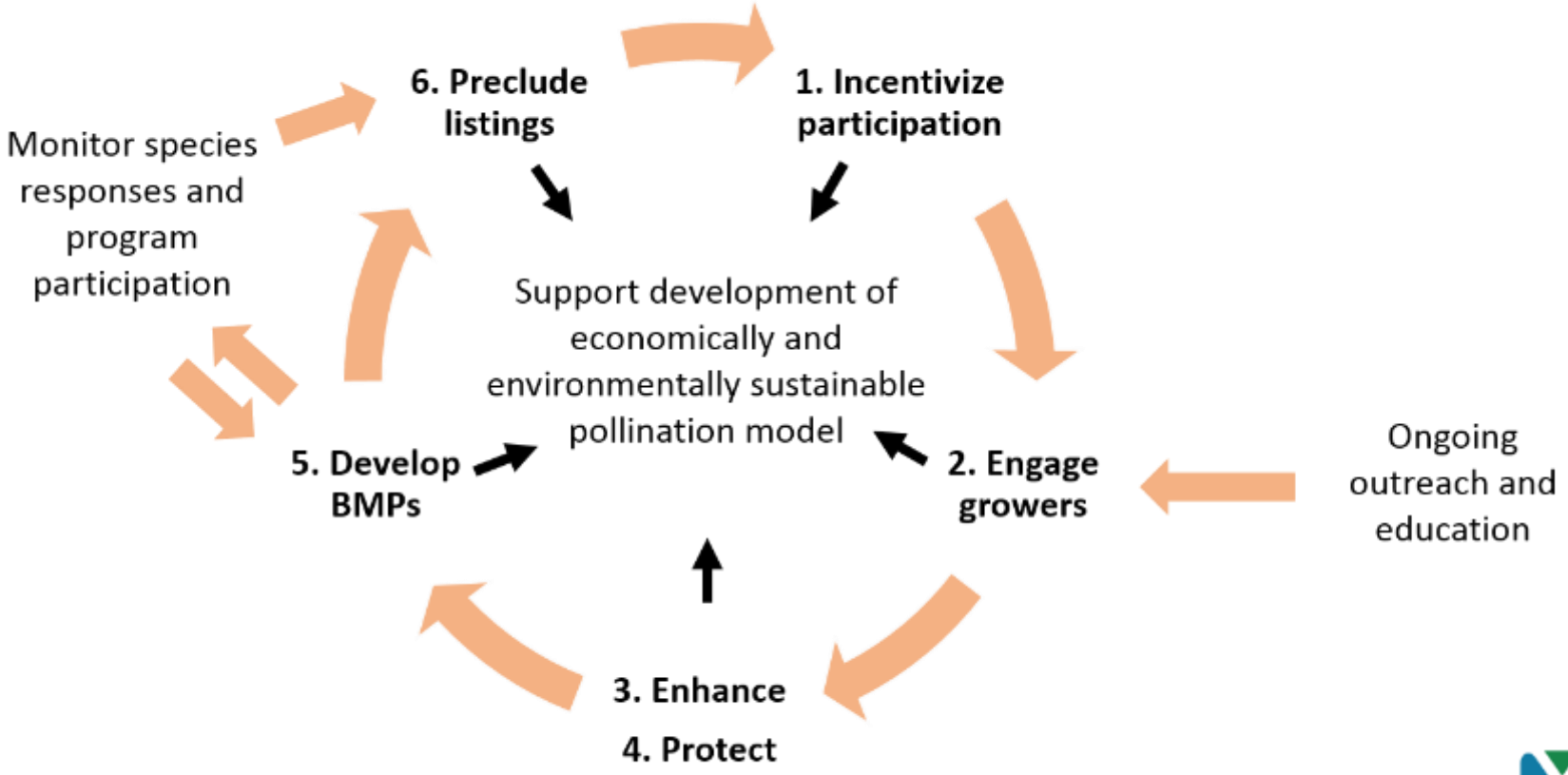

Image provided by Eric Venturini (Xerces)

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Strategic approach

Conservation projects prioritized based on:

1. Location
2. Benefit to producers
3. Predicted benefit of practice
4. Protection from pesticides
5. Inclusion of targeted pollinator species' superfoods

New England NRCS commitments by state

State	Habitat Acres	No. of Producers	IPM Acres
ME	2,400	480	300
NH	1,800	360	-
VT	2,400	240	6
CT	60	12	-
MA	900	60	60
RI	120	30	-
Total →	**7680**	**1182**	**366**

Table provided by Eric Venturini (Xerces)

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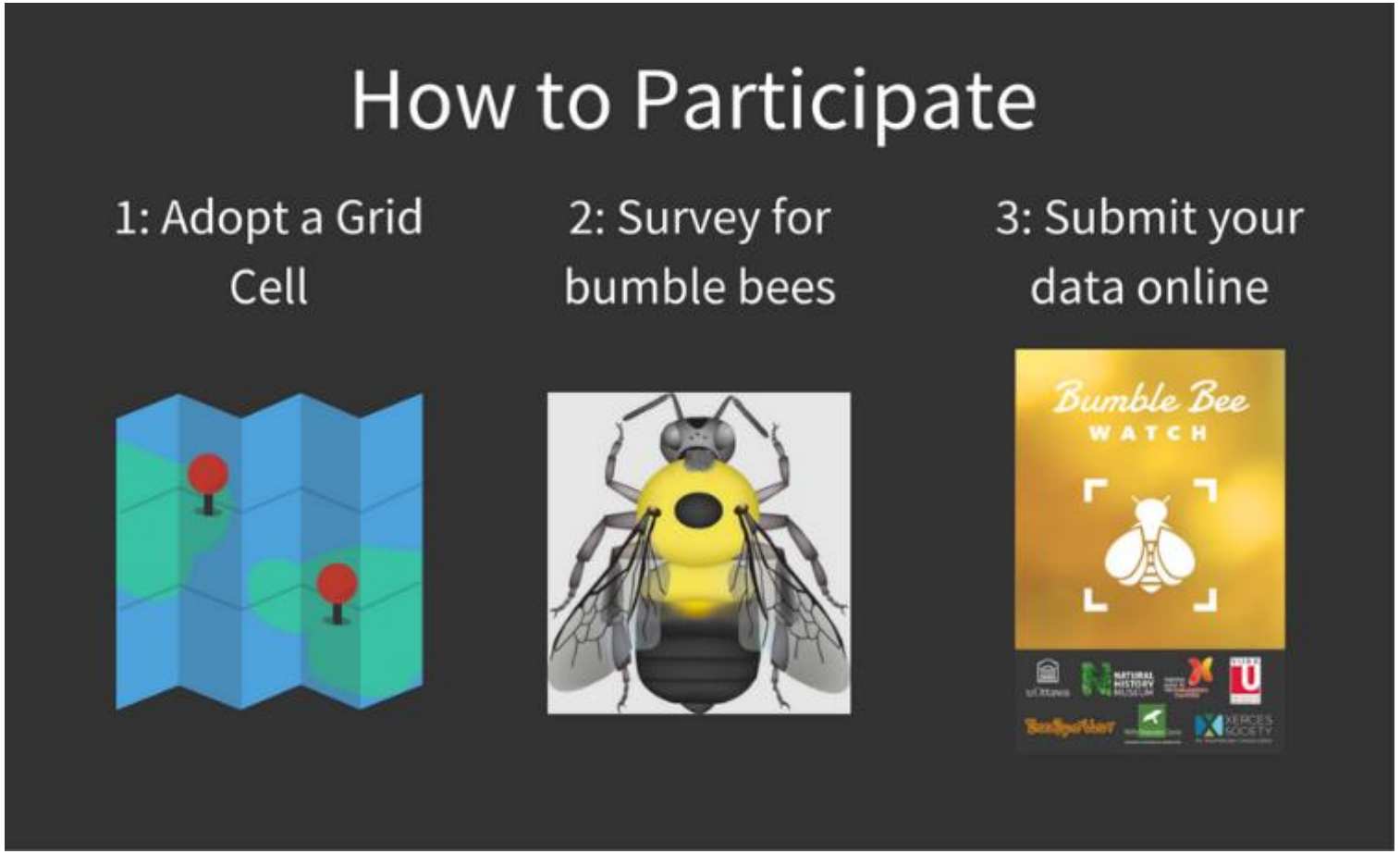
Pacific Northwest Bumble Bee Atlas



