Attracting Pollinators and Beneficial Insects to Your Yard and Keeping them There

Catharine Mannion
University of Florida, IFAS
Tropical Research and Education Center

UF UNIVERSITY of FLORIDA
IFAS Extension

Acknowledgements
(Information, slides, photos)

- 2015 IST on Insecticides and Pollinators
  - Minimizing Honey Bee Exposure to Pesticides (http://edis.ifas.ufl.edu/in1027)
- National Conference on Protecting Pollinators in Ornamental Landscapes, October 2015

Importance of Pollinators

- Most animal pollinators are insects and most insect pollinators are bees.
- More than 80% of flowering plants require animal pollination.
- An estimated 1/3 of the food we eat comes from animal pollinated plants.
- “Bee-pollinated commodities account for $20 billion in annual U.S. agricultural production and $217 billion worldwide.” (USDA, 1 Aug. 2013)
- More than 20,000 species of bee pollinators worldwide, 4,000 in the United States and 300+ in Florida.

Insect Pollinated Plants

- Many insect pollinated plants have evolved features that facilitate pollination:
  - large, brightly colored petals,
  - sweet scents,
  - nectar sources with varied nectar structures,
  - moderate quantities of pollen, (less pollen wasted)
  - sticky or spiky pollen,
  - anther qualities that enhance the likelihood of pollination,
  - and “sticky” stigmas to which pollen is more likely to adhere.

Types of Pollen Dispersal

Common Insect Pollinators

bees

wasps

beetles

flies

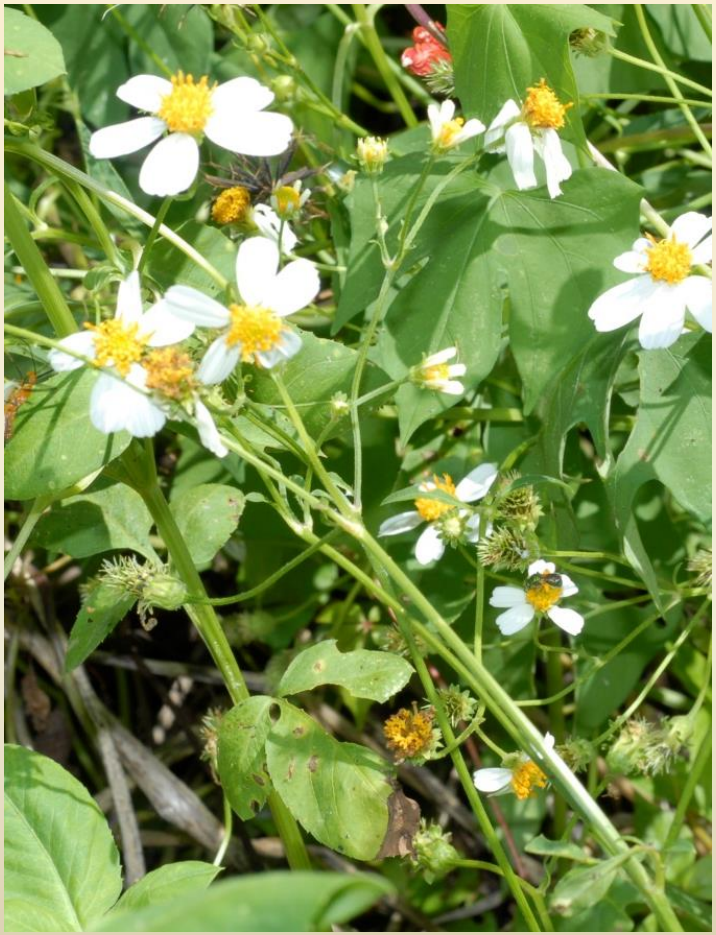
ants

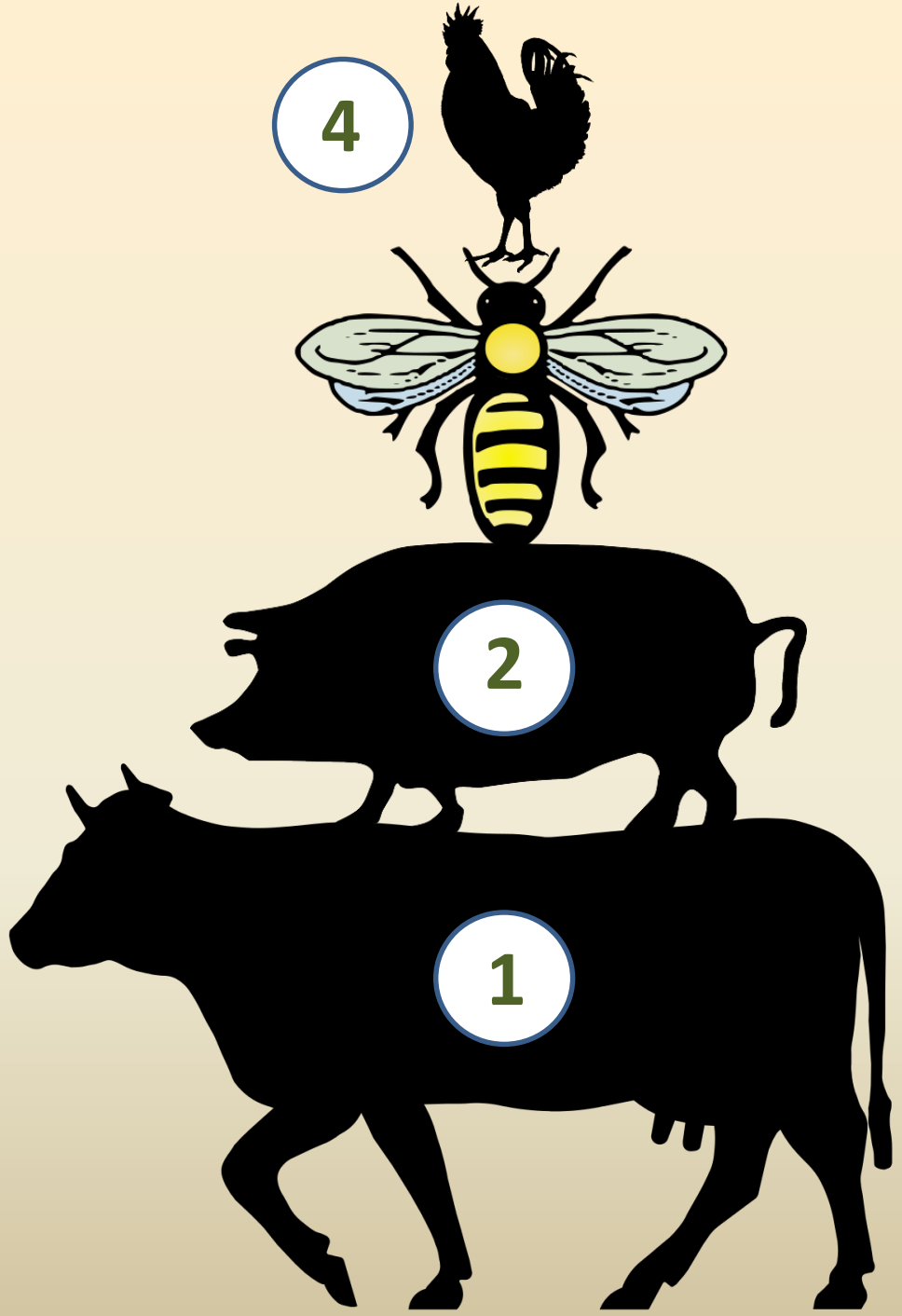
moths

butterflies

Pollinators' Needs

- Food
  - Nectar and pollen bearing plants
  - Some bees need a variety of blooming plants. For example, variety in:
    - bloom schedule (time of day and year)
    - color, shape, size of flowers
    - height and texture, etc.
- Water
- Nesting materials





