

# Bee Health, Pesticides & Grower/Beekeeper Communication

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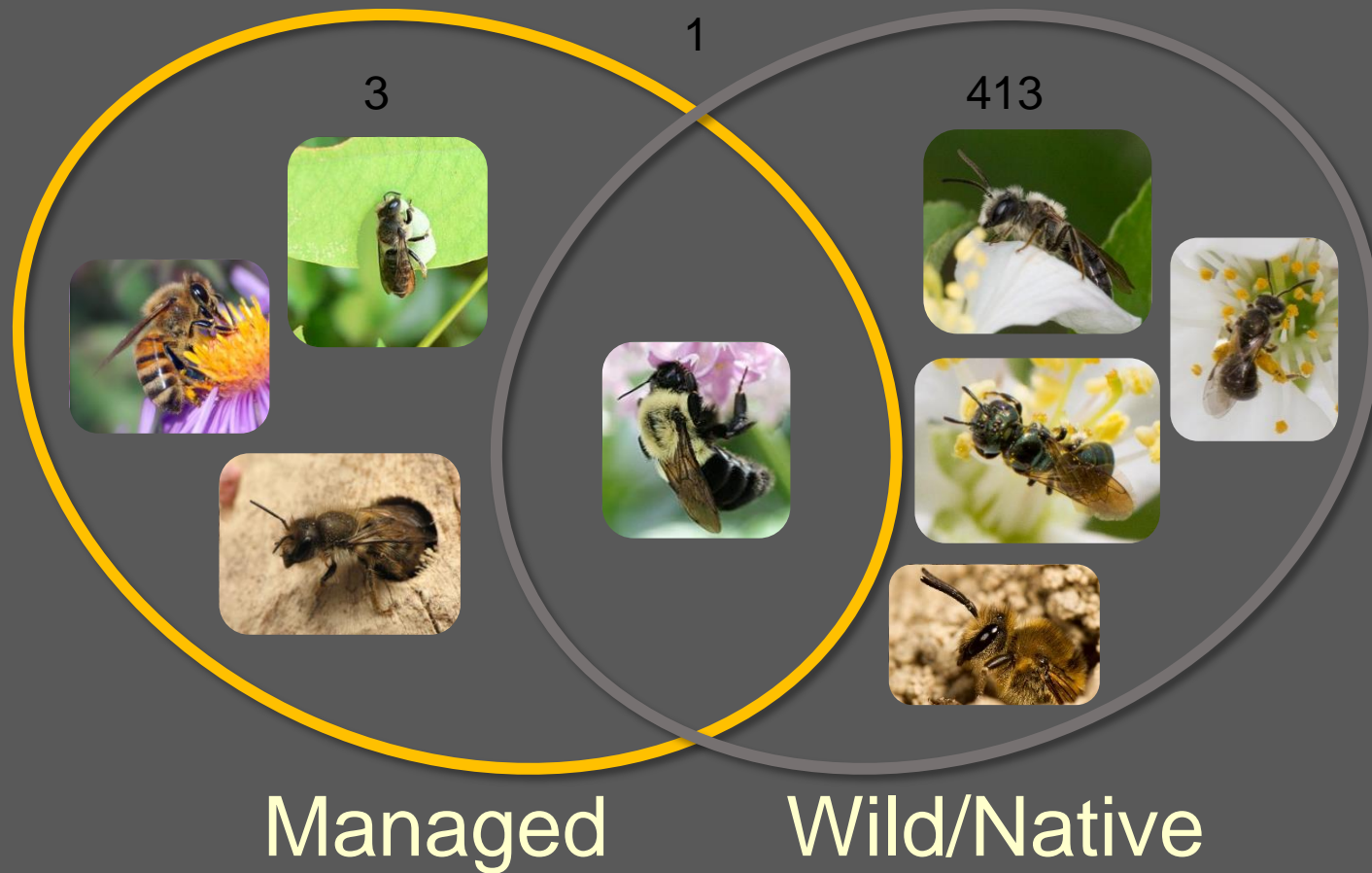