A collaborative effort to track and conserve the bumble bees of the Northwest

Stay tuned for more information at: www.pnwBumbleBeeAtlas.org

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Bumble Bee Watch

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Photos: The Xerces Society

Bumble Bee Watch

Photos: The Xerces Society

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Bumble Bee Watch

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Photos: The Xerces Society

Bumble Bee Watch

Bumble B

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Bumble Bee Identification Guide

How to use this guide

This is an identification guide to help you determine the species of bumble bee in your photo. This guide will only work for females, and is not comprehensive as there are many additional color forms, and many look alike species. See this page for more information about bumble bee anatomy. To use the ID guide, compare your photo(s) on the left to the illustrations and select the features of each body part that most closely match the features on the bee in your photograph. Once you have chosen the correct features, choose a matching species. For more help with this identification guide, watch this video.

Mouse your cursor over your photo to see more detail.

Identification Guide

Face:

Yellow face

Black face

Not Sure

Thorax:

All yellow

Yellow in front

Bumble Bees

You must select one of the choices below before submitting your sighting

Bombus caliginosus

Bombus insularis

Bombus occidentalis

Bombus occidentalis

Bombus occidentalis

Bombus vosnesenskii

Photos: The Xerces Society

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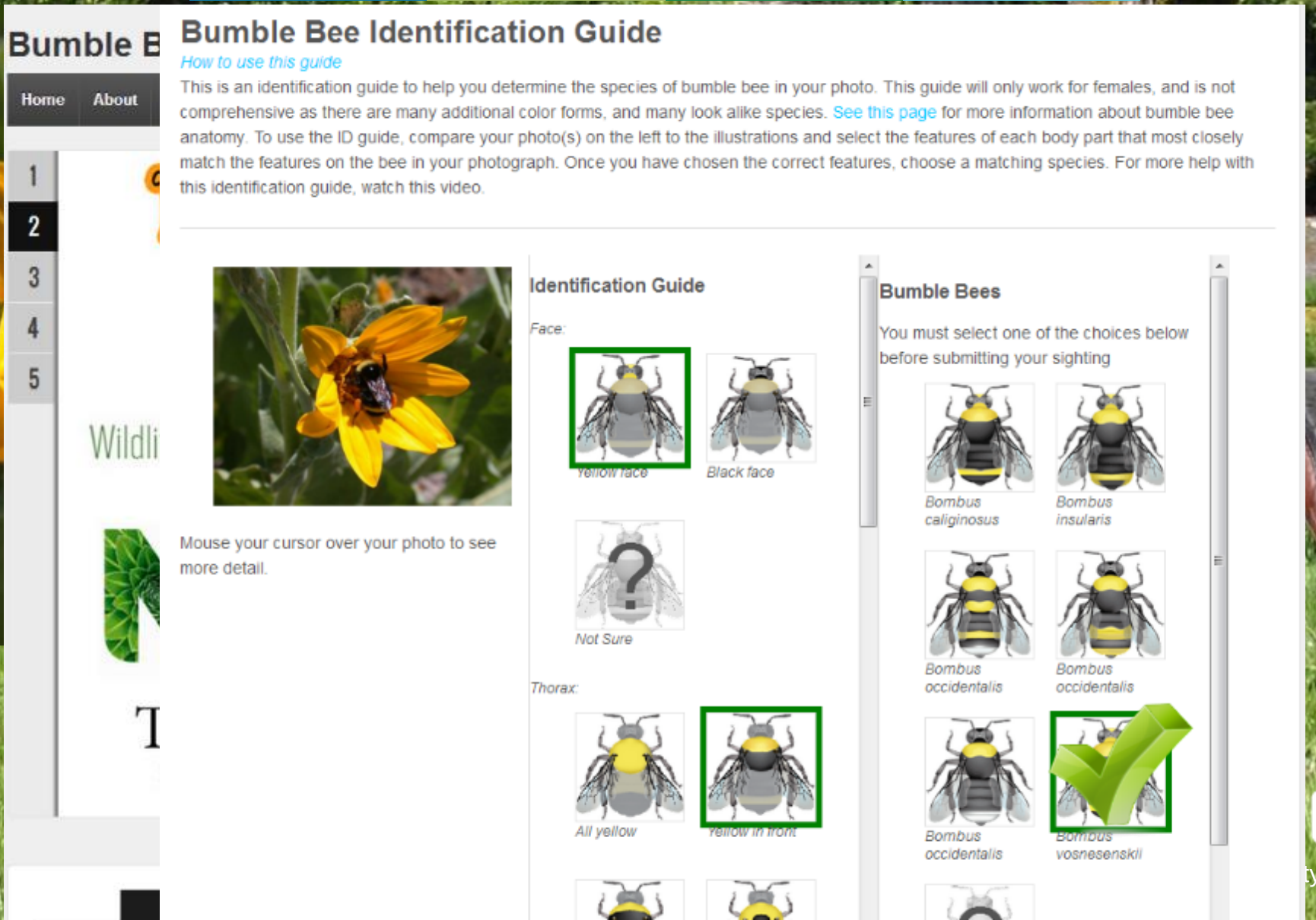
Bumble Bee Watch



Photos: The Xerces Society

Bumble Bee Habitat

Four components

Food Sources	Shelter	Connectivity	Pesticides
Nectar and pollen spring through fall	Nesting and overwintering sites; protection from managed bees	Landscape scale	Consider both direct and indirect effects




Photos: Xerces/Rich Hatfield; NRCS/Lynn Betts; Xerces/Eric Mader, Sarah Greenleaf

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PNW- Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	Scientific name	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Lacy phacelia	*Phacelia tanacetifolia*								
California poppy	*Eschscholzia californica*								
Lance selfheal	*Prunela vulgaris* ssp. *lanceolata*								
Bigleaf lupine	*Lupinus polyphyllus*								
Royal penstemon	*Penstemon speciosus*								
Showy milkweed	*Asclepias speciosa*								
Nettle-leaf horsemint	*Agastache urticifolia*								
Coyote mint	*Monardella odoratissima*								
Nuttall's sunflower	*Helianthus nuttallii*								
Canada goldenrod	*Solidago canadensis*								

From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

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CA - Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	**Scientific name**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Lacy phacelia	*Phacelia tanacetifolia*								
Carmel ceanothus	*Ceanothus griseus*								
California poppy	*Eschscholzia californica*								
Bigleaf lupine	*Lupinus polyphyllus*								
Nootka rose	*Rosa nutkana*								
Showy milkweed	*Asclepias speciosa*								
Nettle-leaf horsemint	*Agastache urticifolia*								
Coyote mint	*Monardella odoratissima*								
Nuttall's sunflower	*Helianthus nuttallii*								
Canada goldenrod	*Solidago canadensis*								