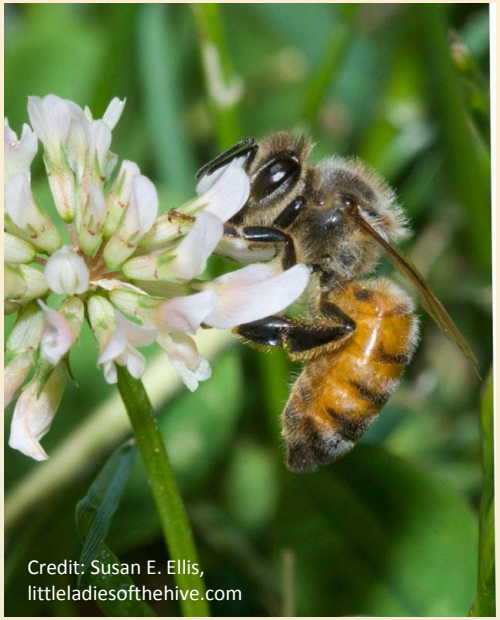
Value of Bees

Economic ranking of cattle, pigs, honey bees and poultry

The Buzz about Beets; J Tautz and H Heipringer Springer, Heidelberg 2008

Importance of Bees

- Western honey bee (*Apis mellifera*)
  - credited with approximately 85% of the pollinating activity
  - responsible for about 1/4 to 1/3 of the nation's food supply
- 50 crops pollinated in the U.S. and 10-20 million lbs. of honey
- 300 + other species of wild bees in Florida alone



Examples of Native and Managed Bees

- Apidae:
  - bumble bees (*Bombus impatiens*, *Bombus terrestris*)
- Halictidae:
  - alkali bee (*Nomia melanderi*)
- Megachilidae:
  - blue orchard bee (*Osmia lignaria*)
  - alfalfa leafcutting bee (*Megachile rotundata*)
  - Spanish mason bee (*Osmia cornuta*)
  - Japanese hornfaced bee (*Osmia cornifrons*)

Heather Hines, NCSU

Native Bees of Florida

- There have been at least 316 individual species of bee identified in Florida.
- These include individuals from the following families:
  - Colletidae (26 taxa)
  - Melittidae (2 taxa)
  - Andrenidae (63 taxa)
  - Halictidae (66 taxa)
  - Megachilidae (72 taxa)
  - Apidae (87 taxa)

  The majority of these bees are solitary and nearly 80% are ground-nesting. Most are specialist pollinators, meaning they only visit very specific species of plants.

Bee Social Systems

Bees use pollen as a protein source and co-evolved with flowering plants.

About 75% of bees are solitary.

About 10% of bees are social.

- Cooperative brood care
- Reproductive division of labor
- Overlapping generations

About 15% of bees are cleptoparasitic, meaning that they parasitize and use other bee nests.

Honey Bees

- perennial, highly populated, eusocial colonies
- mobile, manageable
- generalist pollinators
- honey production, hive products

Bee decline

Bees are dying

Stop using pesticides

All bees threatened

Colony collapse disorder

Report on Honey Bee Health USDA and EPA 2013

- There are multiple factors playing a role in honey bee colony decline
- Forces impacting honey bee health are complex
  - Parasitic Varroa mite – major factor
  - Bee viruses – major factor
  - Poor genetic diversity
  - Poor nutrition among honey bee colonies
  - Need to determine actual pesticide exposure and effects to bees in the field

Expert Consensus

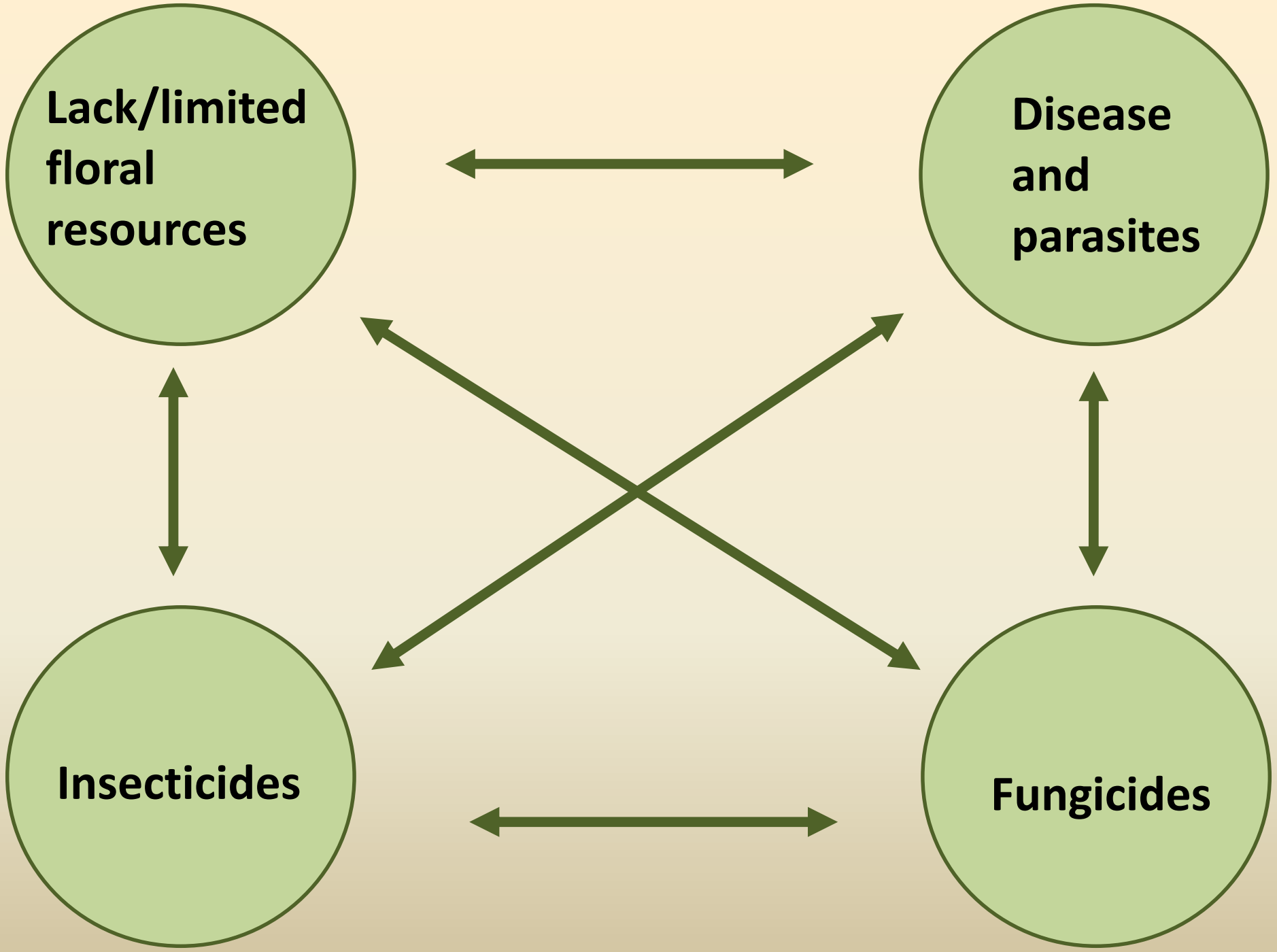
- Bee declines driven by combined stress from parasites, pesticides and lack of flowers
- Exposure to insecticides can be a lethal or sub-lethal stress on bees
- Public awareness of pollinator stress has led to:
  - A National Pollinator Strategy
  - Retail demands on growers to produce plants without neonicotinoids