Cornell University  
College of Agriculture and Life Sciences

In fulfillment of the **NYS Pollinator Protection Plan**

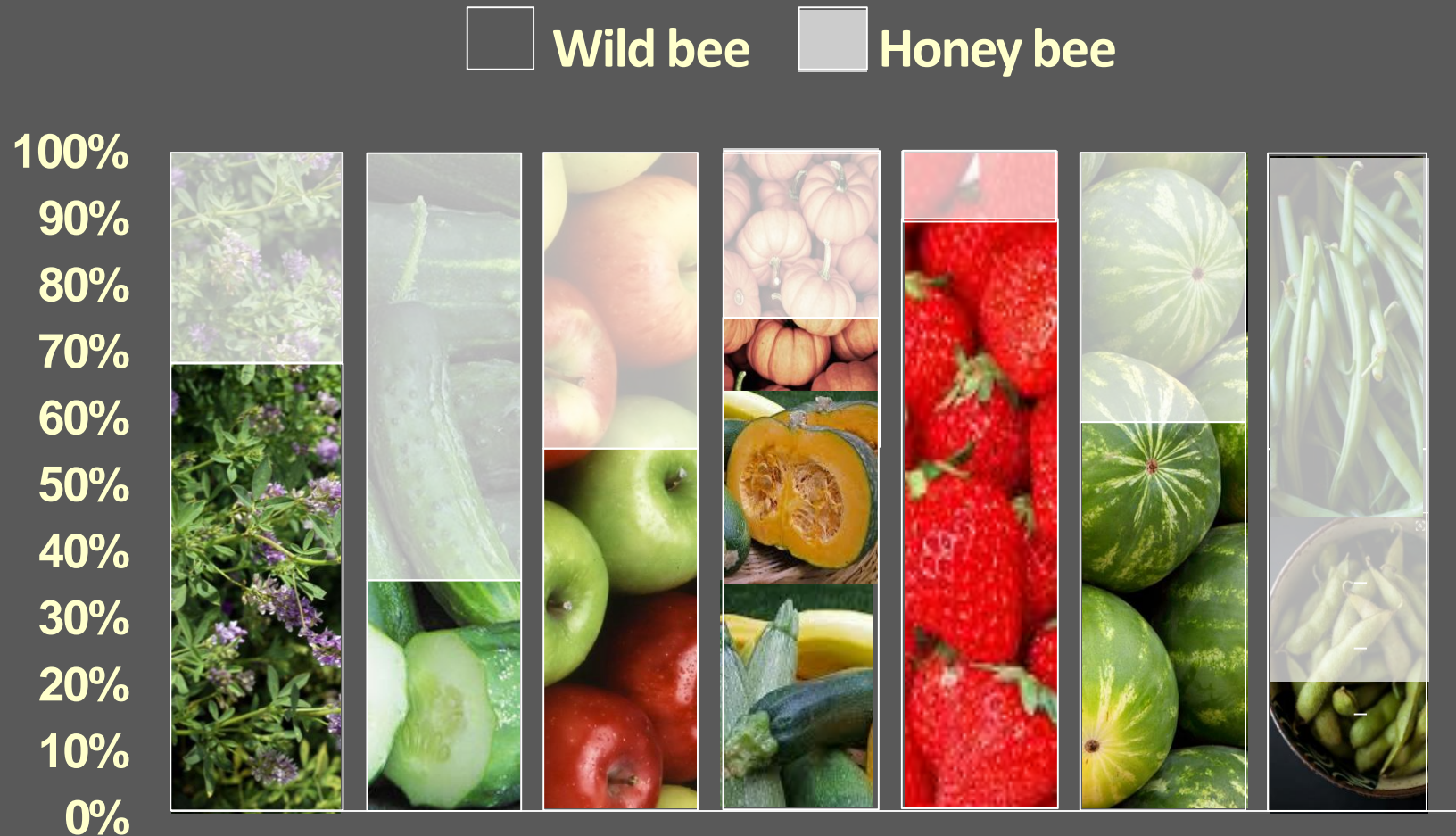


# Bees of New York



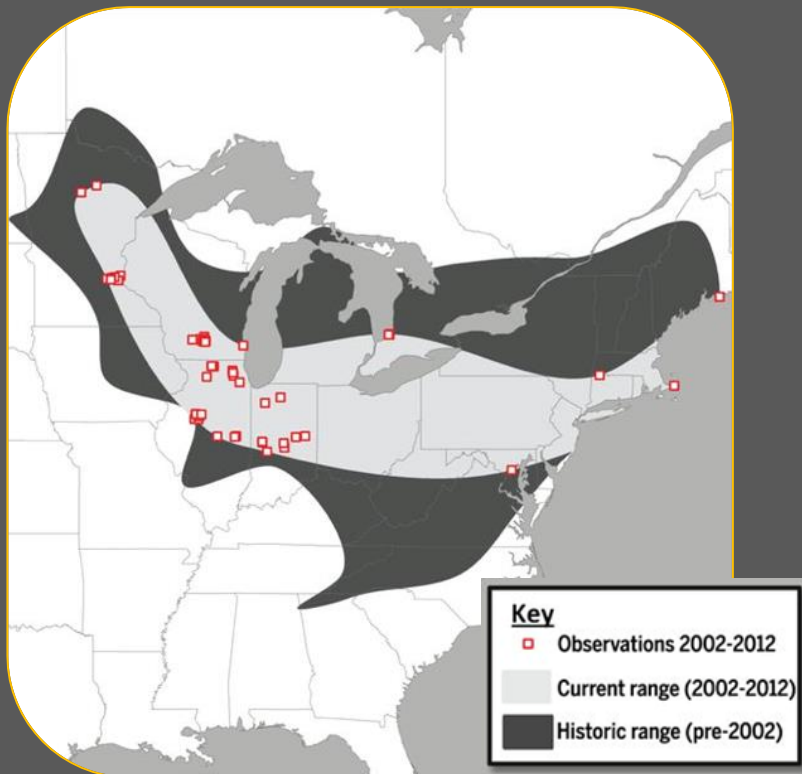
**53 species (~13%) are in decline**

# Both wild