


# Pollinator Conservation



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# Overview

- Importance of pollinators
- Meet the pollinators
- Habitat Needs
- What you can do



sunflower bee (specialist), *Xylocopa Eucera* sp.

High quality, well managed natural habitat (Largesse pine with herbaceous understory maintained by fire), Berkeley County

Specialist bees eat pollen only from one genus or family, but may collect nectar from other plants

## What is the Xerces Society?

Endangered species



Since 1971, the Society has worked to protect wildlife through the conservation of invertebrates and their habitat.

Pollinator conservation



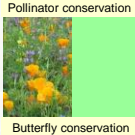
Aquatic conservation



Xerces blue butterfly (*Glaucopsyche xerces*), the first U.S. butterfly to go extinct due to human activities.



Butterfly conservation



**Nancy Lee Adamson**  
 Pollinator Conservation Specialist  
 Xerces Society for Invertebrate Conservation & USDA-NRCS East National Technology Support Center, Greensboro, NC

## The Importance of Pollinators; a review



bumble bee on wild bergamot

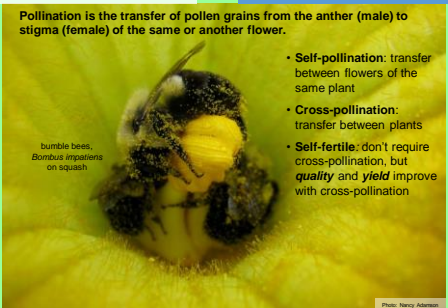
Photo: Nancy Adamson

## The Importance of Pollinators

### Pollination

Pollination is the transfer of pollen grains from the anther (male) to stigma (female) of the same or another flower.

- **Self-pollination:** transfer between flowers of the same plant
- **Cross-pollination:** transfer between plants
- **Self-fertile:** don't require cross-pollination, but **quality and yield** improve with cross-pollination



bumble bees, *Bombus impatiens* on squash


Photo: Nancy Adamson

## The Importance of Pollinators

### Pollination and Human Nutrition

**Food that depends on insect pollination**

- Cucumbers
- Cantaloupe
- Watermelon
- Blueberries
- Strawberries
- Peaches
- Raspberries
- Pumpkins
- Many more...



**Food that depends on insect pollination**

- 35% of crop production, worldwide
- Over \$18 to \$27 billion value of crops in U.S. (\$217 billion worldwide)
- One in three mouthfuls of food and drink we consume

Miller, W., Cresswell, N.W. 2002. The need of honey bees as pollinators of U.S. crops in 2002. *Appl. Geogr.* 23: 1151-1159.  
 Miller et al. 2008. Importance of pollinators in changing landscapes for world crops. *PLoS One* 3: 226-232-213.

Photo: USDA-ARS/Agrip. ©2011

### The Importance of Pollinators

#### Bugs Drive the System

**Benefits to Other Wildlife:**

- Pollinator-produced fruits and seeds comprise 25% of the global bird and mammal diets
- Pollinators are food for other wildlife (spiders, reptiles, amphibians, rodents, terrestrial birds)
- Pollinator habitat is directly compatible with the needs of other wildlife, such as songbirds

Photo: Nancy Adelman  
Photo: Scott Thompson  
Photo: Nancy Adelman  
Photo: Nancy Adelman  
Photo: Nancy Adelman

### The Importance of Pollinators

#### Multiple Benefits of Pollinator Habitat

Pollinators and other insects are food for wildlife

96% percent of terrestrial birds rear their young on insects

Photo: Terry Soling, USFS  
Photo: Jeff Stange, WDCS  
Photo: Ray Owen

Good cover, food, & open foraging

- 85% quail chick's diet is insects
- Eat seeds when older

<http://www.tn.gov/hwa/pdfs/bwhitebasics.pdf>

### The Importance of Pollinators

#### Insect Pollinators Are Ecological Keystones

More than 85% of flowering plants require an animal, mostly insects, to move pollen.