Bee Issues

- Public perception is that pesticides, especially neonicotinoid insecticides, are the main cause of bee decline
- Conflicting studies and media coverage
- Misapplication in Oregon draws national media attention due to bumble bee kill
- Demands on big box stores to not sell plants treated with neonicotinoids

Factors Identified Affecting Bee Health

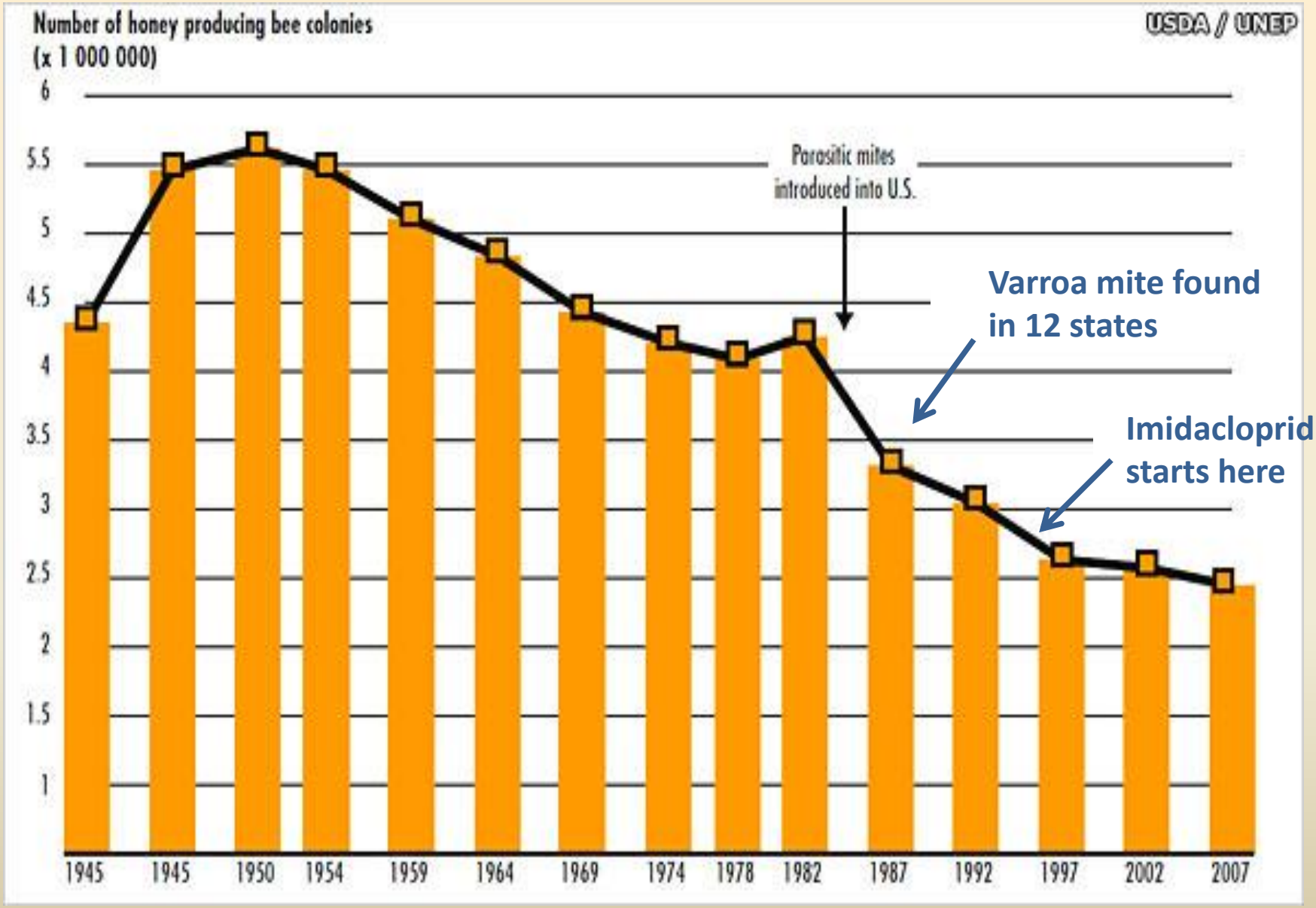
- Genetic diversity
- Loss and fragmentation of habitat
- Plant type and diversity; poor nutrition
- Queen failure
- Pollinator disease and parasites
  - Pathogens increase with urbanization and management; i.e. feral bees have lower disease and stronger immune responses
- Climate change
- Pollution
- Pesticides


Lack/limited floral resources
Disease and parasites
Insecticides
Fungicides

Pollution and Climate Change

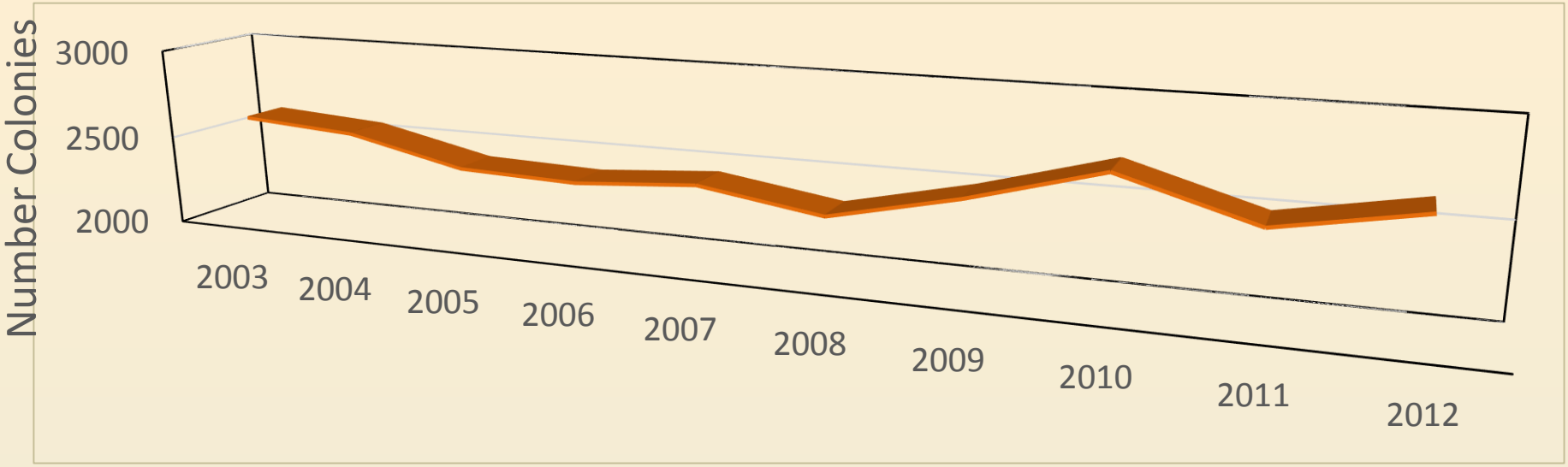
- Diesel fumes degrade floral odors
- Air pollution
- Metal ion toxicity
- Urban heat island (can be good or bad)
- Studies have show impact of climate change on butterfly distribution