native bees and honey bees are crucial to agricultural production





# Wild Bee Decline: Range contractions and extinctions of native bees



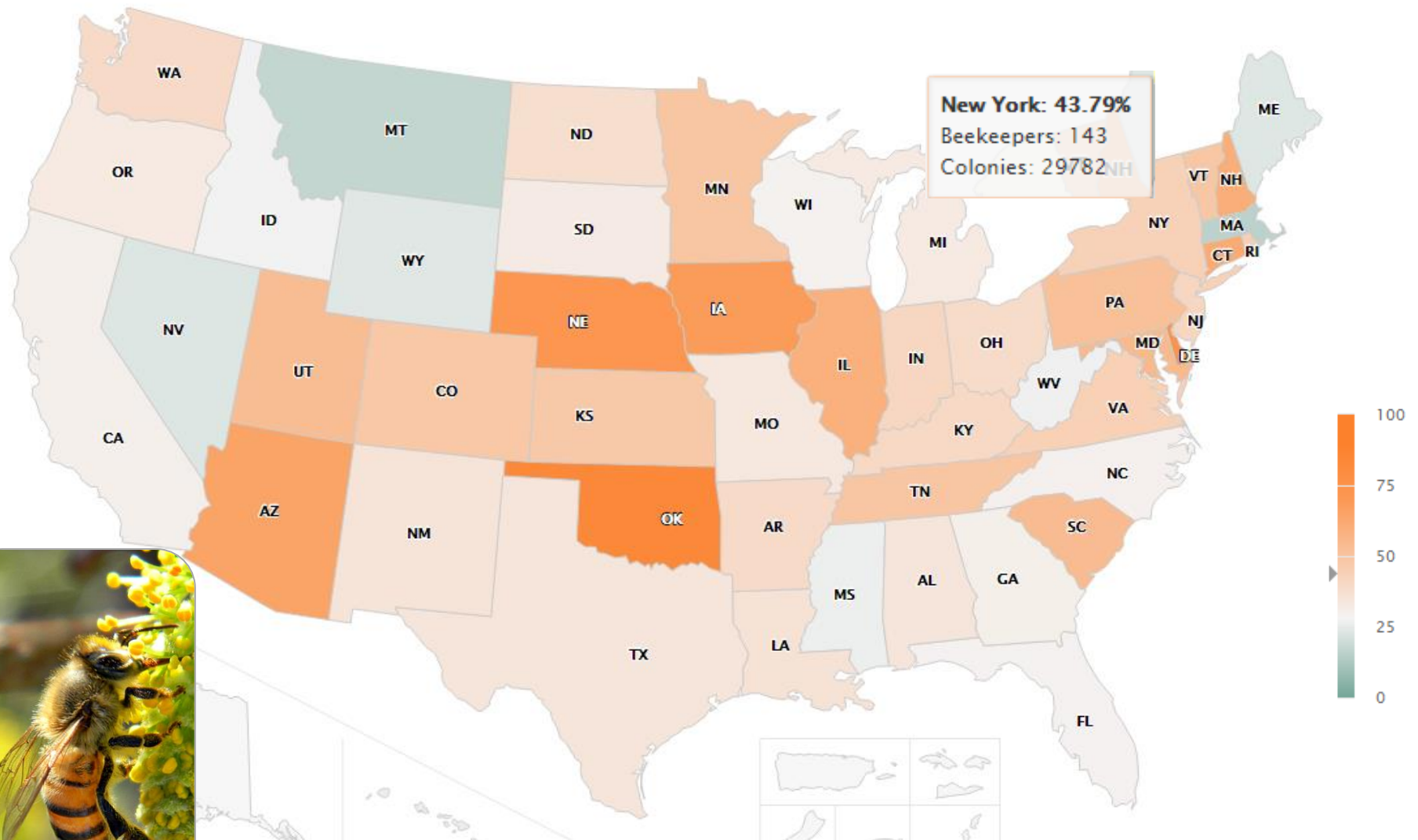
Goulson et al. 2015. Science



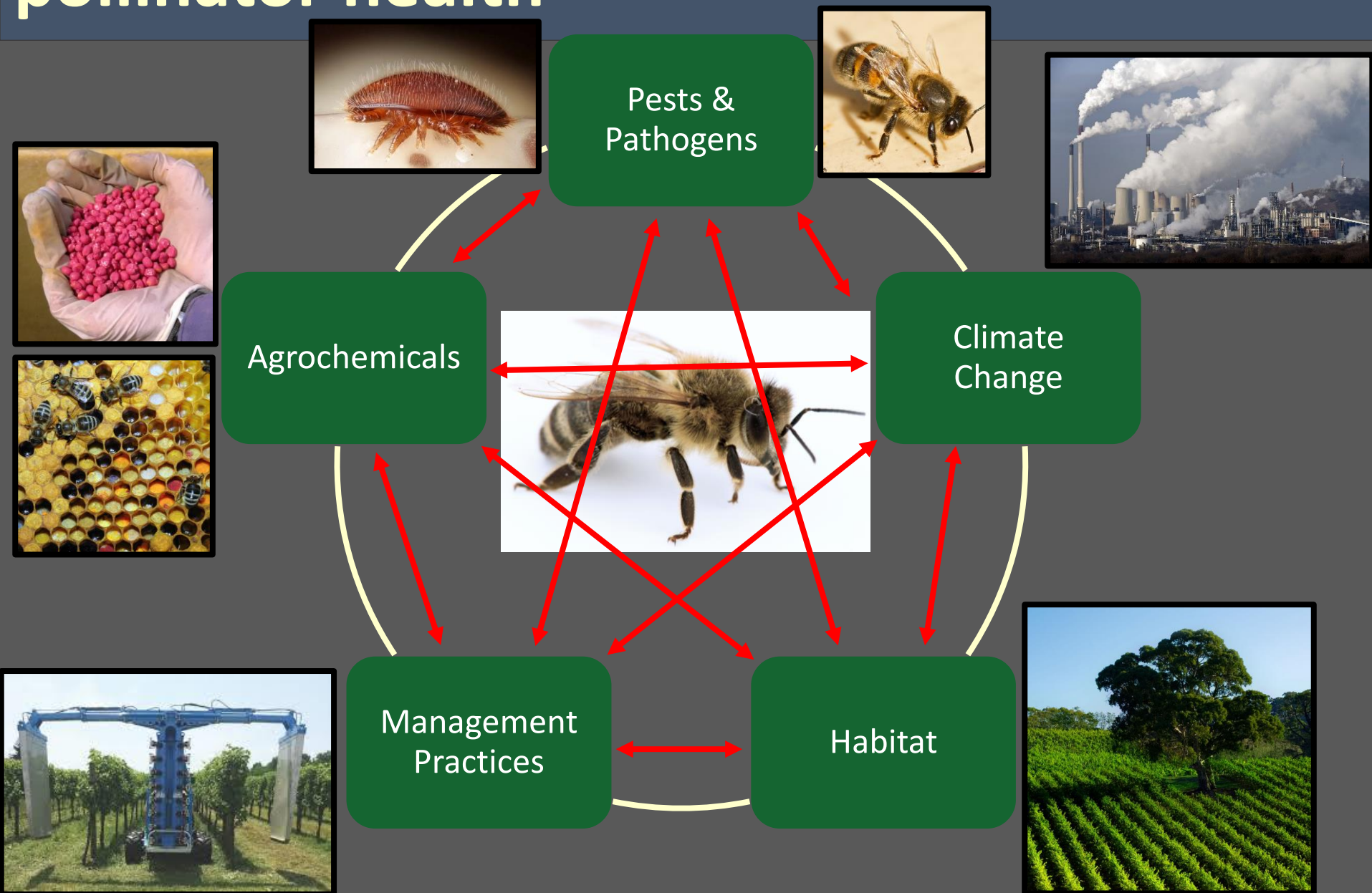
*Bombus affinis*