Oberdor, J., R. Waser, and S. Totterd. 2011. How many flowering plants are pollinated by animals? *Oikos* 120:1072-1080. doi: 10.1111/j.1365-0731.2011.12414.x  
Gurali, S.C., J.C. Rosemary, C. Robert, P. Thompson, G. Schwagerl, and W.E. Kunin. 2010. Global patterns in the diversity, impact, and ecology of pollinators. *Ecology and Evolution* 1:269-283.

Photo: Eric Meier

### Meet the Pollinators: Butterflies and Moths

About 700 species of butterflies & 13,000 species of moths in US

long-tailed skipper  
*Epargyreus clarus*

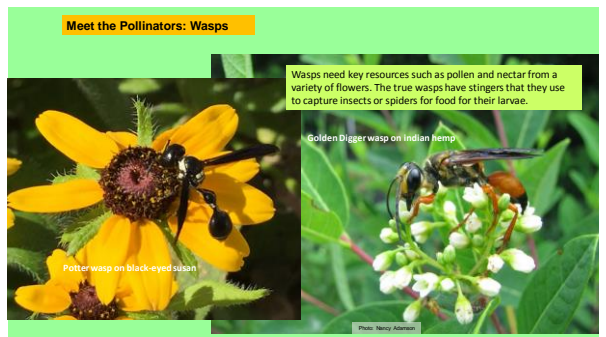
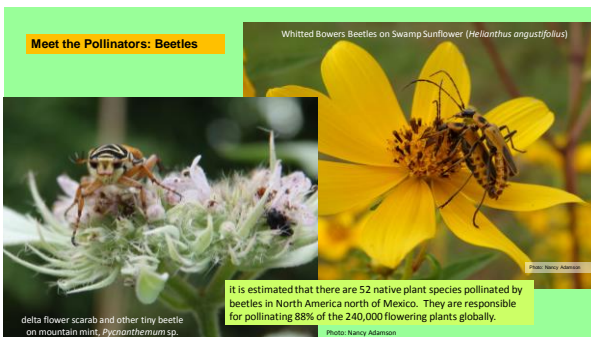
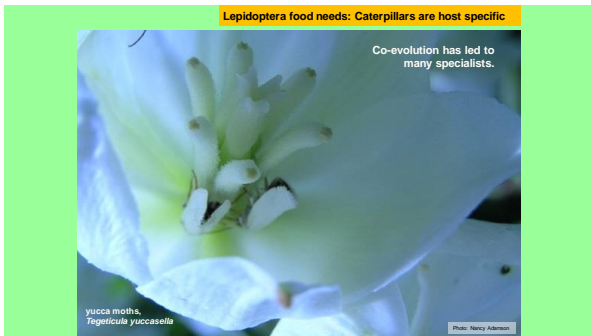
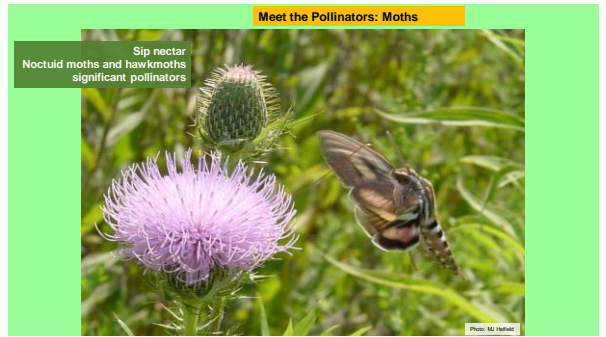
Photo: Nancy Adelman

### Meet the Pollinators: Butterflies

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### Meet the Pollinators: Butterflies

Photo: Jennifer Henswood



### Bees: The Most Important Pollinators

**Bees are the most effective pollinators**

- Bees actively collect and transport pollen
- Bees exhibit flower constancy
- Bees regularly forage in area around nest

**Bees are the most agriculturally important pollinators**

bumble bee on blazing star, *Liatris spicata*

mining bee, *Andrena* sp., on apple

Photo: Nancy Adams

### Bumble bees: Excellent crop pollinators

- Pollinators of red clover, tomato, cucurbits
- More efficient than honey bees for blueberry, cranberry, cucurbits (squash, melon)
- Active in cool and wet weather & "buzz" pollinate

*Bombus ternarius* on blueberry, *Vaccinium* sp.