From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

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SW - Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	**Scientific name**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Lacy phacelia	*Phacelia tanacetifolia*								
White honeysuckle	*Lonicera albiflora*								
Creosote bush	*Larrea tridentata*								
California poppy	*Eschscholzia californica*								
Golden prairie clover	*Dalea aurea*								
Arrowleaf balsamroot	*Balsamorhiza sagittata*								
Silvery lupine	*Lupinus argenteus*								
Showy milkweed	*Asclepias speciosa*								
Beebalm	*Monarda fistulosa*								
Canada goldenrod	*Solidago canadensis*								

From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

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Rocky MT - Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	**Scientific name**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Twinberry honeysuckle	*Lonicera involucrata*								
Large-flowered penstemon	*Penstemon grandiflorus*								
Purple prairie clover	*Dalea purpurea*								
Arrowleaf balsamroot	*Balsamorhiza sagittata*								
Nootka rose	*Rosa nutkana*								
Beebalm	*Monarda fistulosa*								
Showy milkweed	*Asclepias speciosa*								
Silvery lupine	*Lupinus argenteus*								
Nettle-leaf horsemint	*Agastache urticifolia*								
Smooth blue aster	*Symphyotrichum laeve*								

From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

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Great Plains -Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	**Scientific name**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Spiderwort	*Tradescantia ohiensis*								
Purple prairie clover	*Dalea purpurea*								
Smooth penstemon	*Penstemon digitalis*								
Beebalm	*Monarda fistulosa*								
Butterflyweed	*Asclepias tuberosa*								
Narrowleaf mountain mint	*Pycnanthemum tenuifolium*								
Showy goldenrod	*Solidago speciosa*								
Bottle gentian	*Gentiana andrewsii*								
Tall blazing star	*Liatris aspera*								
New England aster	*Symphyotrichum novae-angliae*								

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From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

Great Lakes - Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	**Scientific name**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Spotted geranium	*Geranium maculatum*								
Showy beardtongue	*Penstemon cobaea*								
Sundial lupine	*Lupinus perennis*								
Butterflyweed	*Asclepias tuberosa*								
Beebalm	*Monarda fistulosa*								
Field thistle	*Cirsium discolor*								
Narrowleaf mountain mint	*Pycnanthemum tenuifolium*								
Tall blazing star	*Liatris aspera*								
Showy goldenrod	*Solidago speciosa*								
Bottle gentian	*Gentiana andrewsii*								
New England aster	*Symphyotrichum novae-angliae*								

From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

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NE - Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	Scientific name	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Spotted geranium	*Geranium maculatum*								
Dutchman's breeches	*Dicentra cucullaria*								
Sundial lupine	*Lupinus perennis*								
Smooth penstemon	*Penstemon digitalis*								
Beebalm	*Monarda fistulosa*								
Butterflyweed	*Asclepias tuberosa*								
Field thistle	*Cirsium discolor*								
Narrowleaf mountain mint	*Pycnanthemum tenuifolium*								
Blue giant hyssop	*Agastache foeniculum*								
Showy goldenrod	*Solidago speciosa*								
New England aster	*Symphyotrichum novae-angliae*								

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From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

SE - Bumble Bee Foraging Plants

Plant		Bloom Period and Color							
Common name	Scientific name	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Wild azalea	*Rhododendron canescens*								
Spotted beebalm	*Monarda punctata*								
Sundial lupine	*Lupinus perennis*								
Swamp rose	*Rosa palustris*								
Butterflyweed	*Asclepias tuberosa*								
Common buttonbrush	*Cephalanthus occidentalis*								
Field thistle	*Cirsium discolor*								
Narrowleaf mountain mint	*Pycnanthemum tenuifolium*								
Tall blazing star	*Liatris aspera*								
Great blue lobelia	*Lobelia siphilitica*								

From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

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Bumble Bee Foraging – Trees & Shrubs

Plant		Bloom Period and Color				
Common name	Scientific name	Spring	Early Summer	Mid Summer	Late Summer	Fall
Willow	*Salix* spp.					
New Jersey tea (E)	*Ceanothus americanus*					
Rhododendron	*Rhododendron* spp.					
Redbud	*Cercis* spp.					
Twinberry honeysuckle (W)	*Lonicera involucrata*					
Raspberry	*Rubus* spp.					

From: Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guide-lines for Creating and Managing Habitat for America's Declining Pollinators.

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Nest Sites

Bumble bees build and other native bees nest in:

- Cavities such as old rodent holes
- Overgrown areas
- Brush piles
- Under bunch grasses
- Bare Ground

Conserve un-mowed areas and leave some areas unmulched.

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Photos: Mace Vaughan, Matthew Shepherd, Bonnie Carruthers

Overwintering Bumble Bees

Illustration by Alix Lukas

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Best Management Practices

Photo: Xerces Society / Rich Hatfield

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Managing Land for Bumble Bees

Management practices which can positively or negatively impact pollinators including grazing, fire, mowing, pesticides, recreation, grasshopper management, and managed pollinators

Photos: Heritage Seedlings, Inc.; NYSDOT; Xerces Society / Anne Stine; Yamhill County Council

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Managing Land for Bumble Bees: Overarching Principles

Heterogeneity: diversity in vegetation, structure, and management practices helps maximize biodiversity

Interactions: consider how natural forces, and active management interact

Adaptive Management: management for diverse animals requires active feedback loops and the ability to adapt to changing conditions

Knowledge Gaps: the status of knowledge is incomplete and will benefit from data and information sharing

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Grazing

In general, as grazing intensity increases, pollinator abundance and diversity decreases, especially at high grazing intensities.

Photo: Xerces Society / Sarina Jepsen

Source: Morris 1967; Hutchinson & King 1980; Sugden 1985; Dana 1997; Balmer & Erhardt 2000; Cagnolo et al. 2002; Carvell 2002; Kruess & Tscharntke 2002; Pöyry et al. 2006; Kuussaari et al. 2007; Sjödin 2007; Yoshihara et al. 2008; Littlewood 2008; Börschig et al. 2013; Jerrentrup et al. 2014; Elwell et al. 2016; van Klink et al. 2016

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Grazing

However, grazing can also be an important management tool to maintain forb-dominated grasslands which can benefit specific pollinator species.