The rusty patched bumble bee

# Honey bee colony deaths were 44% in New York last year

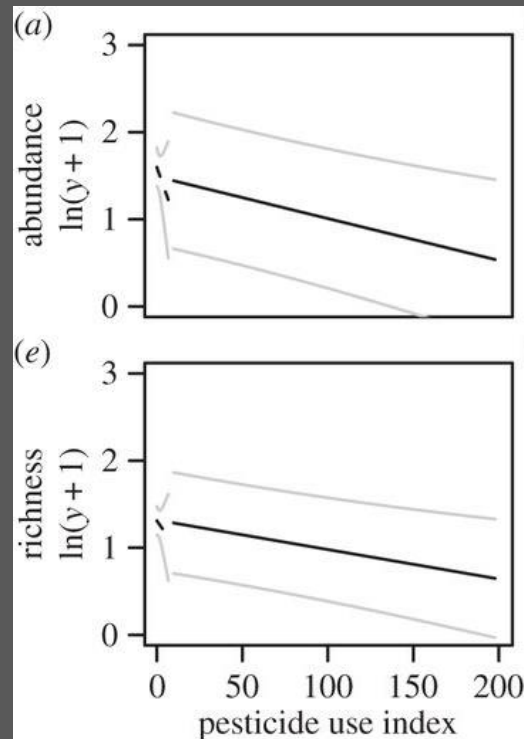


# Interacting factors contribute to poor pollinator health



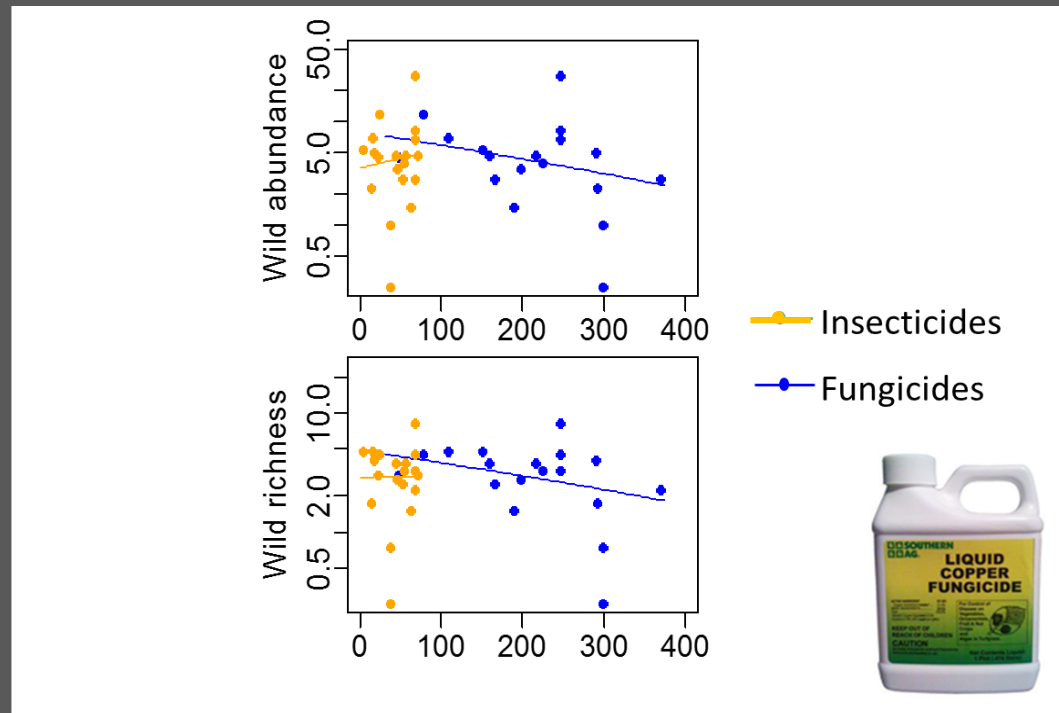
# Pesticide effects (Insecticides & Fungicides)

