Integrating Pollinator Habitat into Your Farm

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Permaculture Approach to Integrating Pollinator Habitat

- How can pollinator habitat serve multiple farm goals?
- Incorporating pollinator habitat into:
  - Farm production (honey, fruit, flowers, medicinal herbs, grazing)
  - Agritourism, education, and farm beautification
  - Soil and water management (cover cropping, erosion control, riparian buffers)
  - Making use of edges and marginal land
  - Integrating into production fields where possible (need to be aware of potential for conflict with pesticide use, mowing, and tillage)

What are your goals for pollinator habitat?

- Honey bee health and honey production
- Agricultural pollination
- Bumble bee conservation
- Conservation of native pollinator diversity and healthy plant - pollinator networks

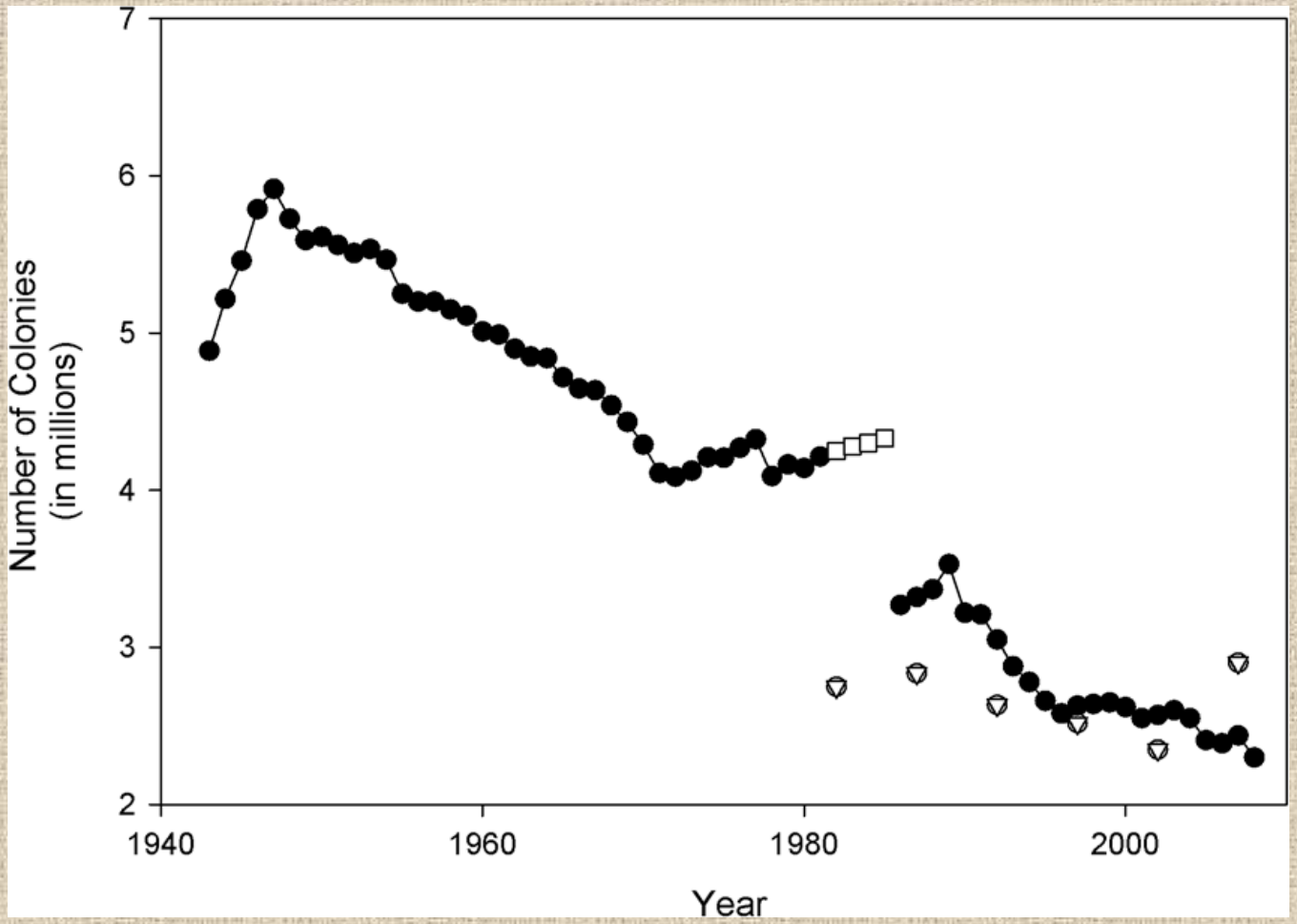
Honey Bees – Honey, Wax, Pollen

From BeeInformed.org

Honey Bees are Different from All Native Bees

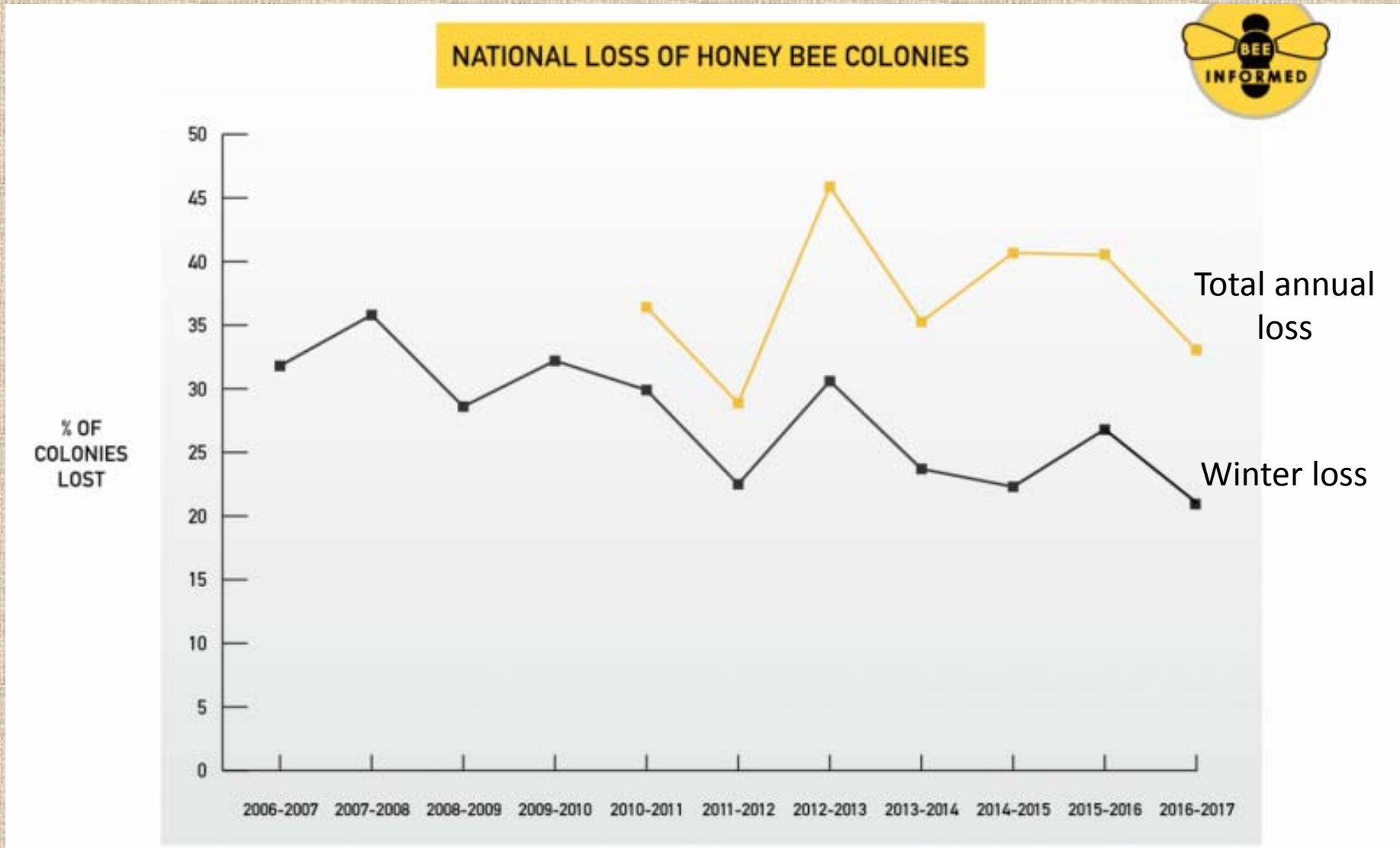
- Genus evolved in Asia, our species evolved in Africa, lived in Europe for 10,000 years, brought to US by European settlers
- Overwinter as a tight cluster of workers and queen. Keep the temperature in center of the cluster 55 - 91° F, going up to 90-95° F in early February when the queen starts laying eggs and they raise brood! Need honey as fuel.
- Colonies reproduce by swarming – old queen + workers find new space to colonize, new queen stays
- Communication within the colony – scout bees find nectar and pollen sources, dance to recruit foragers to locations with abundant food