*Bombus impatiens* & *B. griseocollis* on squash

Photo: Nancy Adams, Steve Joseph, iStockphoto

### Bees evolved from wasps & became vegetarians!

**Bees evolved to better collect pollen & nectar**

branched hair

long tongues

leafcutter (aka megachilid) bee

scopa: pollen-carrying hairs (on abdomen or hind legs)

bumble bee

Photo: Ralph Howard/istock, Mark Vaughan, Steve Buchhorn

### Bees are great pollen movers

Bee diet (pollen & nectar) & hairiness make them especially effective pollinators

bumble bee on squash

Photo: Nancy Adams

### Native Bee Crop Specialists

**Squash Bees**

- Ground-nesting directly at the base of squash plants
- Active in early morning hours (before sunrise)
- Pollinate flowers before honey bees begin foraging<sup>1</sup>
- 67% of 87 sites studied across the U.S. had all pollination needs met by squash bees<sup>2</sup>

<sup>1</sup> Tscharntke, T. et al. 2005. The pollination efficiency of the squash bee (*Pezomachus grossipes*) and the honey bee (*Apis mellifera*) on squash (*Cucurbita pepo*). *Journal of Applied Ecology* 42: 1010-1017.

<sup>2</sup> doi:10.1086/384484. *Ecology* 84: 3055-3062.

Photo: Nancy Adams

### Wild Pollinators: Better Quality Pollination

**2013 research highlights importance of native bees: Wild bees improved fruit set **twice** as much as honey bees.**

*Better quality pollination relates to cross-pollination, the ability to buzz pollinate, and other ways bees interact with flowers.*

honey bee

andrenid bees

**We still need honey bees since we can manage them and move them to crops.**

Garibaldi, L.A. et al. 2013. Wild pollinators enhance fruit set of crops regardless of honey bee abundance. *Science* 333:1072-1075.

Photo: Nancy Adams

**Buzz Pollination by Native Bees**



**Example: Cherry tomatoes**

When native bees were present, Sungold cherry tomato production almost tripled.  
Video online highlights buzz pollination:

<https://www.youtube.com/watch?v=UjvR08R1t08>

Copyright © S. and C. Krombein, 2000. The bee species includes worker, queen and queen alternate. All photographs are used with permission. California, Biological Conservation, 10(4): 47-55.  
Photo: Nancy Adelman

**Recognize pollinators: Native bee diversity**



carpenter bee and andrenid bee *Perdita minima* from desert SW

Photo: Stephen L. Bushman

**Hymenoptera: Bees, wasps, ants, & sawflies**

**Rare Behaviors**

- Social (mostly ants & sawflies, a few wasps & bees)
- Honey production (extremely rare)

>3,600 native bee species in the US—most are **solitary** species, not colonial  
~700 native bee species in the eastern US  
~500 in South Carolina

**Most bees are solitary**

- No colony or honey stores to defend, therefore not defensive/aggressive- so only sting if grabbed – tell kids!
- Females collect nectar and pollen every trip

sweat bee, *Agapostemon* sp., on sunflower

Photo: Nancy Adelman

**Three broad groups of native bees**



bumble bees (social)

ground-nesting (solitary)

cavity-nesting (solitary)

Photos: (Upper Right) (L-R) Corrie, Nancy Adelman

**Bumble bees, *Bombus* spp.**



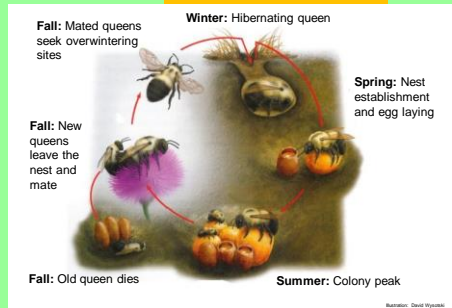
- 45 species in U.S., ~26 in East (16-17 species of bumble bees in SC)
- Social colonies founded by single queen
- Annual colonies—last only one season
- Nest may contain 25-400 workers
- Nests in abandoned rodent burrows or under lodged grasses