Randy Oliver, Scientific Beekeeping

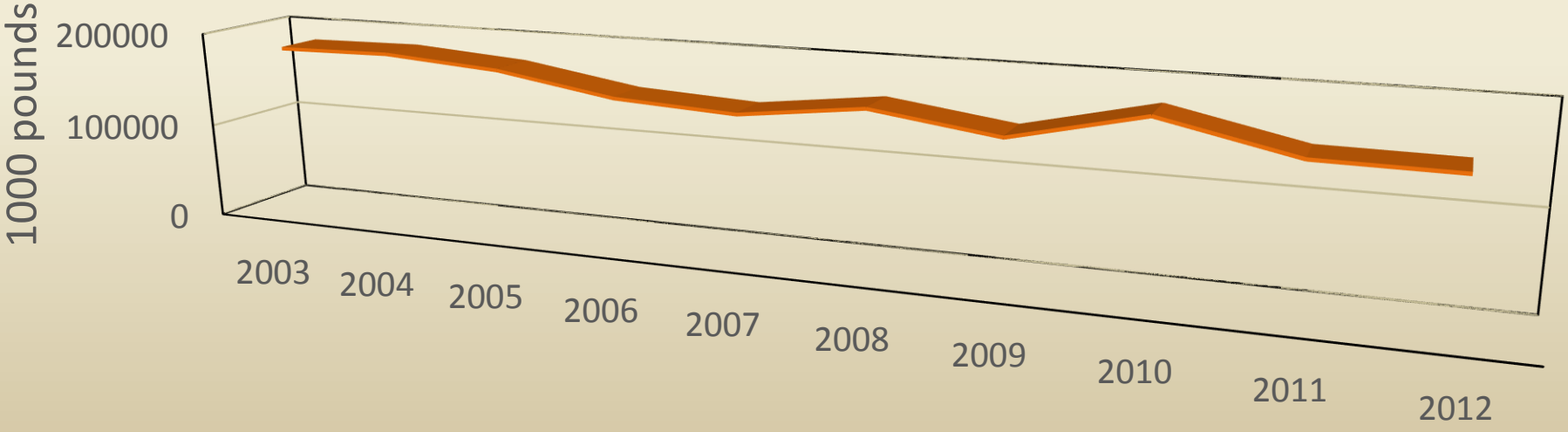


1950 1970 1990 2010

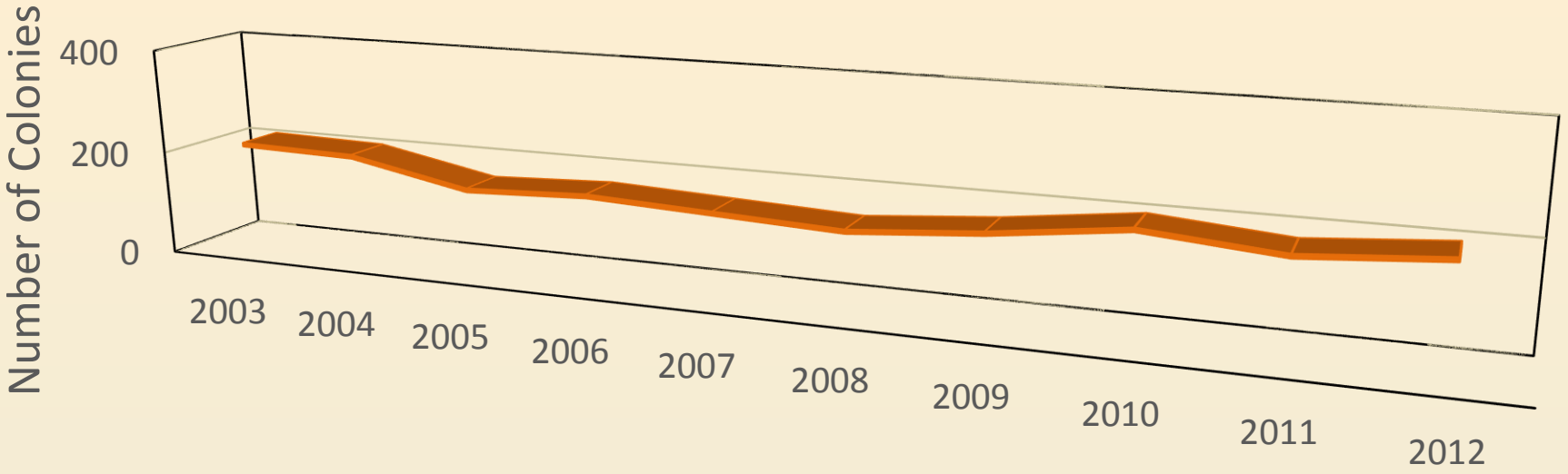
U.S. Honey-Producing Colonies



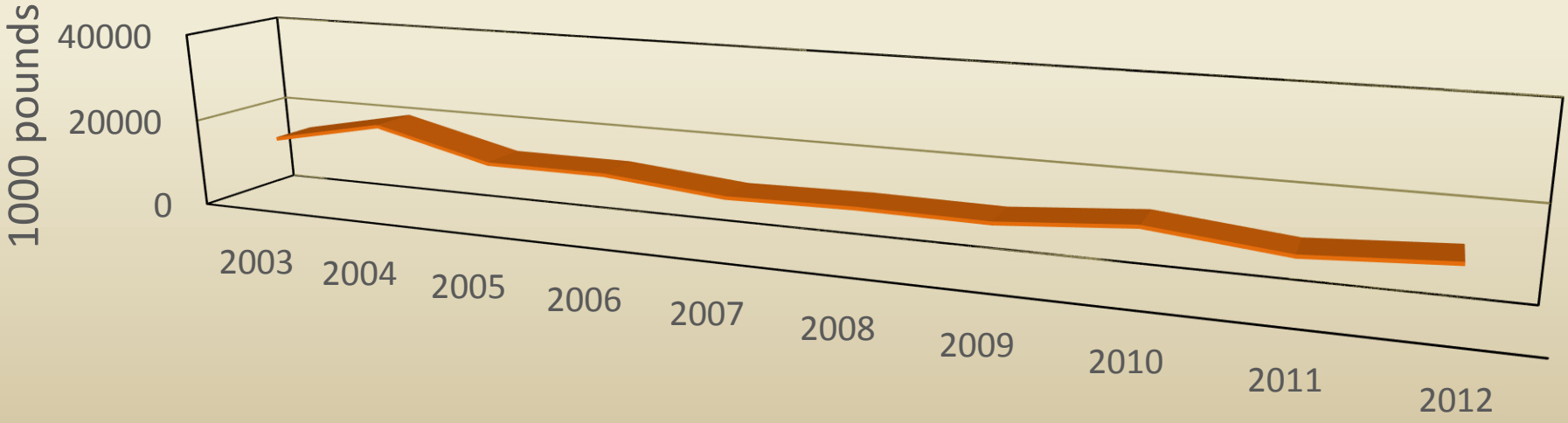
U.S. Honey Production



Florida Honey-Producing Colonies



Florida Honey Production



Plant Type and Diversity

- Increasing plant diversity
  - Increase in wild bees
- Floral resources
- Open versus closed flowers
- Pollen sources
- Access to soil (for some wild bees)
- Nest sites