The Number of Honey Bee Colonies Has Been Decreasing Over the Long Term

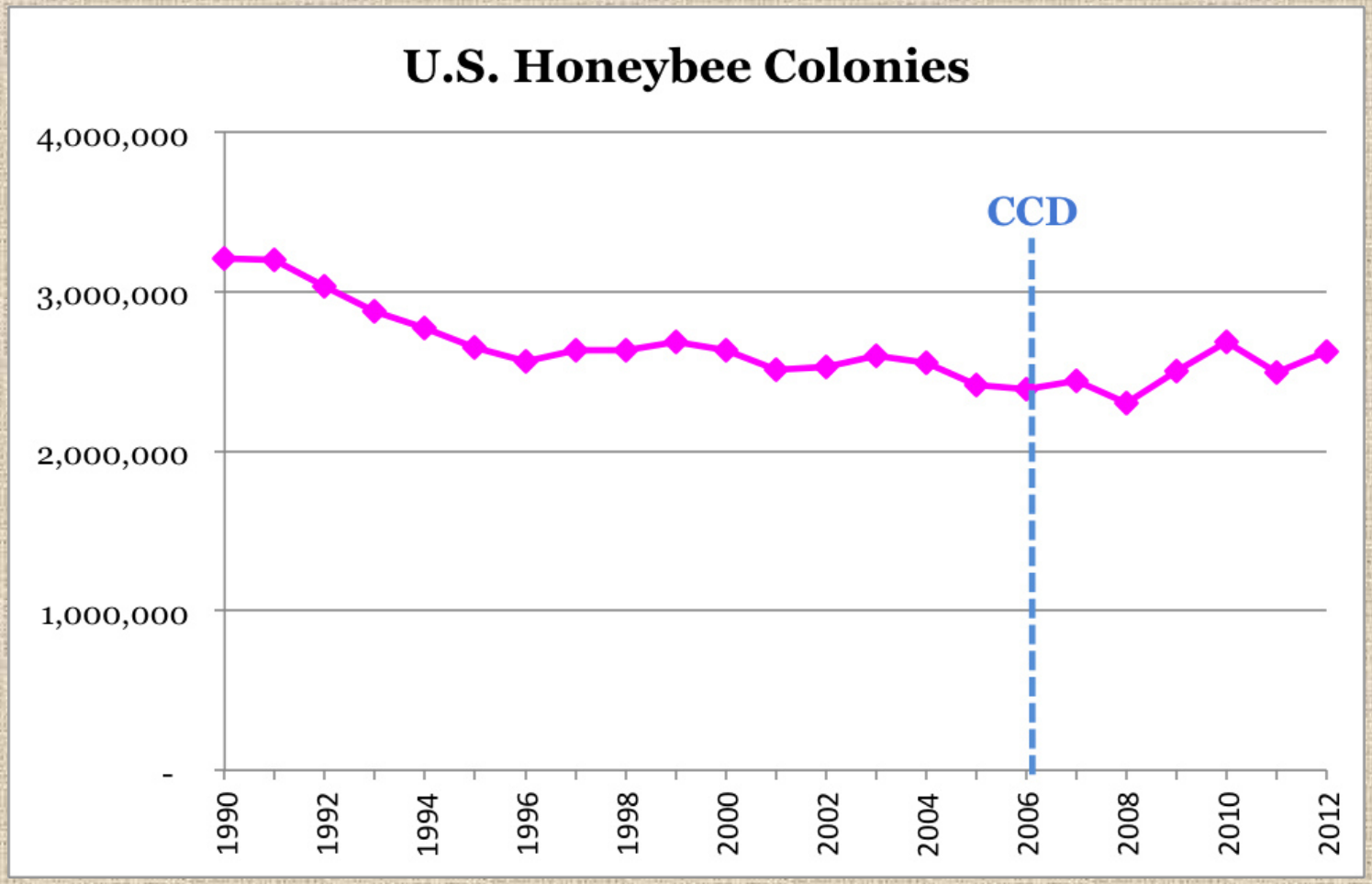


Source: vanEngelsdorp and Meixner in Journal of Invertebrate Pathology (2010)

Beekeepers Continue to Lose Colonies Each Year



But the Number of Colonies is Not Currently Crashing



As of April 2017, NASS estimate is 2.89 million colonies
National Agricultural Statistics Service data

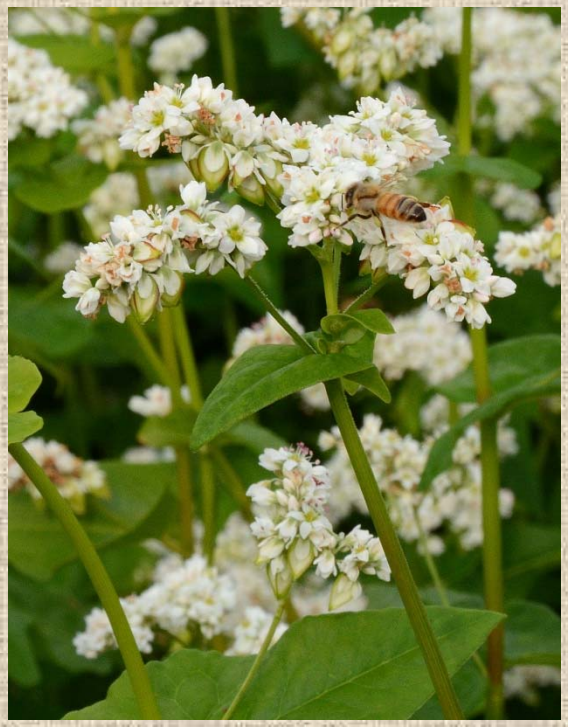
Biggest problem for beekeepers – *Varroa* mites and the viruses they carry

USDA photo
Scott Bauer

What Do Honey Bees Need?

- Management of *Varroa* mites and diseases – this is the biggest problem
- Skilled beekeeper management
- Protection from pesticides – mainly insecticides, but fungicides may also be a problem
- Diverse supplies of nectar and pollen through a long season- not necessarily native plants, because they aren't native bees
- Beekeepers focus primarily on nectar plants in order to get a honey crop – and because honey bees need to store honey for the winter - but honey bees also need pollen to raise larvae for new bees
- Ready supply of fresh water for cooling and for diluting honey

Planting for Honey Bee Health – Pollen & Nectar



Trees and shrubs:
Maples, Willows, Hollies, Apples, Crabapples, Cherries, Raspberries, Linden, Clethra, Sumac

Cover crops:
Brassicas (mustards), Clovers (white, alsike, crimson, sweetclovers), Buckwheat, Alfalfa, Phacelia, Sunflowers

Herbs:
Chives and garlic chives, Dill, Catmint, Oregano, Anise Hyssop, Motherwort

Wildflowers:
Dandelion, Mint-family plants (especially Mountain mint,) Cornflowers, Asters, Goldenrod

Planting Specifically for Honey Production

- For honey production, focus specifically on nectar sources and plant over a large area
- Flavor, color and granulation of honey also important
- More information: Cowles's talk on fixed-land honey production on CAES website

Trees and shrubs	Perennials	Annuals and Biennials
Linden/basswood (*Tilia*)	Alsike clover	Lacy phacelia or purple tansy (*Phacelia tanacetifolia*)
Sumac (*Rhus*)	White clover	Crimson clover
Inkberry , Winterberry, Holly (*Ilex*)	Mountain mint (*Pycnanthemum*)	Sweetclovers (*Melilotus*)
Maple (*Acer*)	Anise hyssop (*Agastache*)	Buckwheat (strong flavor)
Sweet pepperbush (*Clethra*)	Motherwort (*Leonurus*)	
Fruit trees	Figwort (*Scrophularia*)	