Photos: Rich Hatfield, the Xerces Society

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Grazing BMPs

- 40% max utilization rate
- Move livestock frequently: rotational grazing; HDSD; or low AUMs
- Limit access to riparian areas & butterfly host plants
- Fall and winter grazing = fewer impacts

Photo: Xerces Society / Anne Stine

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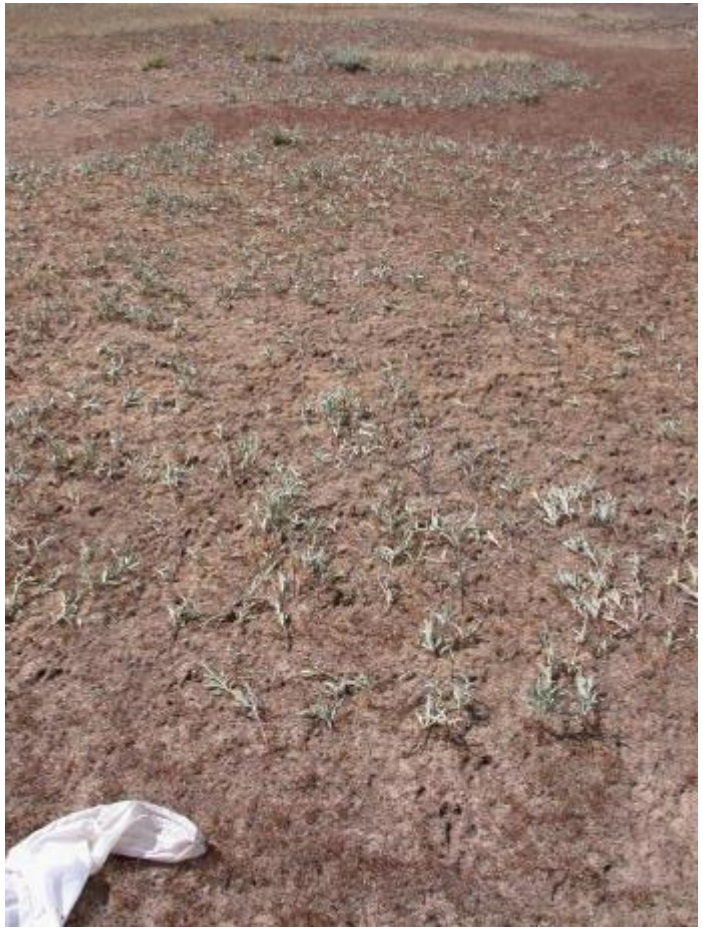
Grazing BMPs

Monitor local conditions

- Native grazers
- Drought
- Sensitive habitats/riparian areas



Photos: Rich Hatfield

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Mowing

There are millions of acres of roadside habitat that are mowed.

Mowing can kill pollinators & remove floral resources and excessive mowing reduces wildflower abundance and diversity over time.

Photo: Xerces Society / Jessa Cruz

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Sources: Thomas 1984; Wynhoff 1998; Di Giulio et al. 2001; Humbert et al. 2010; Hatfield et al. 2012; Kayser 2014

Mowing BMPs

- Leave unmowed strips
- Delay mowing until fall
- Increase mower height
- Mow in the middle of the day when temps are warm

Photo: Ron Klataske

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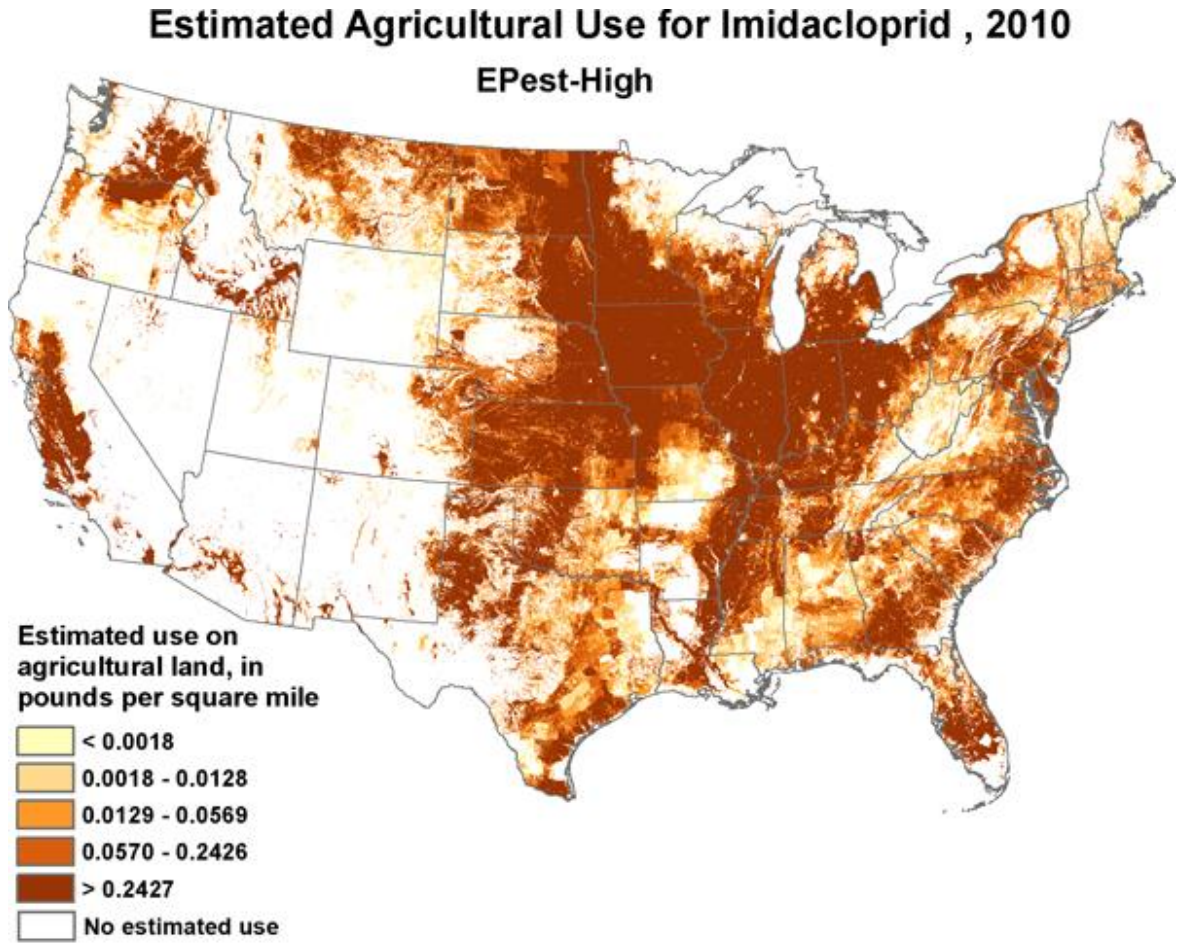
Pesticides: General Considerations

- Consider non-chemical alternatives
- Use least toxic and targeted options
- Carefully consider timing
- Minimize non-target exposure



Baker, N.T., and Stone, W.W., 2015, Estimated annual agricultural pesticide use for counties of the conterminous United States, 2008-12: U.S. Geological Survey Data Series 907, 9 p.

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Insecticides: If you must

Resources

How to Reduce Bee Poisoning from Pesticides

Provides information on how specific pesticides affect bees

UC IPM's On-line Bee Precaution Pesticide Rating tool

Provides info on risk of specific pesticides, guidance on how to reduce bee poisoning, and includes information on potentially harmful mixtures

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Pesticides: Herbicides

- Consider alternate food sources before removal
- Use targeted methods
  - Spot treating
  - Do not broadcast
- Target vulnerable time periods of weeds
- Avoid confusion of native plants
  - Thistles!
- Plan for replacement of food sources!

Photo: Xerces/Rich Hatfield

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Managed Pollinators

Beekeeping is not wildlife conservation.

Honey Bees:

- Compete with native bees
- Alter pollination networks
- Transmit diseases to native bees

Photo: Scott Bauer/USDA

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Photo by Eric Mader

Managed Pollinators on Public Lands

- Avoid areas with sensitive bee populations
  - Honey bees will regularly fly up to 3 miles
- Diverse wildflower areas are likely to have diverse native bee populations – avoid competition
- Ensure there is sufficient infrastructure
  - Roads, landing area, etc.
- Consider compatibility with invasive plant species management and other management goals
- Consider human-bear conflicts

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Photo by Rollin Coville

If Honey Bees are Compatible with Management

- Apiaries should be placed more than 4 miles from:
  - Known locations of pollinators that are listed on state or federal endangered species acts, or designated as special status, sensitive, or other species of concern (including plants);
  - Wilderness and wilderness study areas as well as congressionally designated preserves, and monuments.
  - Habitats of special value for biodiversity and/or pollinators (e.g. high elevation meadows, wet meadows, etc.).
- Each apiary should have no more than 20 hives.
- Apiaries should be separated by at least 4 miles.