Floral Resources

- Generalist bees – visit many plant species for pollen/nectar
- Specialist bees – visit one or few species
- Floral preferences
  - Differences among bees
  - Native versus non-native
  - Timing (season-long; early and late season)
  - Weeds

Floral Resources

- Flower diversity seems to be one of the most influential forces for bee abundance and richness
  - Pollination is not necessarily higher when bee abundance is high
- Urban areas can have more bees than wild areas
  - Have higher heterospecific pollen

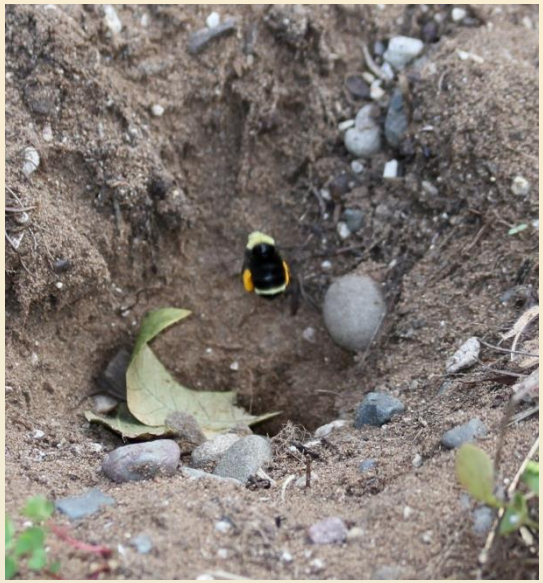
Presence of bees in the urban environment

Native versus Non-Native Plants

Bees equally visited native and non-native floral resources

Ground-nests

- undisturbed ground
- preferences vary
  - loose, sandy soil
  - smooth, lightly packed soil
  - ditches, mounds,
  - under and in between plants
- not too moist
- sunny
- accessible



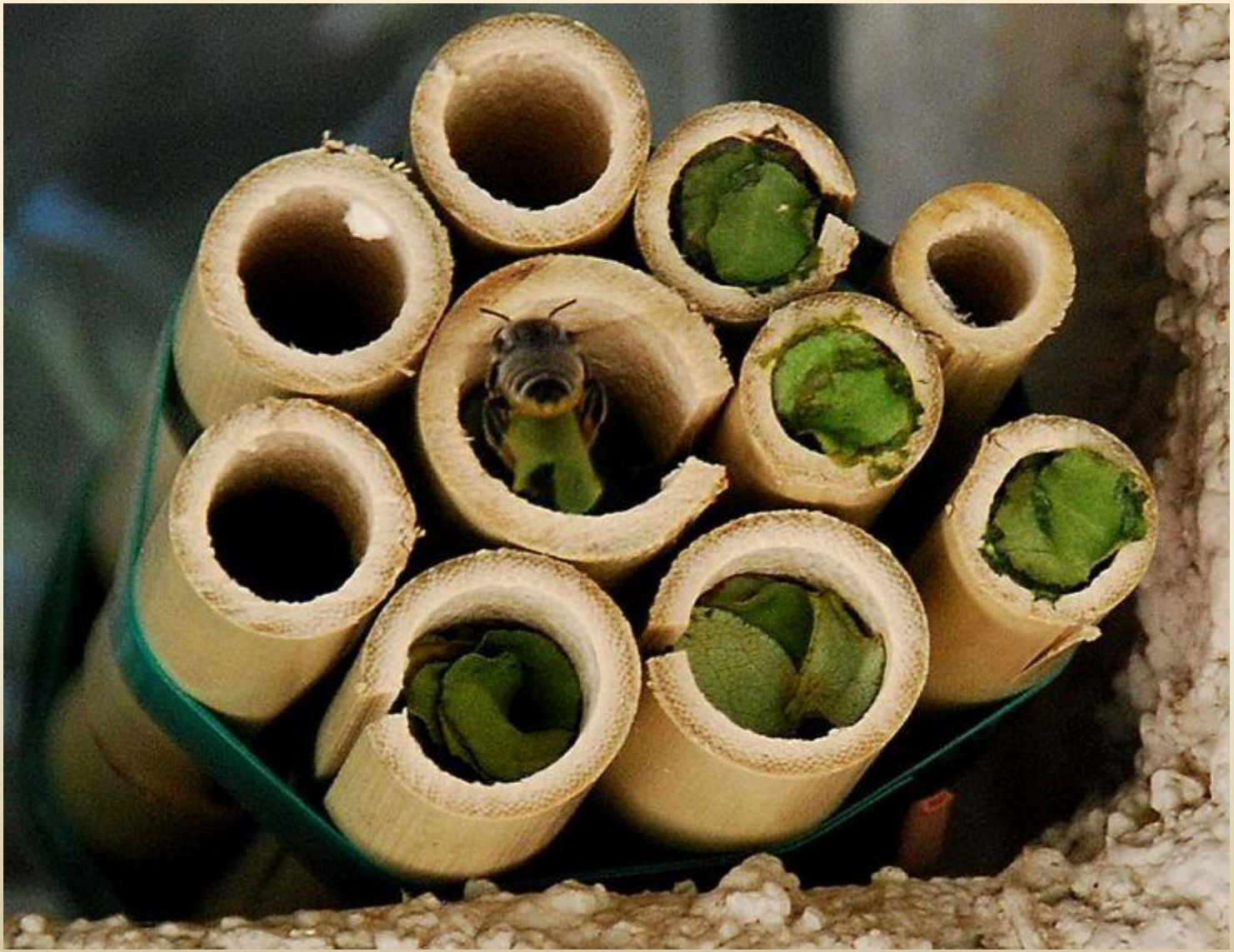
Jason Graham, University of Florida

Bob Hammon, Colorado State University, Bugwood.org

Tunnel-nests

- hollow wood, reeds, etc.
  - various diameters
- nest cap and construction materials vary:
  - mud, leaves, sand, resin