1) Pesticides negatively affect **honey bee, wild bumble bee & solitary bee health**, abundance, and diversity



# Pesticide effects (Insecticides & Fungicides)

- 1) Pesticides negatively affect **honey bee, wild bumble bee & solitary bee health, abundance, and diversity**
- 2) Fungicides are impacting bees as much as insecticides

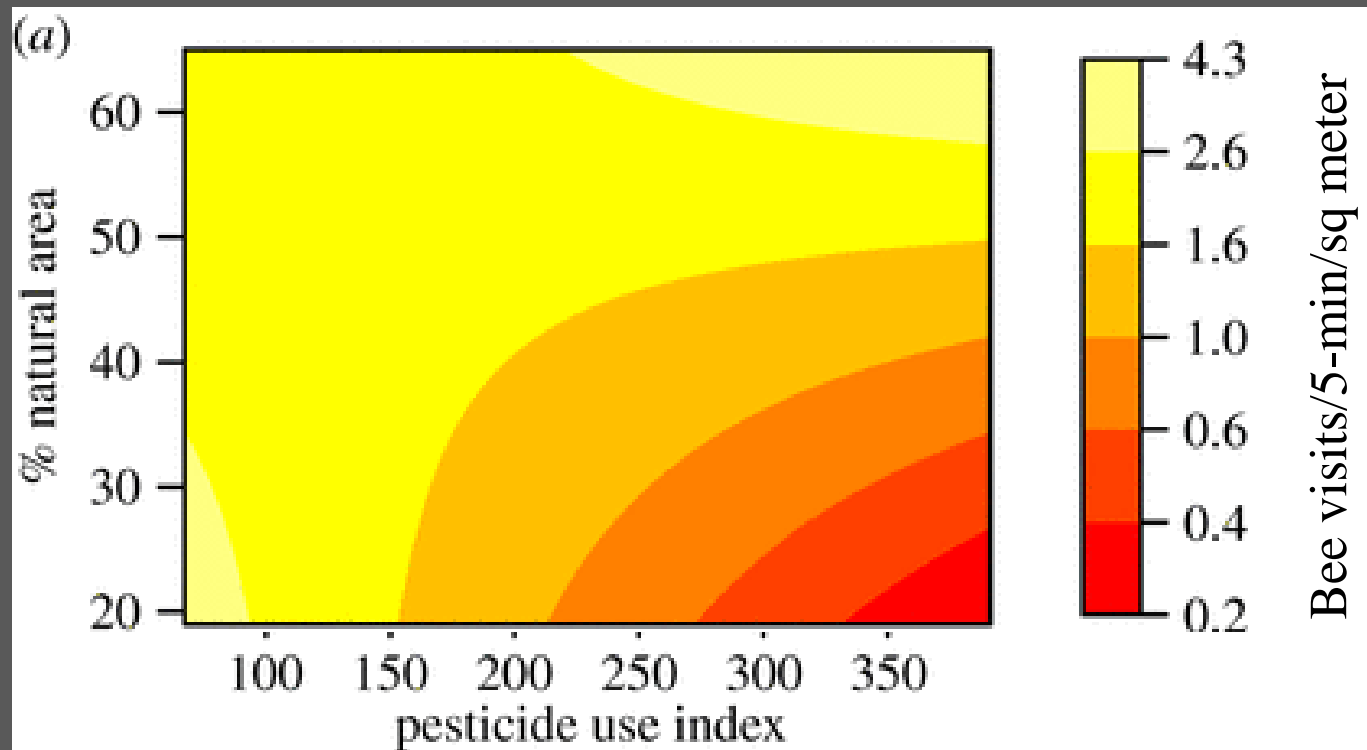


Low intensity  High intensity



# Landscape can buffer the negative effects

Bee abundance and diversity increase with diverse natural habitat.



# Fungicide Effects

## Direct and indirect harmful effects on bees.

- disrupt adult bee foraging behavior
- affect larval bee development (babies).

## Critical Interactions

- Exposure to some **fungicides (DMI)** can greatly increase toxicity of **insecticides** (*neonics, pyrethroids, pyrethrins*)
- Exposure to fungicides **reduces resistance to diseases**
- A **poor diet** can exacerbate the ability of bees to cope with both toxins and pathogens

# Pesticides to be aware of

**Pesticides are more mobile than previously thought.**

- uptake of systemic/persistent residues by weeds in field margins and cover crops.