Conserve brush piles, un-mowed areas

*Bombus vagans* on clover

Photo: Ellen Egan, Nancy Adelman

**Life cycle of a bumble bee colony**



Fall: Mated queens seek overwintering sites

Winter: Hibernating queen

Spring: Nest establishment and egg laying

Fall: New queens leave the nest and mate

Fall: Old queen dies

Summer: Colony peak

Illustration: David Waxman

### Ground nesting solitary bees

Roughly 70% of bee spp. nest underground

- Resemble ant & ground beetle nests from above
- May aggregate nests (some nest communally, but forage alone)
- Nest chambers lined with waxy glandular secretions that resist flooding

*Scout for nests, conserve sandy soil & bare ground*

mining bee *Andrena barbara*

Photo: Jim Carr, Dennis Briggs, Nancy Adamson

### Life cycle of a solitary bee

Mining bee (*Andrena* sp.): a year in its underground nest as egg, larva, and pupa before emerging to spend a few weeks as an adult.

Photo: Dennis Briggs, Nancy Adamson

### Ground nesting: Southeastern blueberry bee

*Habropoda laboriosa*

- Apidae family
- Blueberry specialist, active early spring
- Looks like small bumble bee
- Coastal plain distribution
- Gregarious nesting

*Scout for & conserve nesting sites; avoid deep tilling*

male (Photo: Bob Doherty) female (Photo: Bob Doherty)

pale face patch

long antennae

male on redbud, *Cercis canadensis*

Photo: Nancy Adamson

### Tunnel/wood/cavity nesting solitary bees

Roughly 30% of native species nest in hollow plant stems, or old beetle borer holes

- Nest tunnel partitions constructed of mud, leaf pieces, or sawdust
- Artificially managed for some crops

*Conserve snags, brush piles & pithy-stemmed plants*

Plants with pithy (hollow) stems include sumac, black raspberry, blackberry, and elderberry that also provide pollen and nectar

Photo: Nancy Adamson

### Tunnel nesting bees (mason bees and leafcutter bees)

Hollow stem example:

Cross-section of silk cocoons

Pollen mass Egg Mud wall Larva Pupa Adult

Silk cocoons with dormant bees inside

Mud cap closure

### Cavity or tunnel nesting: Mason or orchard bees

*Osmia*

- Small to medium size, robust build
- Usually metallic blue or green
- Wide bodies and heads
- Scopa on underside of abdomen
- Active in spring and early summer

*Conserve snags, brush piles & pithy-stemmed plants*

scopa (photo: Nancy Adamson)

*O. collaris* on acalis

Bosch, J. and W. Kemp. 2001. How to Manage the Blue Orchard Bee as an Orchard Pollinator. Sustainable Agriculture Network, Beltsville, MD. 88 pp.

*O. cornifrons* or *O. taurinus* (reticulated) on blueberry

**Megachile** Tunnel nesting: Leafcutter bees

- Small to large size
- Wide bodies and heads
- Dark, typically with pale stripes
- Scopa on underside of abdomen
- *M. rotundata* intro'd for alfalfa seed

**Conserve snags, brush piles & pithy-stemmed plants**

scopa (coapal hairs)

sunchoke, *Helianthus tuberosus*

*M. mendica* on blackberry

Photos: redbud, Lara Berkley, nest, Christine Farmer, others, Nancy Adamson

**Some flowers with pollen specialist bees**

- asters (various genera)
- *Cirsium*, native thistles
- *Chrysopsis*, goldenaster
- *Cucurbita*, squash
- *Helianthus*, sunflowers
- *Hibiscus*, rose mallow
- *Ipomoea*, wild potato vine
- *Oenothera*, primroses
- *Physalis*, ground cherry
- *Pityopsis*, silkgrass
- *Salix*, willows
- *Strophostyles*, fuzzy bean
- *Vaccinium*, blueberry
- *Vernonia*, ironweed
- *Viola*, violet
- ...many more

Specialist bees eat pollen only from one genus or family, but may collect nectar from other plants

sunflower bee, *Svaestra* or *Eucera* sp.