Anise Hyssop

Major Nectar Producer

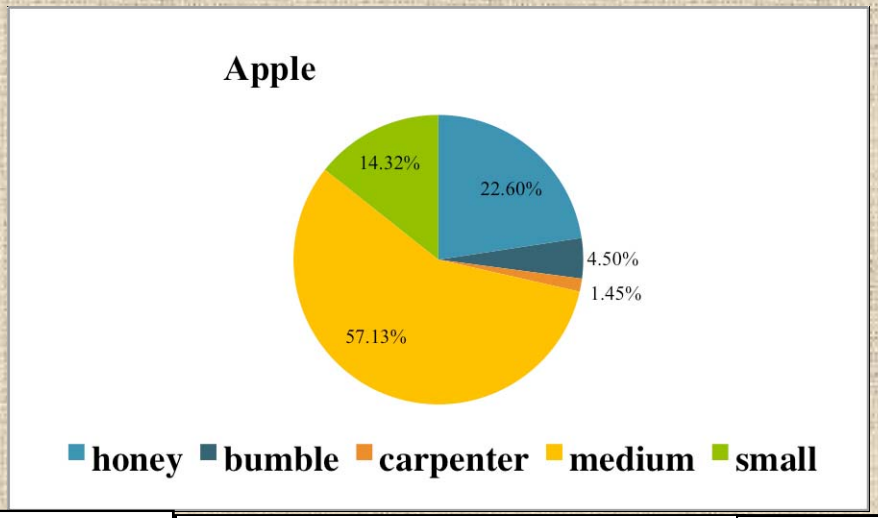
Perennial (short lived, but reseeds profusely)

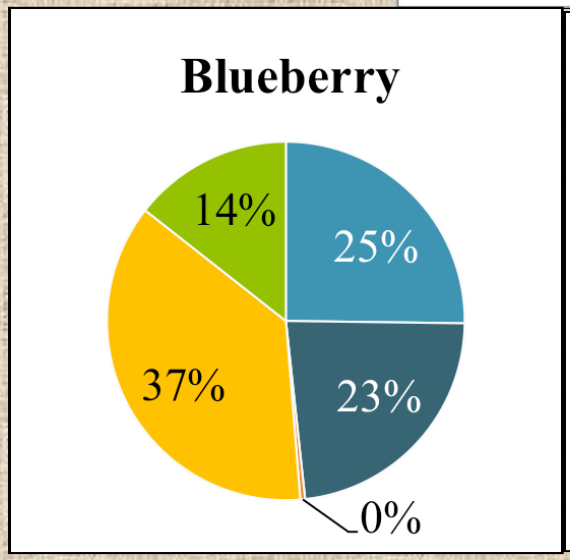
Used by honey bees and bumble bees

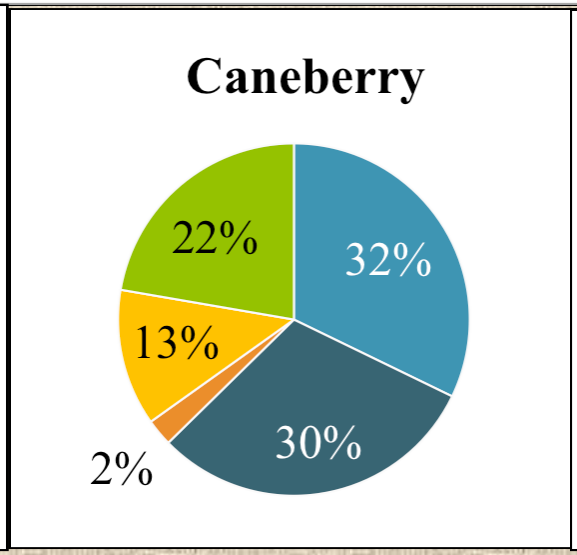
Potential surplus of 2000 lb. of honey per acre

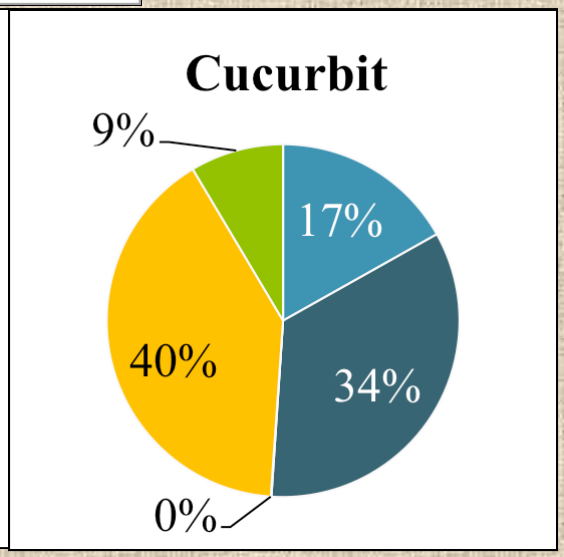
Planted with other complementary honey plants, could be a profitable use of land