## **Currently known mobile chemicals**

- Boscalid (Pageant Intrinsic)
- Dimethoate
- Pyrimethanil (Scala SC)
- Tryfloxystrobin
- Neonicotinoids



## **Negative bee interactions**

- Tryfloxystrobin
- Pyroclostrobin
- Cyprodinil
- Propocanozole
- Neonics + Pathogens

## **Synergistic effects on bees**

- Piperonyl butoxide + Fungicides
- Neonics + EBI Fungicides
- Pyrethroids + EBI Fungicides

# Apple's **most** toxic pesticides: pollen & wax

Chemical	Product Name(s)	Type of Pesticide	Toxicity LD50	Persist- ance	Residue (ppb)
<b>Thiamethoxam</b>	Actara,Cruiser,Durivo,Platinum, Voliam	Neonic	<b>H</b>	Mod	21.5
<b>Cyfluthrin</b>	Leverage, Defcon, Aztec, Tombstone, Baythroid	Pyrethroid	<b>H</b>	Mod	93.3
<b>Chlorpyrifos</b>	Lorsban, Cobalt, Hatchet	Organoph.	<b>H</b>	Mod-H	143
<b>Indoxacarb</b>	Avaunt	Oxadiazine	<b>H</b>	?	557.1
<b>Methidathion</b>	Sumonic, Supracide, Somonil	Organoph.	<b>H</b>	<b>Low</b>	400
<b>Imidacloprid</b>	Macho,Admire,Couraze, Brig.	Neonic	<b>H</b>	High	6.6
<b>Carbaryl</b>	Sevin	Carbamate	<b>H</b>	Low	69.9
<b>Acetamiprid</b>	Assail	Neonic	<b>M</b>	Mod-H	160.5
<b>Piperonyl butoxide</b>	Pyronyl Crop Spray	Synergist	<b>H</b>	Low-M	.16
<b>Cyprodinil</b>	InspireSuper, Vanguard	AP	<b>L*</b>	Mod	1216.4
<b>Iprodione</b>	Rovral 4	Dicarb	<b>L</b>	<b>Low</b>	929.3
<b>Pyraclostrobin</b>	Insignia,Headline,Cabrio,Pristine	QoI	<b>L*</b>	High	1.63
<b>Fluxapyroxad</b>	Priaxor	SDHI	<b>L</b>	High	353.6
<b>Difenoconazole</b>	Aprovia Top, Inspire Super, QuadrisTop, RevusTop	EBI	<b>L*</b>	High	327.1
<b>Propiconazole</b>	Bumper, Quilt, Propimax EG	EBI	<b>L*</b>	High	1.54
<b>Trifloxystrobin</b>	Flint, Gem, Luna, Sensation	QoI	<b>L*</b>	Mod	14.1
<b>Myclobutanil</b>	Rally 40 SWP	EBI	<b>L*</b>	High	49.5



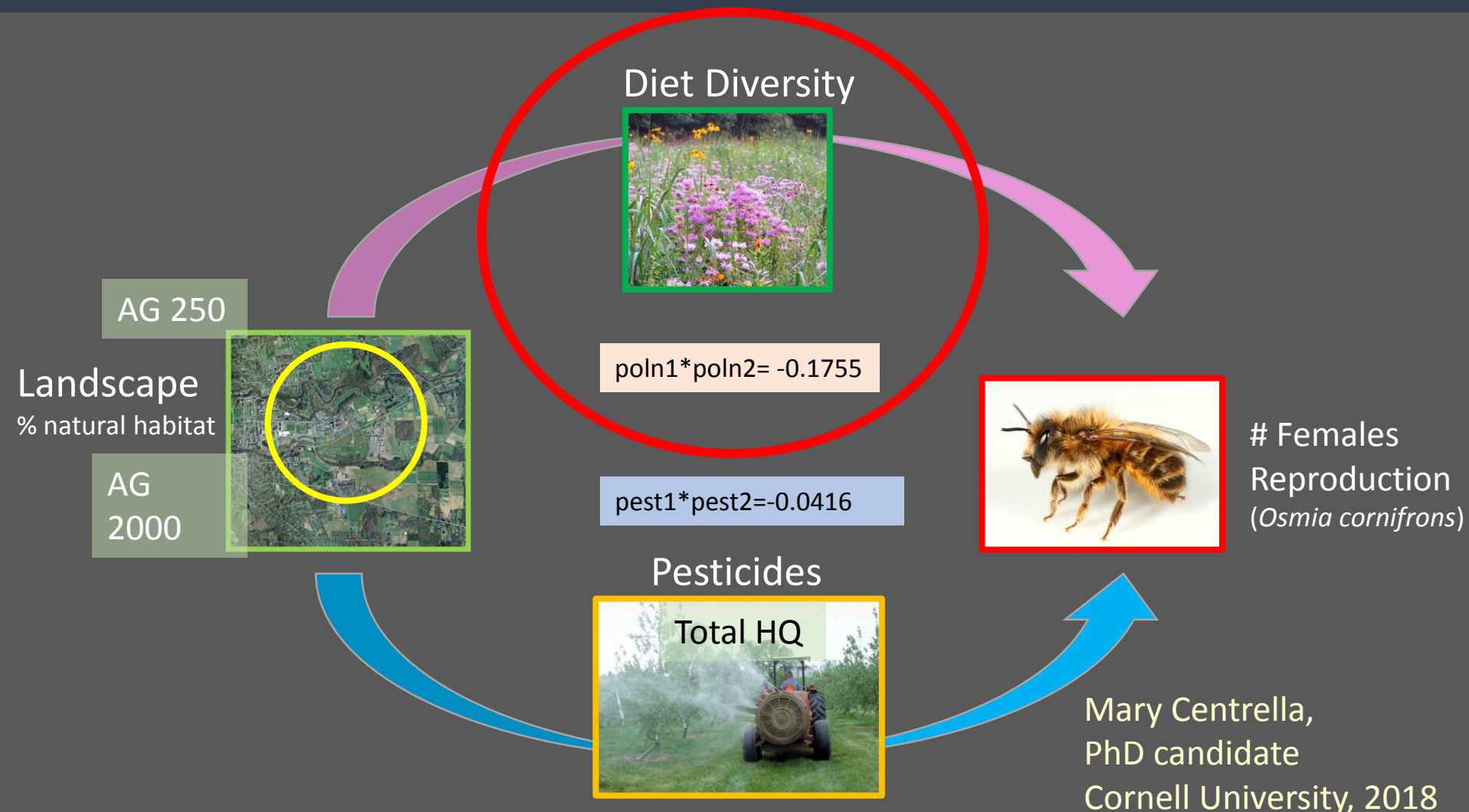
# Precautions published by the **California Almond Board**