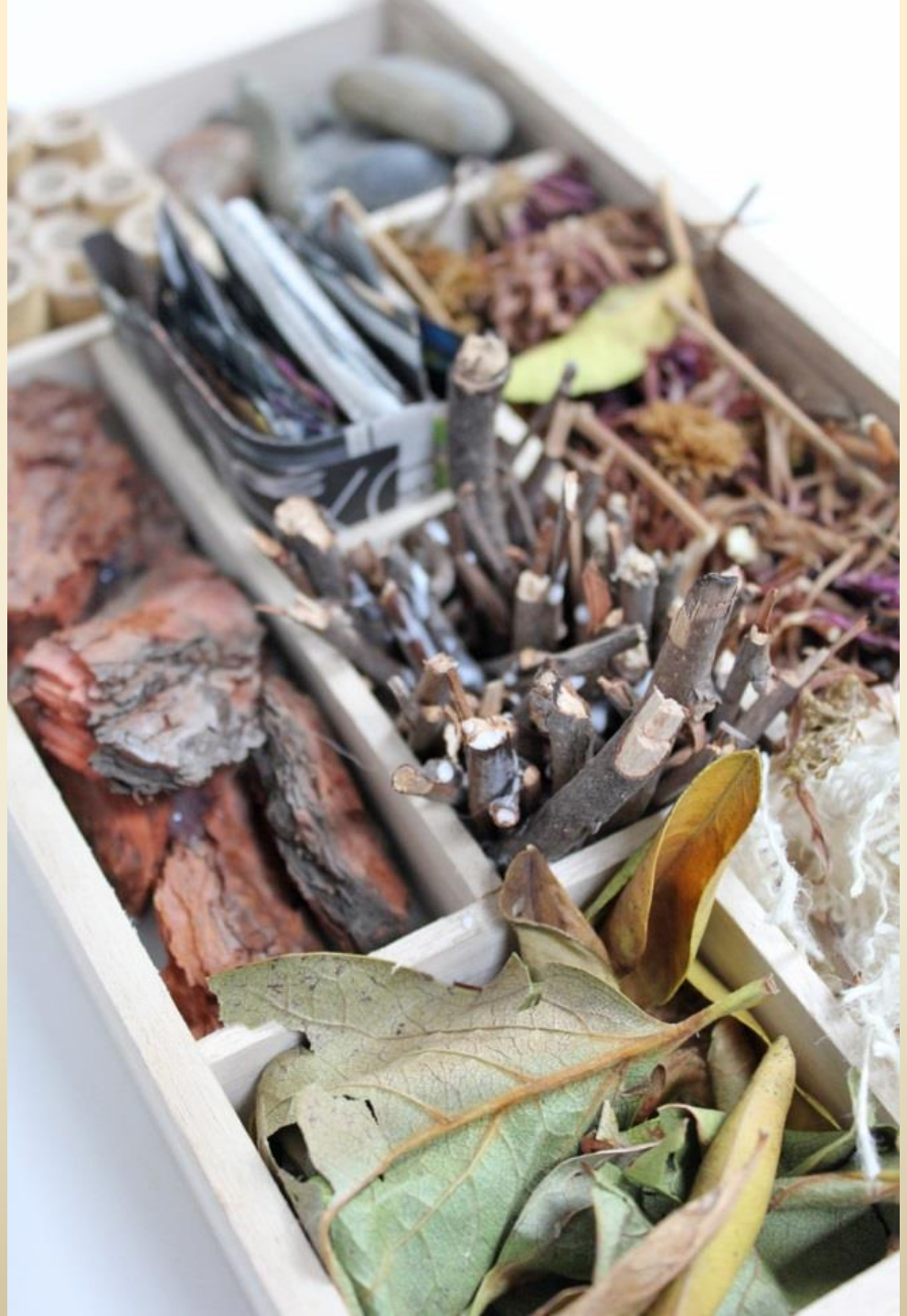
Leaf cutter bee

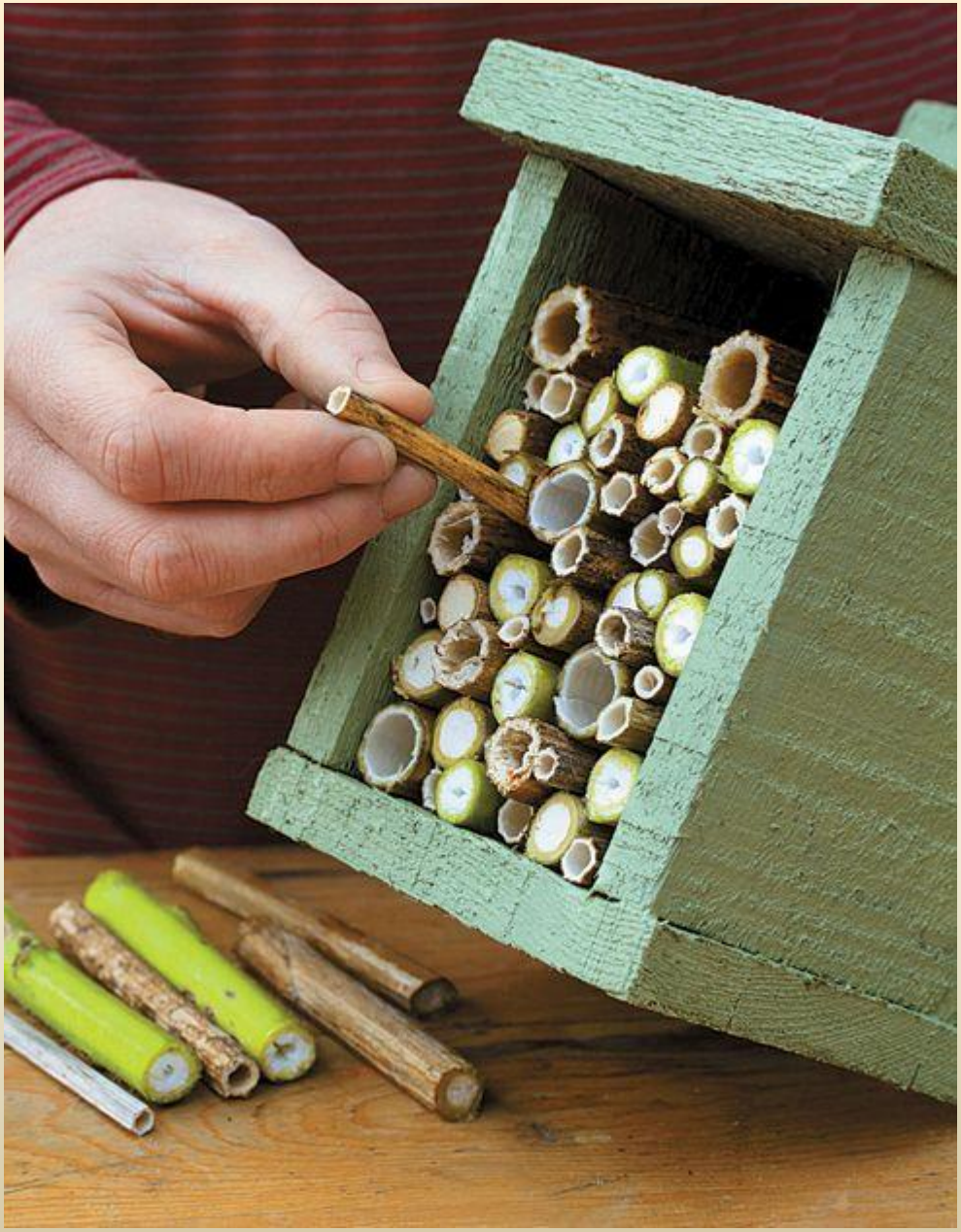


Greener Places Insect Hotel


Creepy Crawly
Towers


Red Ted Art



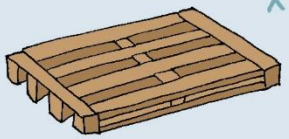


How to build a bug hotel

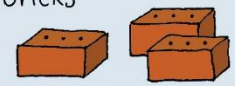
Wild About Gardens

You will need:

- Wooden pallets x4

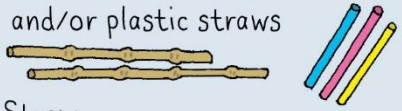


- Bricks



- Plastic bottles

- Bamboo canes and/or plastic straws

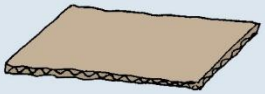


- Straw

- Leaves

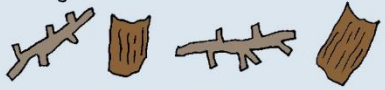
- Tiles

- Cardboard

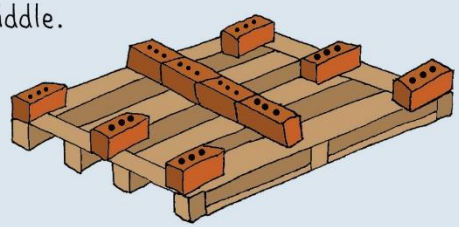


- Stones/pebbles

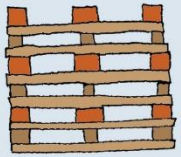
- Twigs/loose bark



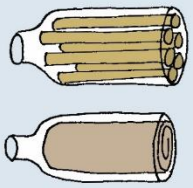
1. Place a wooden pallet in your chosen location. On top of the pallet, line bricks around the corners and across the middle.



2. Place your next pallet on top of this and repeat the process for all of your pallets.



3. Cut off the top two-thirds of your bottles. Fill up half of them with bamboo canes/plastic straws and the other half with rolled up cardboard. Place these inside the hotel.



4. Fill in the remaining spaces with bricks, leaves, pebbles, stones, tiles, loose bark and straw.

5. Add in any extra materials that you want to recycle e.g. old pipes, carpeting, toilet tubes, old plant pots. Be creative - add a welcome sign or give your hotel a name!

Pollinators and Pesticides

- Protecting honey bees and other pollinators is important to the sustainability of agriculture.
- Potential exposure of bees to pesticides can vary greatly depending on the type of pesticide, formulation, application method, label restrictions, and other factors.
- The goal in using a pesticide is to achieve maximum benefit (success) with minimum negative impact.

Credit: Florida Department of Agriculture and Consumer Services

Effects of Pesticides on Bees

- Acute exposure can kill individuals or colonies of honey bees immediately or within hours of exposure.
- Chronic exposure may include lethal and sub-lethal effects on the brood, workers, drones, and queen.
- Sub-lethal effects include:
    - physiological,
    - behavioral,
    - reproductive, and
    - compounded.

Credit: James Hill
University of Florida

Sub-lethal Effects

- Motor function
- Feeding
- Learning
- Homing
- Foraging
- Reproduction

Pesticides Used in the Landscape

- United Kingdom – 300 registered a.i.'s
- France – 500 registered a.i.'s
- Most European countries – 400-500 a.i.'s
- U.S. – more than 1,200 a.i.'s (sold in 18,000 products)
- More than 500 neonicotinoid products