A diversity of bees are needed for crop pollination



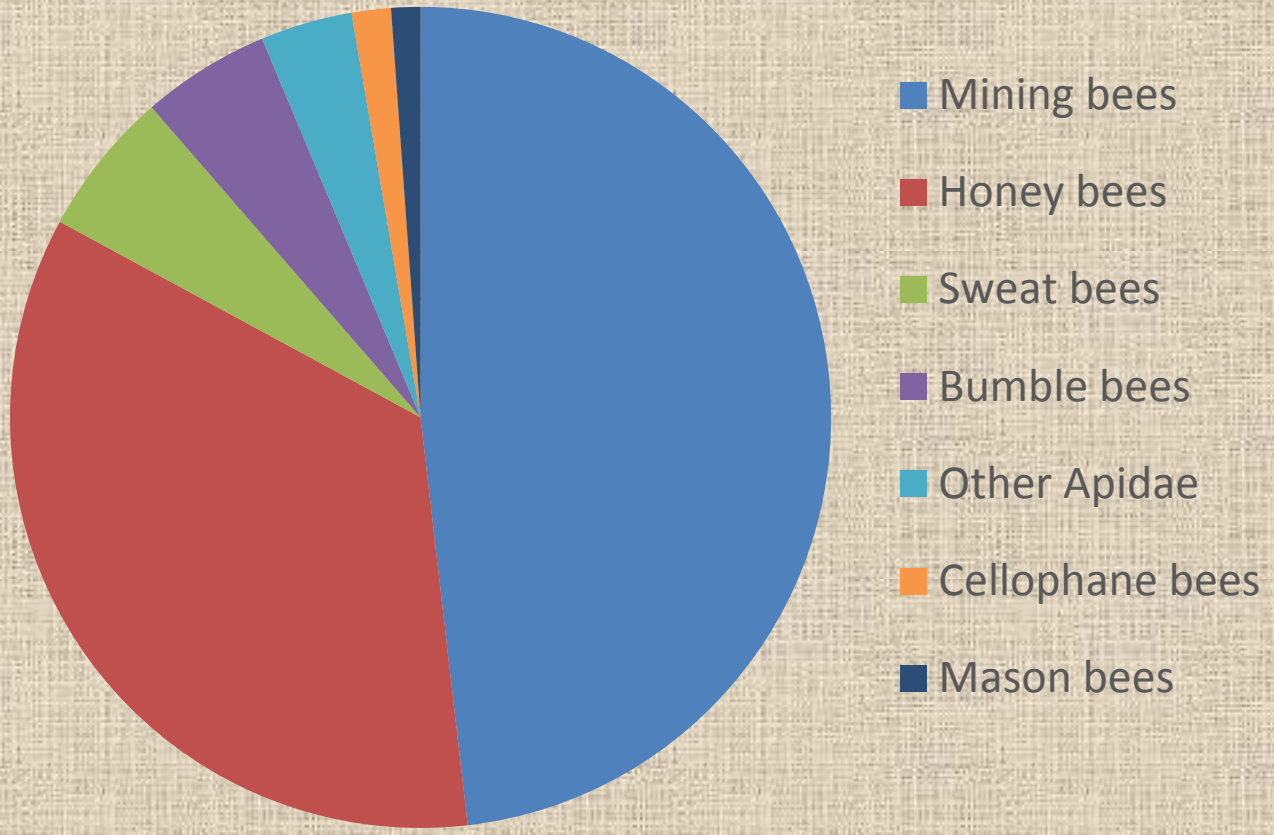






From Nancy Adamson, Ph.D. Thesis, 2011, Virginia Tech

Bees on flowering apple trees – New York State



Data from Russo et al. 2015

Numbers of Bee Species Visiting Different Crops

Crop	Number of bee species collected from crop flowers or carrying crop pollen
Apple (NY, PA)	174
Blueberry (ME, NY, RI, NJ, MI)	118
Watermelon (NJ)	45
Cucumber (NJ)	18
Muskmelon (NJ)	18
Pumpkin (CT, NJ)	4
Tomato (NJ)	20
Pepper (NJ)	14

Bushmann & Drummond 2015, Gardner & Ascher 2006, Kammerer et al. 2015, MacKenzie & Eickwort 1996, Park et al. 2010, Russo et al. 2015, Scott et al. 2016, Stubbs et al. 1992, Tuell et al. 2009, Winfree et al. 2008, and Stoner unpublished

Bee Diversity in Connecticut

- Bees recorded in CT – 349 species
- 9 species are exotic, rest are native to US
- 1 species of honey bee (exotic, social)
- 16 species of bumble bees (native, social)
- 10 species of *Colletes* (cellophane bee, solitary)
- 20 species of *Osmia* (mason bees, solitary)
- 84 species of *Andrena* (mining bees, solitary)
- Over 91 species of sweat bees (*Halictus, Lasioglossum, Agapostemon, etc.*) most solitary, but some social
- Many other species, mostly solitary

Halictids or Sweat Bees

Tiny bees, can be black, bright green or striped
Can Be Social or Solitary
Land on Skin Seeking Sweat

Halictus ligatus

Augochlorella

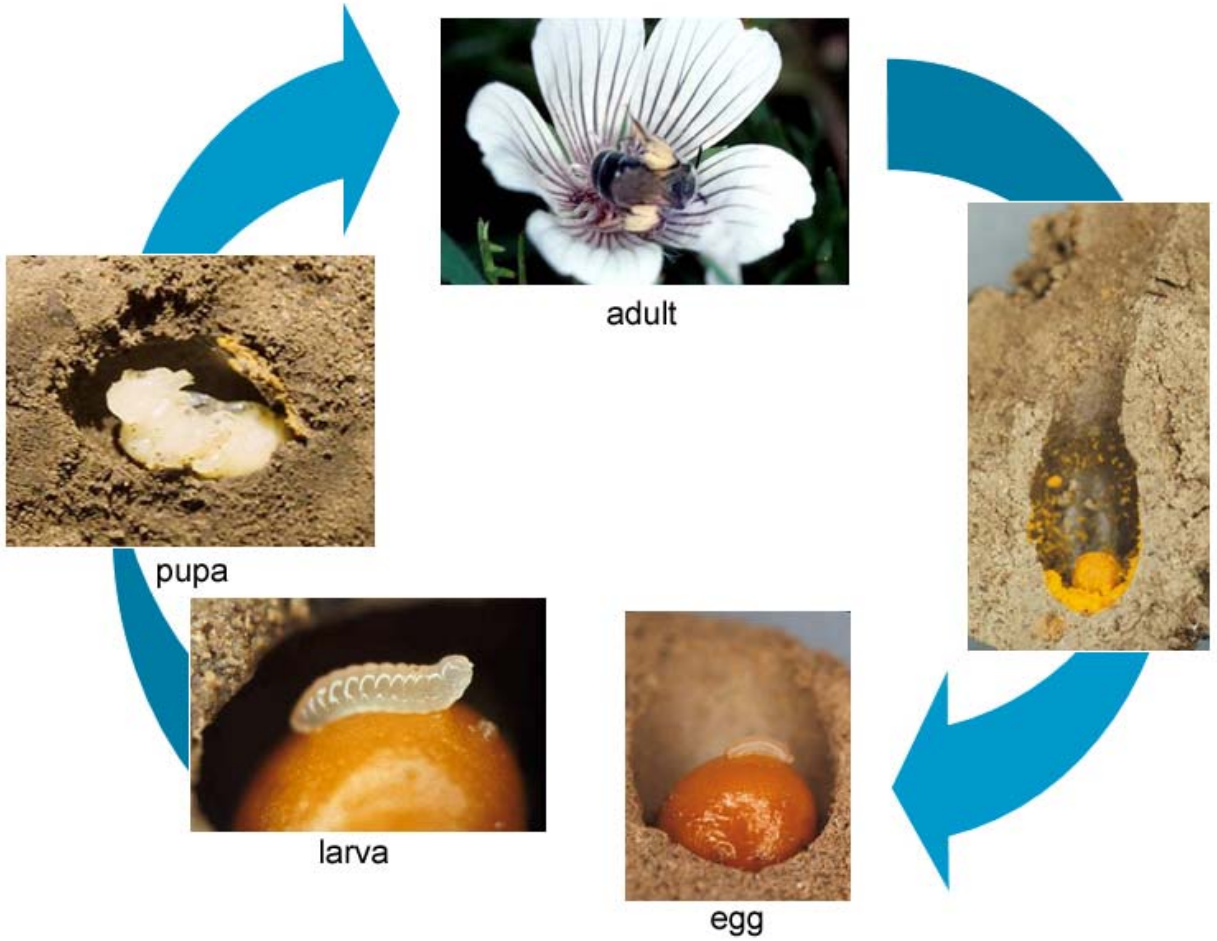
Mining Bees (Andrenidae)
Ground-Nesting, Solitary, No Venom