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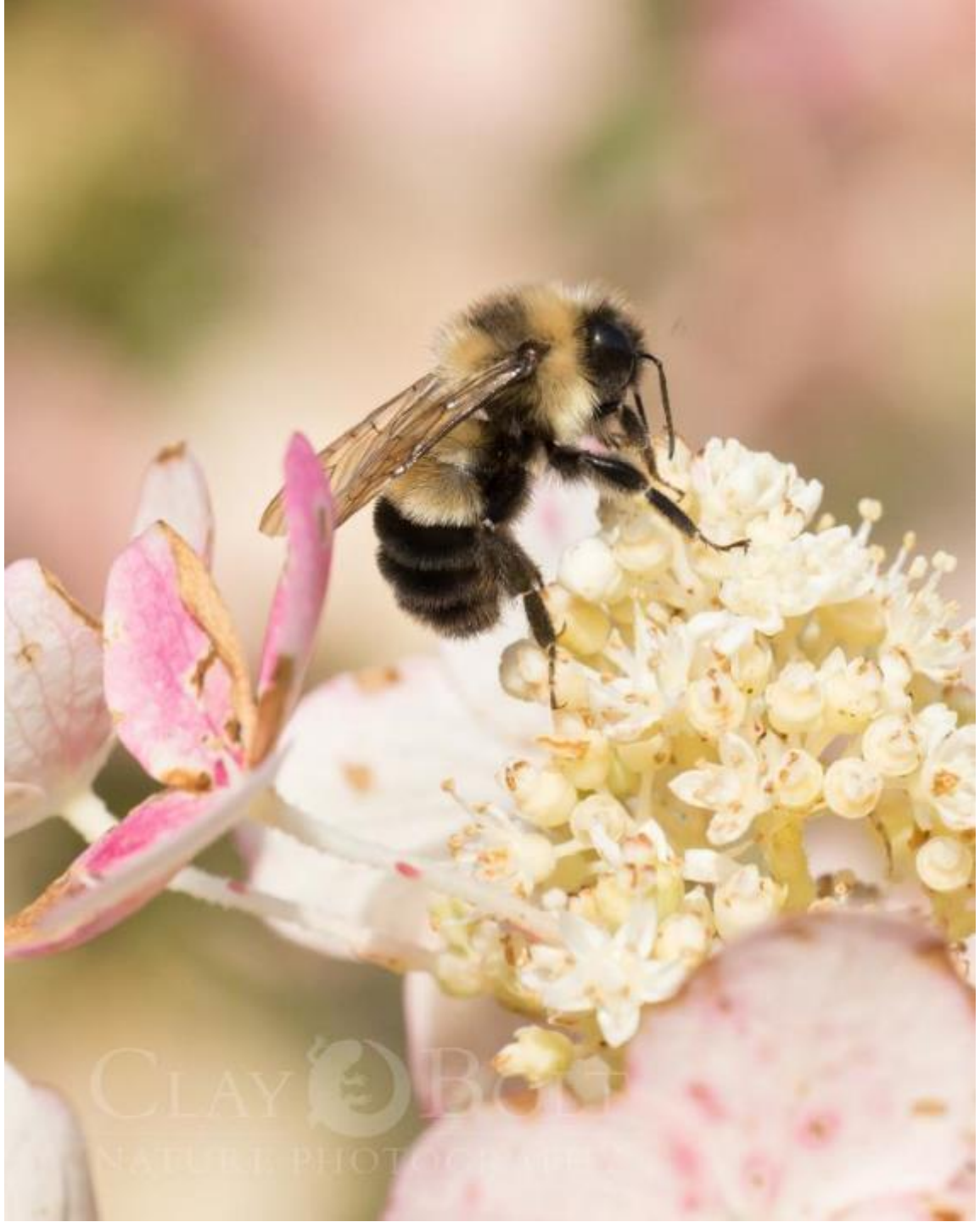

Photo: Clay Bolt

The Rusty Patched Bumble Bee

Bombus affinis

Life History:

- Very early emerging and late senescing – around longer than most species
- Varied nesting habits – underground, and also historically in compost piles, chairs, etc.
- Short tongue
- Most common food plants:
  - Wild bergamot
  - Prairie clover
  - Giant hyssop
  - Native cranberry
  - Goldenrod
  - Echinacea
  - Native thistles
  - *Amorpha canescens* (leadplant)
  - Jewelweed
  - Mountainmint
  - Native spirea
  - Spotted joe-pye weed (***Eutrochium maculatum***)

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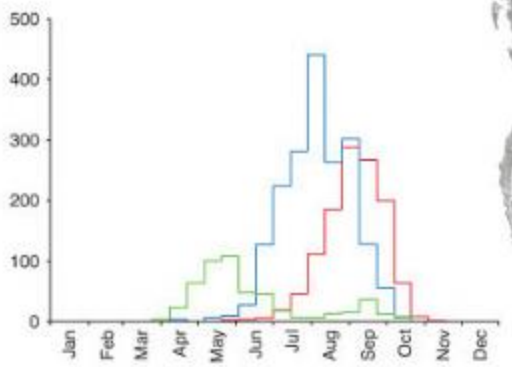
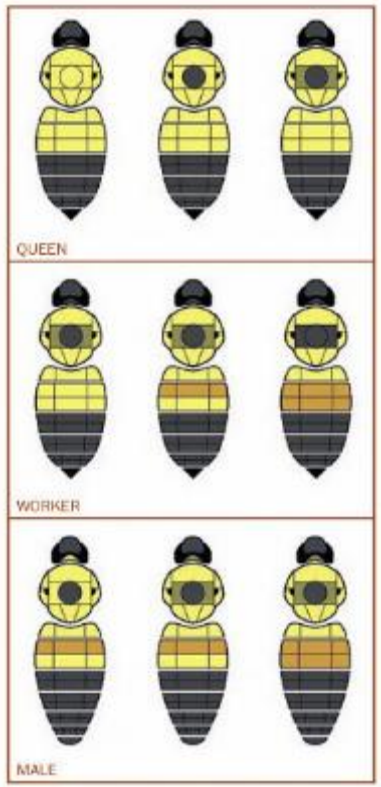
The Rusty Patched Bumble Bee - Identification





Illustrations from Bumble Bees of North America. By Williams et al.; Photo by Clay Bolt

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The Rusty Patched Bumble Bee - Identification

ID Tips:

- Rusty patch completely surrounded by yellow
- Short round face
- Queens have no rusty patch!