J. Frazier, C. Mullin, & M. Frazier, Penn State University

Flowering crop

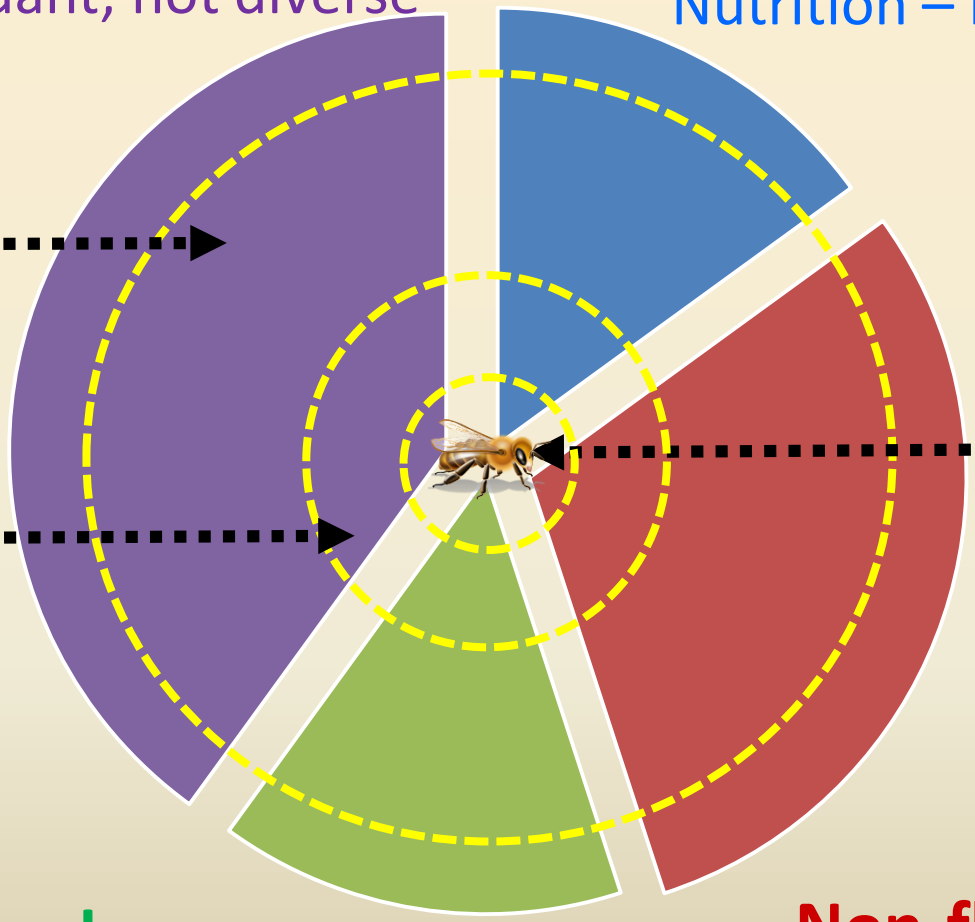
Pesticide exposure – high

Nutrition – abundant; not diverse

Field margins

Pesticide exposure – medium

Nutrition – less abundant; diverse



Wild-flower meadows

Pesticide exposure – low

Nutrition – less abundant; diverse

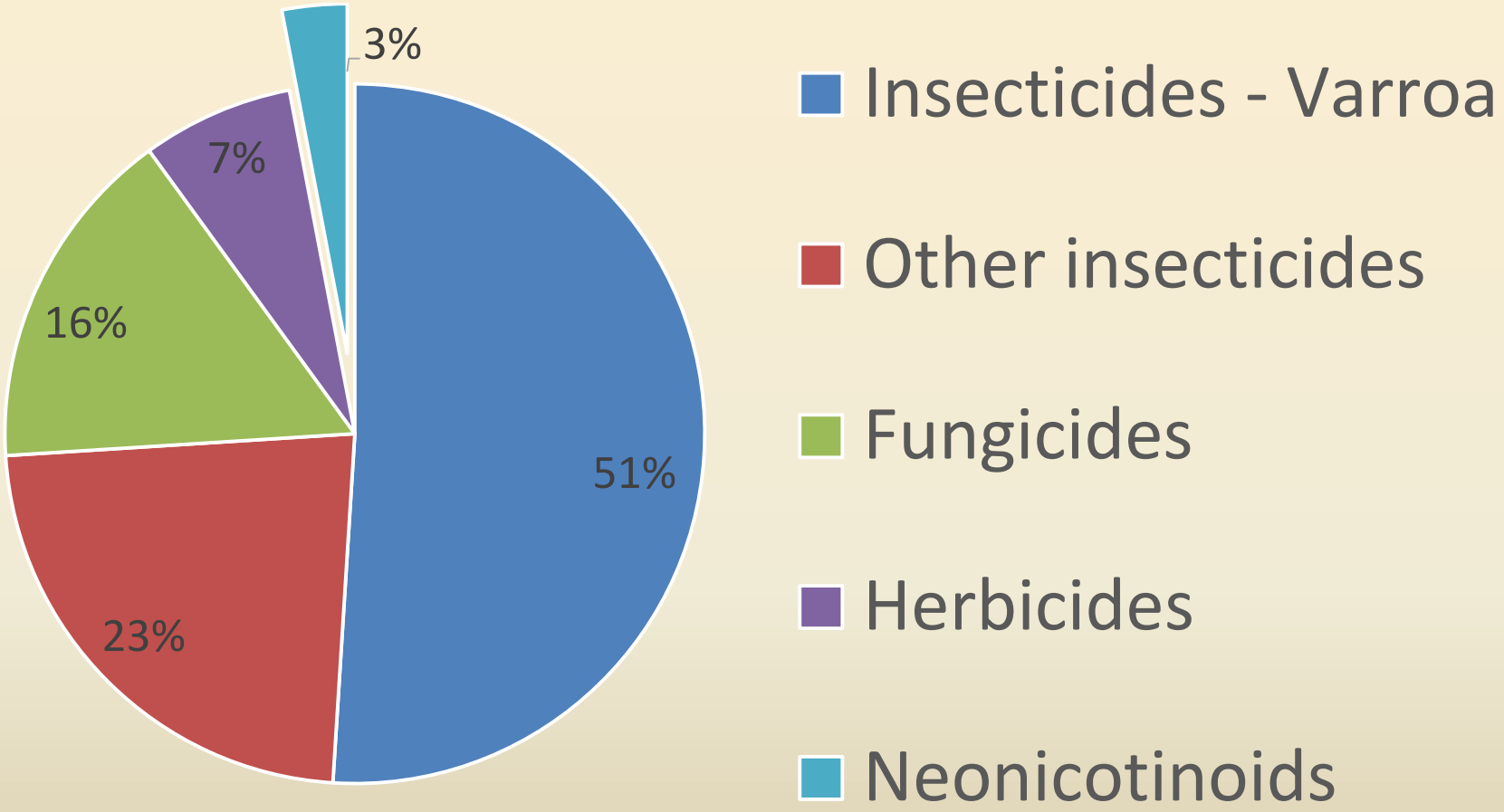
Non-flowering crop

Pesticide exposure – low

Nutrition – scarce

Raine & Gill, Nature 2015

Pesticide Detections



Total detections: 1,497

O. Bernauer & K. Traynor, Univ. of Maryland

Proposed List of Pesticides Toxic to Bees

- Carbamates
  - aldicarb, carbaryl, carbofuran, methomyl, methiocarb, oxamyl, propoxue
- Neonicotinoids
  - Acetamiprid, clothianidin, dinotefuran, imidacloprid, thiamethoxam
- Organophosphates
  - Acephate, chlorpyrifos, dimethoate, diazinon, and others
- Pyrethroids
  - Bifenthrin, cyfluthrin, fenpropathrin,permethrin, pyrethrins, and others
- Naturals
  - Azadirachtin, spinosad, spinetoram
- Others
  - Fipronil and others

Neonicotinoids and Pollinators Effects on Bees

- Gained media attention
- Many studies ongoing
- Has been some misleading work
  - Harvard study – claims 2 of the a.i.'s significantly harm bees; used unrealistic rates fed directly to bees
- Bee kills due to misuse of products
- Some box stores now require special labeling

Neonicotinoids

Active Ingredient	Trade Names Professional Use
Acetamiprid	TriStar (no soil application)
Clothianadin	Arena, (Aloft – no longer available in Florida)
Dinotefuran	Safari, Zylam
Imidacloprid	Merit, Marathon, Coretect, Discus, Allectus, several generic labels
Thiamethoxam	Flagship, Meridian

Neonicotinoid Insecticide Precautions

- Toxic to bees
  - Use lowest effective dose
  - Avoid use on highly attractive tree species; use after bloom
- Least expensive preventative insecticides for white grubs (turf)
- Less hazardous and more practical than sprays
- Simplify outdoor pest control by homeowners

Neonicotinoids and Weeds

- Over spraying flowering lawn weeds with clothianidin or imidacloprid reduced foraging, colony vigor, and reproduction
- New blooms formed after mowing not harmful

Gels, Held & Potter JEE 2002
Larson, Redmond & Potter PLOSONE 2013
Larson, Redmond & Potter Ecotoxicology 2014

Cosmetic Use of Pesticides

- Definitely there should be a focus on reducing the use of pesticides for cosmetic use

- What is cosmetic????????

Pesticide Reduction Policies

- European Union neonicotinoid moratorium (Dec 2013)
- Amendment to Ontario Pesticide Act (July 2015)
- Ontario's Cosmetic Pesticide Ban (April 2009)
- U.S. local cosmetic pesticide use bans (2015); Montgomery County, Maryland and Portland, Oregon

Pesticide Regulations

- Pollinating Insect Hazard Statement
  - If a pesticide is used outdoors as a foliar application, and is toxic to pollinating insects, a “Bee Hazard” warning generally has been required to be included in the Environmental Hazards.
- An EPA-driven label includes:
  - crop-specific use instructions,
  - risk-mitigating instructions, and
  - label language that will detail chronic effects on developing (larval) bees.

Risk Reduction Approaches

- Make sure employees/applicators can understand and follow the pesticide label
- Use pesticides only when needed.
- Some products prohibit application during bloom.
- Avoid applications at times when bees are foraging actively.
- Consider formulations or application methods
- Do not contaminate water.
  - Avoid puddles, drips, spills, runoff, and leaks.
- Consider using less toxic compounds.
  - Choose compounds with low acute and residual toxicity.
  - Use caution when using broad spectrum products.

Media Attention to Bee Issues Also Has Some Benefits:

- People are more aware of the role of pollinators and their diversity
- Where flowers are present, bees are indicators of the health of the insect community. Protecting bees protects all beneficial insects and biological control.

Slide from D. Smitley, MSU

Building a Bee-Friendly Landscape

- Flower form – open versus closed
- Native and non-native plants can both be good
- Diversity with bee-friendly flowering plants
- Combination of early and late bloomers
- Leave buffer zones
- Promote tolerance of some weeds
- Use low toxicity, selective, short residual products
- Use reduced risk pesticides

Resources

- Bees of Florida ID Guide
  - http://entnemdept.ifas.ufl.edu/hallg/melitto/intro.htm
- NE Florida's Native Bees
  - http://www.floridasnativebees.com/
- UF Honey Bee Research and Extension Lab
  - www.Ufhoneybee.com
- Florida Department of Agriculture and Consumer Services, Bee Protection Website
  - www.floridabeeprotection.org

Catharine Mannion

Research and Extension Specialist
Ornamental Entomology

University of Florida, IFAS
Tropical Research and Education Center
18905 SW 280th Street
Homestead, FL 33031

305-246-7000
cmannion@ufl.edu
http://trec.ifas.ufl.edu/mannion

UF IFAS
UNIVERSITY of FLORIDA