Andrena carolina on blueberry – J. Tuell

Andrena on American holly

Squash bee female , *Peponapis pruinosa,* on male pumpkin flower

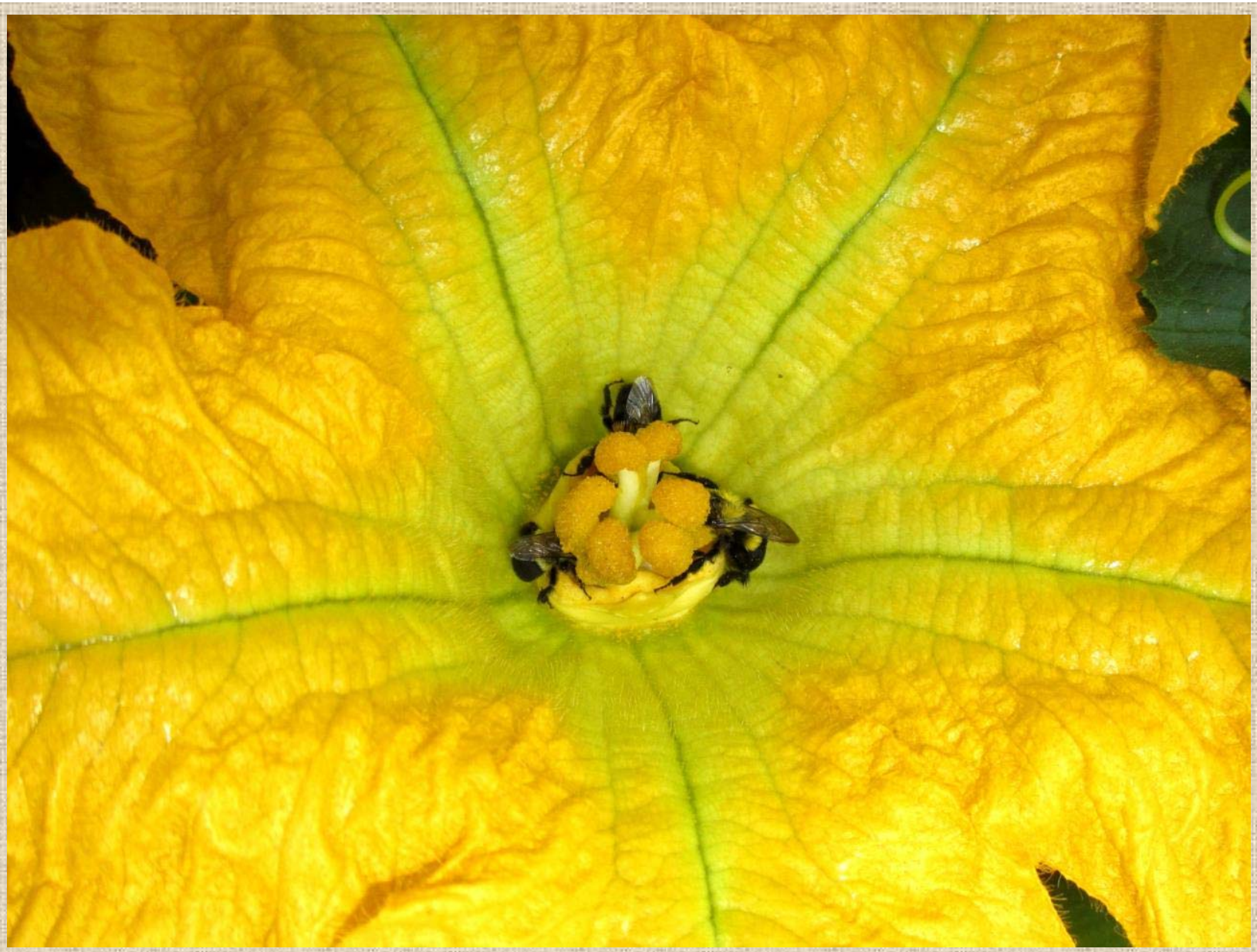
Life Cycle of Solitary Bees



www.xerces.org/nativebees

What do solitary bees need?