[How to Reduce Bee Poisoning from Pesticides](#)

at

<http://www.almonds.com/pollination>

# Negative effects of pesticides can be buffered by increased diet breadth and/or diverse natural habitat



# Good habitat increases bee abundance and diversity

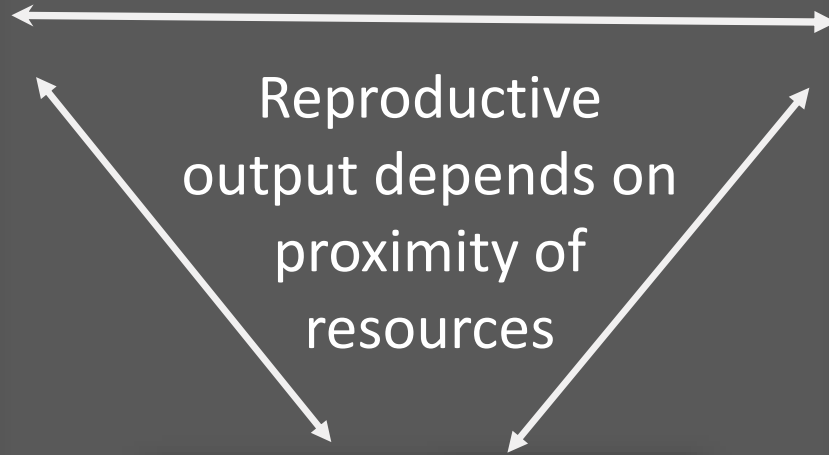
Enhancement	Increases Abundance?	Increases Diversity?	Reference
Hedgerows	Yes	Yes	Hannon and Sisk. 2009. Biological Conservation 142: 2140-2154. Morandin and Kremen. 2013. Ecological Applications 23: 829-839.
Wildflower strips	Yes	Yes	Haaland et al. 2011. Insect Conservation and Diversity, 4: 60-80 Nicholls and Altieri. 2013. Agronomy for Sustainable Development 33(2): 257-274 Tschumi et al. 2014. IOBC-WPRS Bulletin Vol.100: 131-135 Klein et al. 2012. Journal of Applied Ecology, 49: 723-732.
Adjacent fields	Yes	Yes	Steffan-Dewenter. 2003. Conservation Biology, 17: 1036-1044 Kremen et al. 2004. Ecology Letters, 7:1109-1119 Williams and Kremen. 2007. Ecological Applications, 17: 910-921
Field margins	Yes	Yes	Morandin and Kremen. 2013. Ecological Applications 23: 829-839.



# GOOD HABITAT Proximity of resources



**Pollen & nectar**



**Water**



**Nests**



# GOOD HABITAT

Plant a diversity of species with at least 3 species flowering at any given time (Spring, Summer, Fall)

Honey Bees

Bumble Bees

Digger Bees

Blue Mason Bees

Leaf-cutting Bees

Squash Bees



January

February

March

April

May

June

July

August

September

October

November

December



# Native plants that honey bees and wild bees use for nectar or pollen.

## Attractive Native Plants

	Native Bee	Honey Bee		Native Bee	Honey Bee
<i>Agastache nepetoides</i>	97	8	<i>Ratibida pinnata</i>	58	2
<i>Amorpha canescens</i>	13	0	<i>Rosa wild</i>	6	6
<i>Aster laevis</i>	16	2	<i>Scrophularia marilandica</i>	32	3
<i>Aster novae-angliae</i>	23	12	<i>Silphium perfoliatum</i>	272	10
<i>Arnoglossum atriplicifolia</i>	48	2	<i>Spiraea alba</i>	50	19
<i>Cephalanthus occidentalis</i>	6	0	<i>Vernonia sp</i>	32	9
<i>Eupatorium perfoliatum</i>	33	22	<i>Allium sp</i>	24	106
<i>Helianthus strumosus</i>	19	0	<i>Apocynum cannabinum</i>	10	10
<i>Heuchera americana</i>	6	0	<i>Asclepias incarnatum</i>	34	197
<i>Liatris aspera</i>	58	0	<i>Solidago -Goldenrod</i>	90	178
<i>Lobelia siphilitica</i>	186	1	<i>Veronicastrum virginicum</i>	72	140
<i>Monarda punctata</i>	12	23	<i>Verbena stricta</i>	8	18
<i>Penstemon hirsutus</i>	7	0			
<i>Potentilla</i>	41	1			

Tuell et al, 2008



# GOOD HABITAT

Plant each species in large clumps at least 3-5 sq ft



## THINK LIKE A BEE:

An abundance of flowers is more attractive than just a few individuals.