Photo: Clay Bolt Illustrations from Bumble Bees of North America. By Williams et al.; Photo by Clay Bolt

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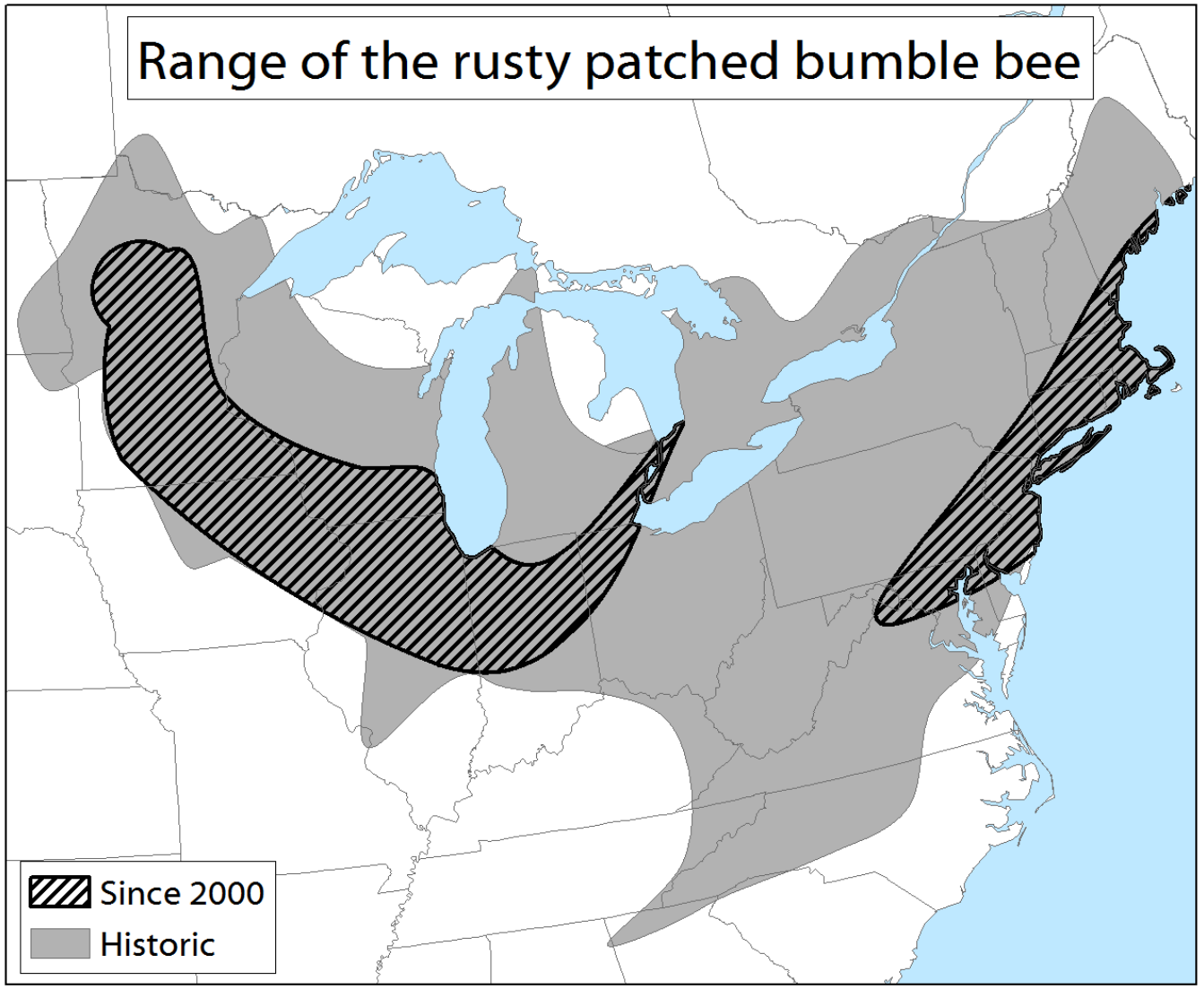
Rusty Patched Bumble Bee - Range



Data: Bumble Bees of North America By Williams et al.; and www.BumbleBeeWatch.org; Map by The Xerces Society

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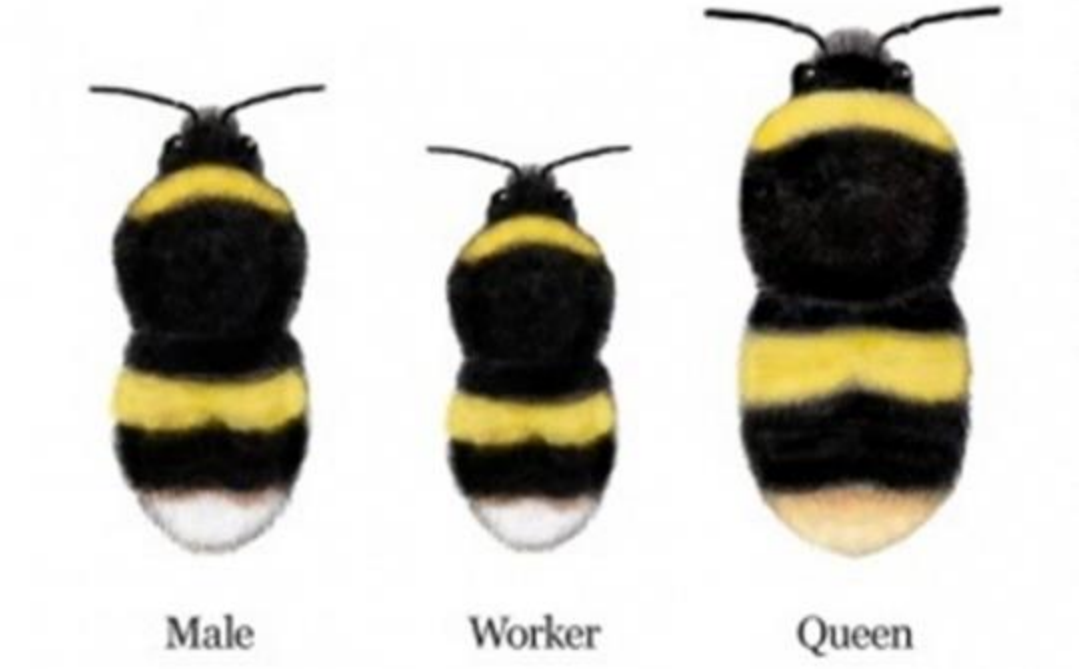

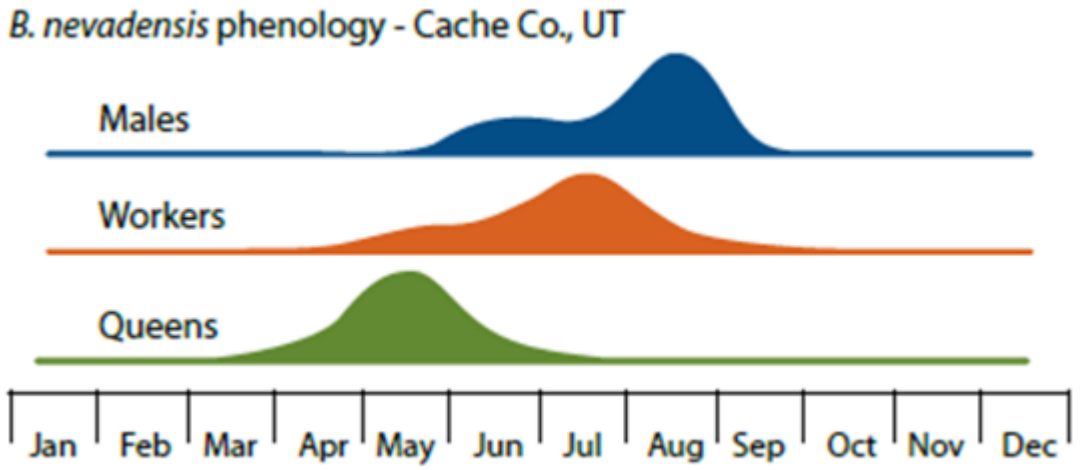

Bumble Bee ID

Different Castes have:

- Different color patterns
- Different sizes (even within castes)
- Different periods of activity

Illustrations from: Bumble Bee Conservation Trust and Bumble Bees of the Western United States. By Koch, Strange and Williams.