- Most crop pollinators are generalists and will feed on a wide range of plants in bloom during the short time they are active
- Pollen driven – Pollen needed for reproduction.
- Nectar – source of energy, but can't store as honey, less important for these bees than for honey bees
- Nesting sites – mostly ground nesting, need patches of undisturbed soil. Others nest in hollow stems, holes in wood, gravelly areas
- Short season of activity – 6 to 8 weeks. Spend the rest of the year in nest (larval development, pupation, in some species adult dormancy)



Bumble bees in female pumpkin flower

Mike Thomas - CAES

Bumble Bee Life Cycle

In the early stages, the queen takes care of all nest duties

Nest Making (spring)

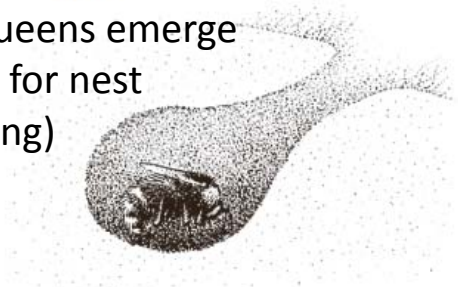
As the colony grows, the workers take over

Nest Development (summer)

At the end of the colony cycle, males and queens are produced

Queens and males (summer)

Queen Hibernates (winter)



Mated queens emerge And look for nest Site (Spring)

Queen Foraging (spring)

What do bumble bees need?

- Sources of nectar and pollen through the season – especially early and late. Can only store tiny amounts of honey and pollen for a short time.
- Holes to nest in – most species nest in holes abandoned by rodents or other insects
- Early blooming flowers near the nesting sites
- Protection from pesticides

Planting for Bumble Bees

- Bumble bees are generalists – they use a wide diversity of flowers over a long season
- Need season-long bloom, but the critical periods are spring and late summer - fall
- March - May – Queens establishing nests, need nectar and pollen near nesting sites
- Summer – Need lots of protein-rich pollen to feed larvae
- August - October – New queens bulking up to overwinter, need lots of nectar
- Can buzz flowers to release pollen
- Long tongued species can reach nectar deep in flowers

Early season plants for queen bumble bees

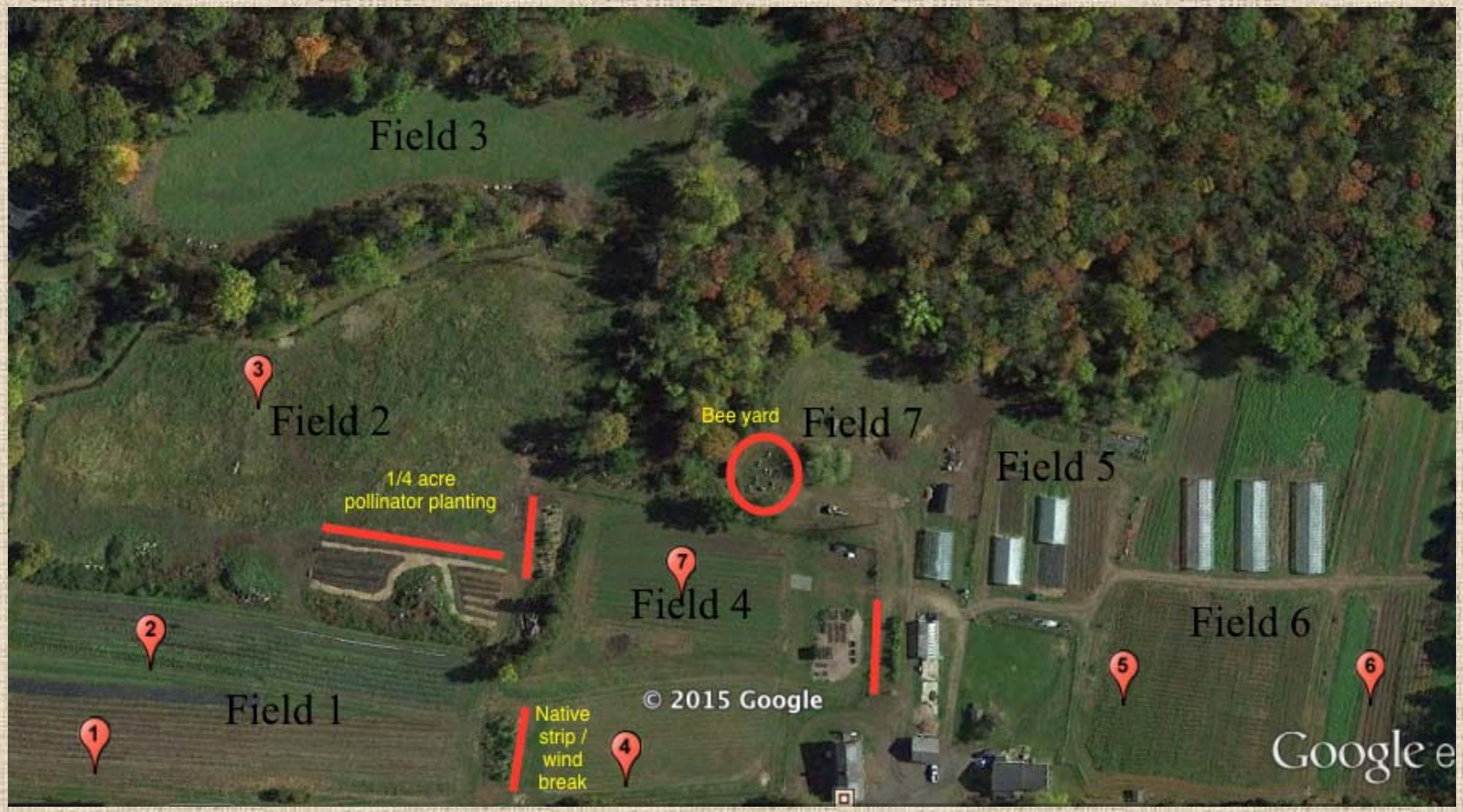
- American pussy willow (*Salix discolor*)
- Dogwood (*Cornus* spp.)
- American holly (*Ilex opaca*)
- Black cherry (*Prunus serotina*)
- Winterberry (*Ilex verticillata*)
- Black willow (*Salix nigra*)
- Beach plum (*Prunus maritima*)
- Beard tongue (*Penstemon* spp.)
- Southern arrowwood (*Viburnum dentatum*)
- Swamp rose (*Rosa palustris*)
- Lowbush blueberry (*Vaccinium angustifolium*)