# Demonstration Garden showing GREAT habitat

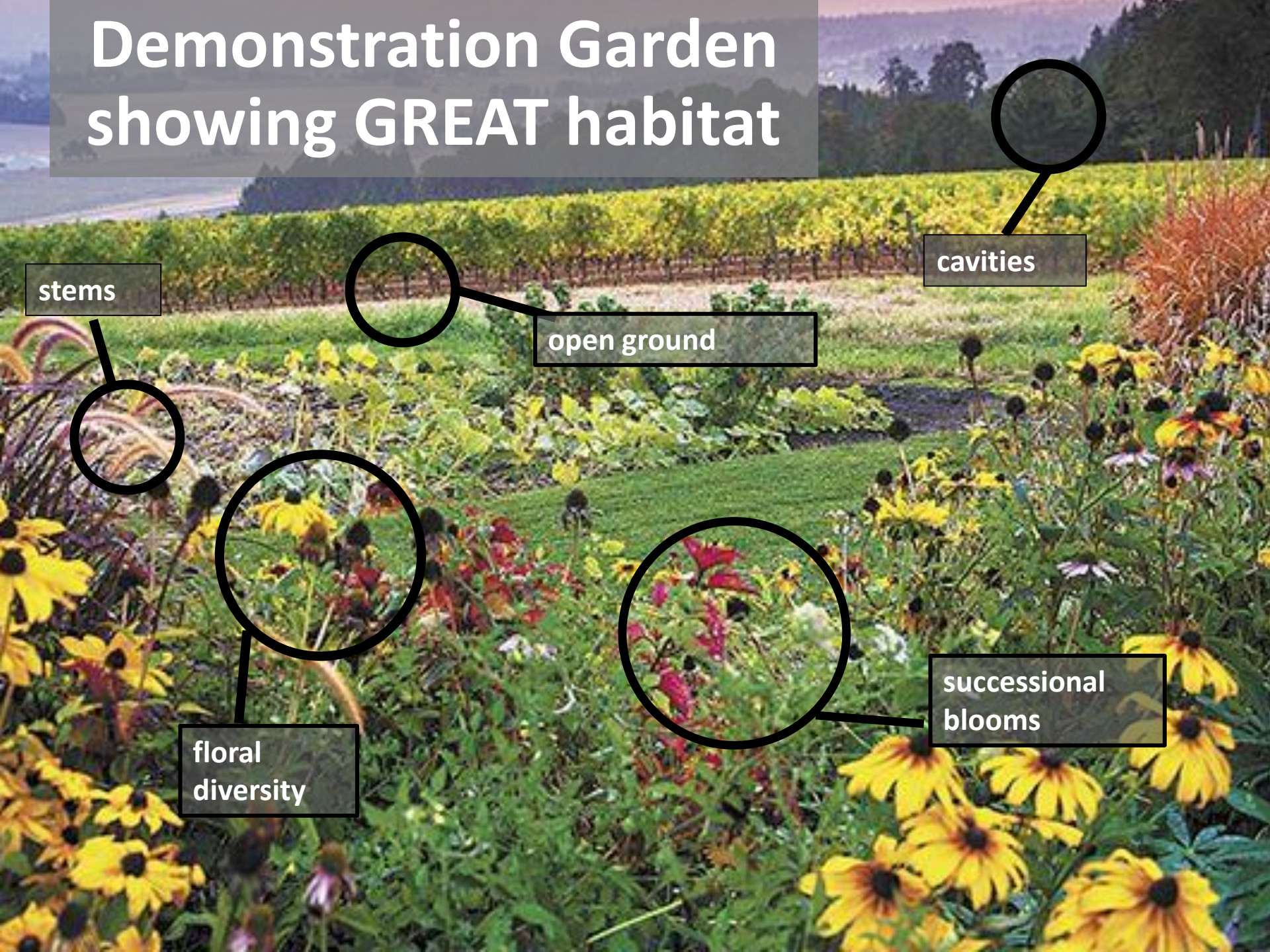
stems

open ground

cavities

floral  
diversity

successional  
blooms





## Provide access to safe nesting sites

- 
- The diagram illustrates a plant root system with various types of root nodules. The nodules are labeled with letters: B (bacterial), M (mycorrhizal), F (fungal), P (parasitic), and E (ectomycorrhizal). The photograph shows a soil sample with several nodules, some of which are yellowish and others are brownish, matching the colors of the nodules in the diagram.



# Pesticide Management

## Growers & Homeowners should follow IPM & IDM

- Scouting early and often
- Remove infected plant materials
- Use disease risk models
- Spray between late afternoon and very early morning
- Select fungicides that do not synergize with neonicotinoids or pyrethroids (non EBI/DMI fungicides)
- Use shorter-lived neonicotinoids like imidacloprid and/or thiacloprid, in a targeted manner

**Creating or sustaining natural habitat  
floral diversity within 250 m of orchard**





# Pesticide Management :

## Communicate with beekeepers

- Grower/Homeowner should communicate with beekeeper when intending to spray
- Beekeeper lets growers/homeowner know when they put their hives nearby (1-2 miles radius).
- Beekeeper educates grower/homeowner
- Grower educates beekeeper





Marketing your grower-beekeeper relationships...



**Marketing & Habitat Management**



# Questions?



Tall Ragweed



Blackberry



Elderberry



mud  
partition

egg

pollen/nectar  
provision

Email your questions to  
[mtv32@cornell.edu](mailto:mtv32@cornell.edu)

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