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Illustration from: Bumble Bees of North America by Williams et al. 2014

Bumble Bee ID

Color Pattern Differences

While bumble bees can be easier to identify than many other speies groups:

- Color patterns are not 100% reliable
- Color patterns vary geographically
- This is particularly true with male bumble bees

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Morphology

Additionally:

- 2 pairs of wings
- Corbicula
- Sternal segments (S1-S6)
- Vertex

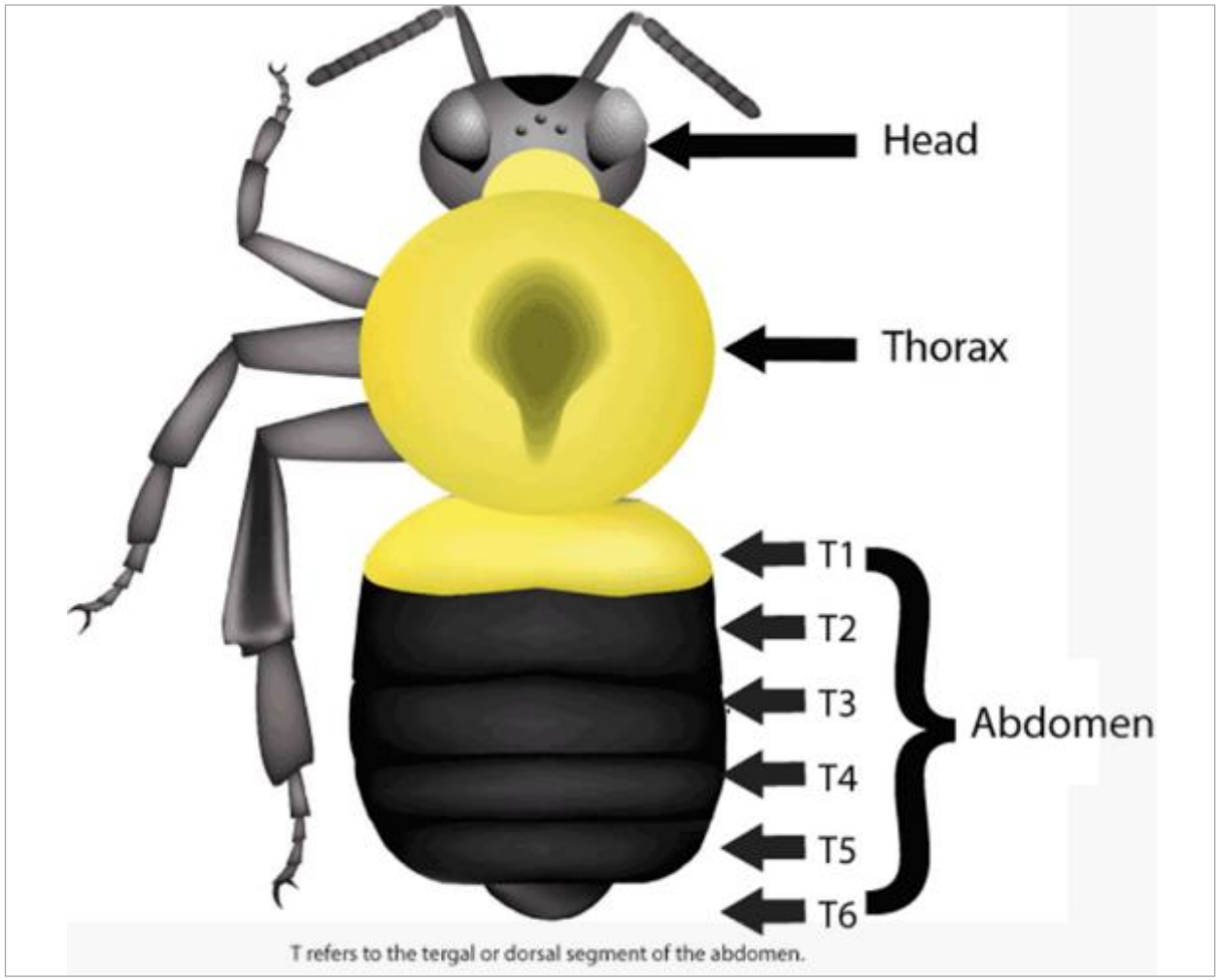

Illustration by Elaine Evans

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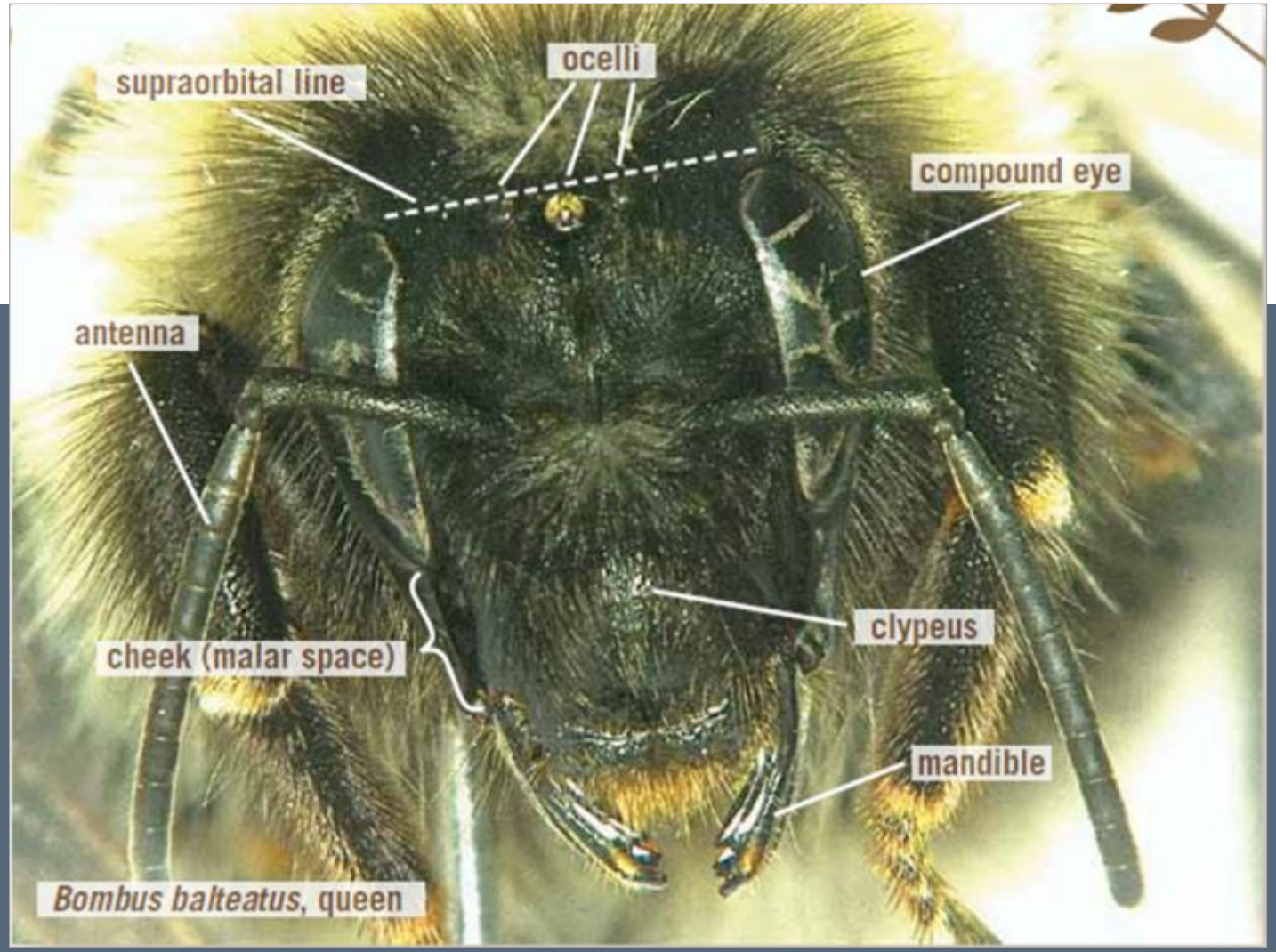
Mophology: The Face