From Couto, A.V. and A.L. Averill, A Review on Bees, Northeast Crops Edition

Clovers have pollen high in protein

Late season – goldenrod and asters

Pollinator and native plantings – Massaro Farm (Steve Munno)



¼ acre pollinator planting
Massaro Farm – marginal land

Field blocks – Massaro (Steve Munno)

Buckwheat in onion paths – Massaro Farm

Frost-killed buckwheat in fall brassicas- Massaro Farm

Buckwheat cover crop – Massaro Farm

Lavender – Jones Family Farm
Many flowering herbs have abundant nectar:
Catmint/Catnip
Mint
Basil
Anise Hyssop
Borage
Oregano/Marjoram
Lavender (some cultivars)
Thyme
Sage

Don’t make your pollinator habitat an ecological trap

An ecological trap is a habitat that is attractive to an organism, but is detrimental to fitness. An attractive pollinator habitat contaminated with pesticides harmful to the pollinators is an ecological trap!

Some Organic Pesticides Are Hazardous to Bees

Active Ingredient	Common trade names	Notes
Spinosad	Entrust, Natular, Monterey Garden Insect Spray, Natural Guard, GF-120 Insecticide Bait	Highly toxic. Greatest effect with contact before spray has dried
Pyrethrum, Pyrethrins	Pyganic, Azera, Altiara, Merus, Safer Pyrethrin	Highly toxic. Effect lasting hours to days
Horticultural oil	Monterey Horticultural Oil, Safer, Orchex, Plantoil	Greatest effect within 2 hours of application or with direct contact
Insecticidal soap	Natria, Safer, KOPA, etc.	Direct contact
Diatomaceous Earth	Mostly used in grain storage or livestock pest management, but some field uses allowed	Exposure to dust
Beauveria bassiana	Mycotrol, Botaniguard	Fungus that can infect bees in the laboratory
Copper Sulfate	Many products	When applied to plants for disease control

Avoid Spraying Crops in Bloom – But Also Avoid Drift

- Pay attention to trees and shrubs, field edges, and any flowering weeds
- Powder formulations are more hazardous to bees than water sprays – they are likely to drift and are also more likely to stick to bee hairs

How far away is far enough to prevent drift into pollinator habitat?

- Xerces guidelines: 40 feet from ground-based pesticide applications, 60 feet from air blast sprayers
- To avoid dust from treated seeds: 125 feet
- Plant upwind from area where pesticide used (if there are steady prevailing winds)
- Vegetative buffers as windbreaks – evergreens not attractive to pollinators
- Grassed filter strips to catch field runoff

How far do bees travel?

- Depends on availability of good forage close to home
- Depends on the size of the bee
- Also varies with species, even among similar sized-species (such as bumble bees)
- Honey bees are weird – they can recruit foragers for distances up to 4-6 miles away (to a great resource in a poor environment)
- Other pollinators may travel differently – migrating butterflies, for instance

How far some bees travel

Size	Example	Typical distance	Maximum distance
Small	Sweat bee	100 yards	200 – 300 yards
Medium	Mason bee	500 yards	900 – 1000 yards (about ½ mile)
Large	Bumble bee (forager)	Varies from 300-600 yards	Varies from 800 yards to 1.7 miles
Medium	Honey bee	Can sustainably go 4 miles for a good resource if necessary	Have been found to go 7 miles, but this is not sustainable

What about tillage and mowing?

- Tillage has the potential to harm ground-nesting bees in the crop field. Avoid tilling areas with aggregations of ground-nesting bees if possible.
- Mowing:
  - Mowing ground cover during crop bloom can reduce competition for pollination.
  - Mowing nearby pollinator habitat before spraying reduces the effect of pesticide drift.
  - Mowing for hay may not be compatible with managing for pollinators – time for haying determined by nutritional quality, storage, and weather.
  - Meadows – in early years, mowing helps favor perennials over annual weeds. Once established, mowing can be greatly reduced. Best practice is to mow after the first frost in fall or before spring growth, and mow 1/3 to ½ of the habitat each year on rotation to favor diversity.
  - Mowing high and leaving stems can provide habitat for stem-nesting species.

Squash bee aggregation

Nests marked with flags

Photo from Susan Willis Chan

Strategies for Increasing Pollinator Habitat on Farms

- Protect pollinator habitat from pesticide drift
- Use edges – forest edge, riparian areas, roadsides, rights-of-way
  - Encourage blooming trees and shrubs
  - Delay mowing fall wildflowers until after frost
- Blooming cover crops –
  - Mustards, clovers, buckwheat, sunflowers
  - Less common, but very valuable: Phacelia, partridge pea
  - Mixtures
  - Ground covers of clover, dandelions, violets – need to mow before spraying to protect pollinators

Funding from Natural Resources Conservation Service

- Requires a process with paperwork, a site visit, and a conservation plan
- Pollinator habitat considered as part of overall conservation plan and may have multiple functions, such as:
  - Hedgerow
  - Riparian buffer or stream habitat improvement
  - Conservation crop rotation
  - Windbreak/shelterbelt
  - Contour buffer strips
  - Cover cropping

Lots more information on the CT Ag. Experiment Station Website!

www.ct.gov/caes

Pollinator Information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