Picture from Bumble Bees of the Western United States. By Koch, Strange and Williams.

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Morphology: Long vs Short Cheek (Malar Space)

Photos: Rich Hatfield, the Xerces Society

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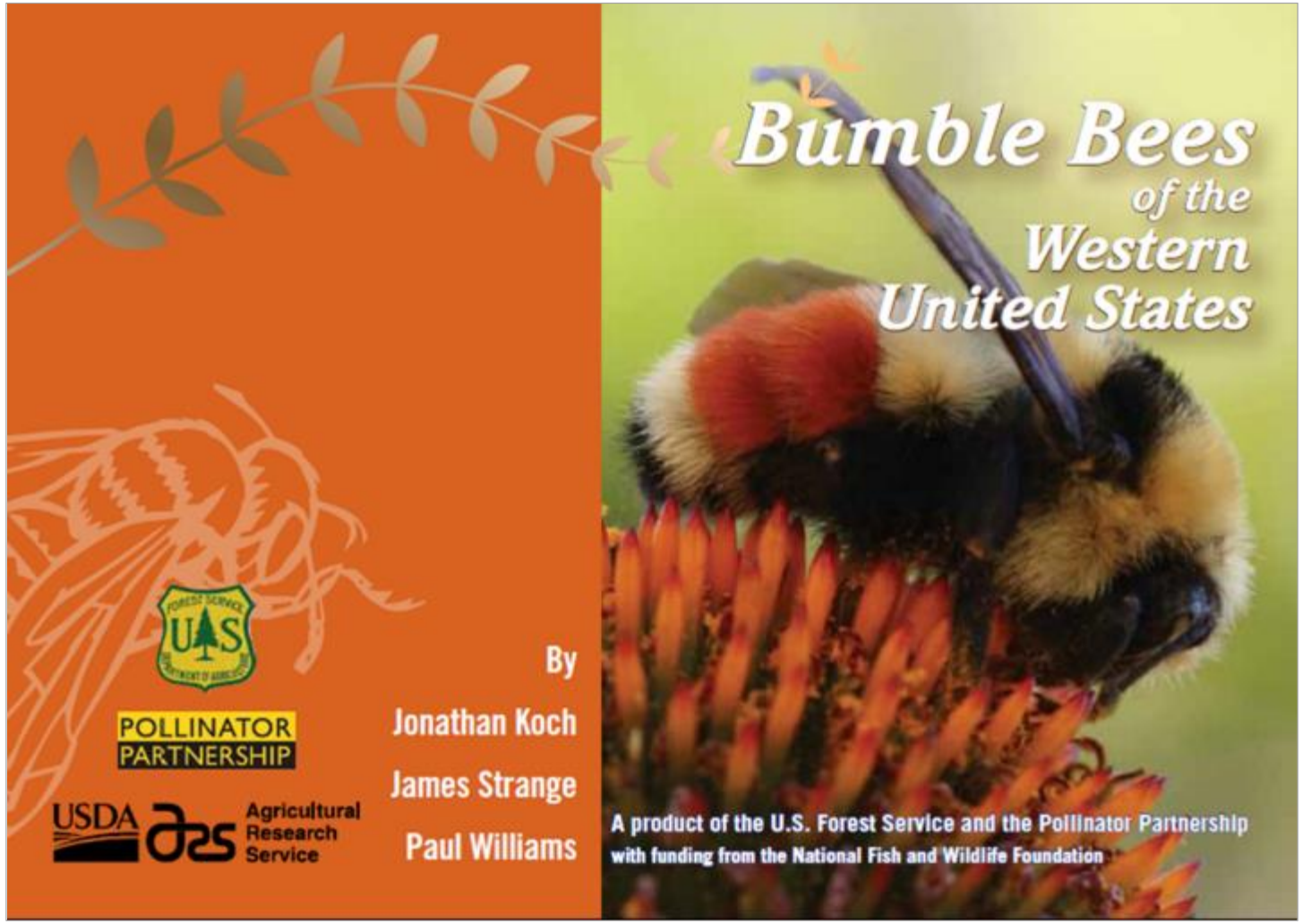
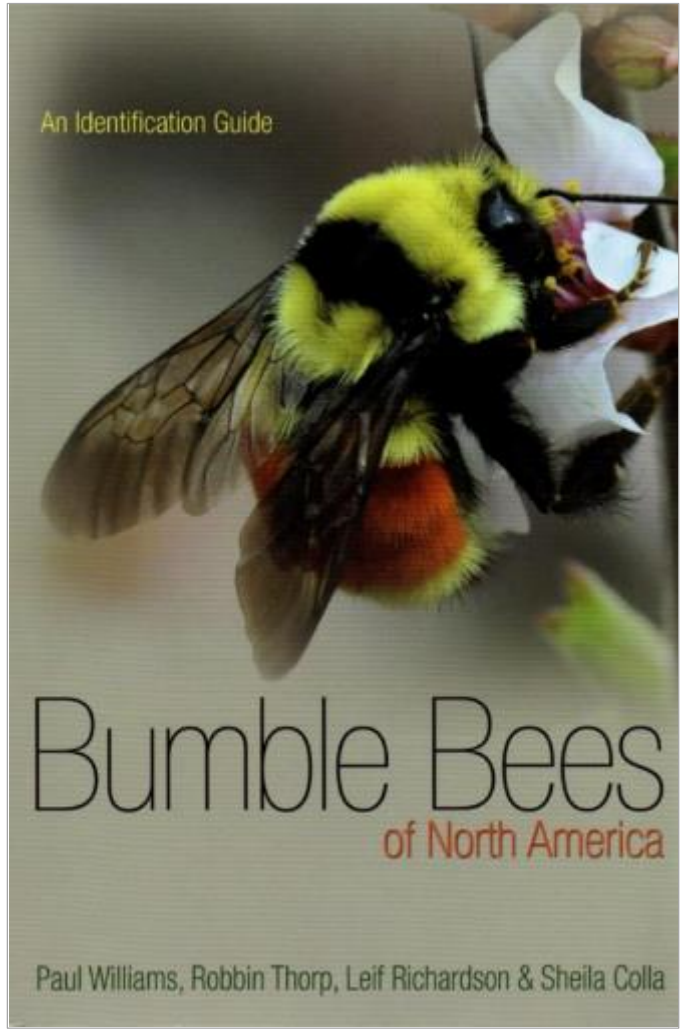
Bumble Bee ID: Resources





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Thank you!