[http://www.illinoiswildflowers.info/flower\\_insects/](http://www.illinoiswildflowers.info/flower_insects/)  
[http://jarrtodowler.com/specialist\\_bees.html](http://jarrtodowler.com/specialist_bees.html)

Photo: Nancy Adamson

**Habitat Needs:**

**Nectar/pollen:**  
Wildflowers spring, summer, fall, woody forbs

**Host plants for Lepidoptera-**  
grasses, wildflowers, woodies

**Refugia, nest sites,**  
structure, litter

**Pesticide free areas**

**Floral Diversity**

**Insect diversity increases with plant diversity.**

Photo: Eric Hahn

Photo: Scott Thomas

Carroll, C., W. B. Meek, R. P. Pywell, D. Gosden and M. Heffernan. 2007. Comparing the efficacy of agri-environment schemes in enhancing foraging bee abundance and diversity in grassland regions. *J. Appl. Ecol.* 44: 25-33.

Philo, S. G., B. Volkmann, A. Dohi, G. Nelesen, and P. G. Willcutt. 2005. Linking Bees and Flowers: how do floral communities structure pollinator communities? *Ecology* 86: 695-702.

Tschornik, T. A., A. Gathmann, and I. Gathmann-Oestermeier. 1998. Specialization using trap-crobbing, bees and wasps and their natural enemies and interactions. *J. of Appl. Ecology* 35: 76-78.

**Pollen and Nectar Through the Growing Season**

Pollinators, predators, & parasitoids need food (nectar, pollen, or prey) and refuge when crops are harvested or pesticides used.

Photo: Steve Hays, USDA, Melissa Thompson, Nancy Adamson, Eric Hahn, Jeff Williams, NCEC, Nancy Adams, Cornell

**Native Milkweeds (*Asclepias* spp.)** **Summer Blooming Understory plants**

- ~80% decline in monarch butterflies since ~2000 in corn/soybean ag regions and ~60% decline in milkweeds
- Tremendous diversity in milkweeds—great potential to expand use

purple milkweed, *A. purpurascens* ↓

pink milkweed, *A. exaltata* ↓

swamp milkweed, *A. incarnata*

green milkweed, *A. verticillata* ↓

scarlet milkweed, *A. quadrifida*

Pleasants, J. M., Oberhauser, K. S. 2012. Milkweed loss in agricultural fields because of herbicide use: effect on the monarch butterfly population. *Insect Conservation and Diversity*, doi: 10.1111/j.1752-4598.2012.00194.x.

Photo: Nancy Adamson

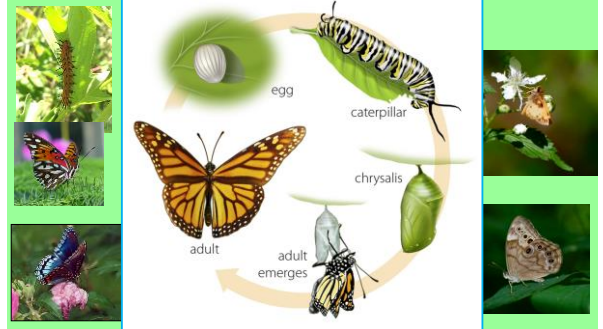
**Lepidoptera food needs: Host & nectar plants**

Larvae eat only specific host plants  
Adults sip nectar from many types

Monarch caterpillar and adult on milkweed, *Asclepias tuberosa*



Photos: Mace Vaughan, Julie Godwin/Dollar

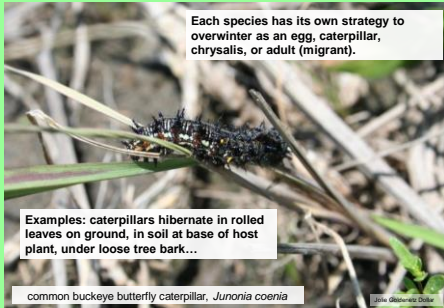


**Lepidoptera Overwintering Strategies**

Each species has its own strategy to overwinter as an egg, caterpillar, chrysalis, or adult (migrant).

Examples: caterpillars hibernate in rolled leaves on ground, in soil at base of host plant, under loose tree bark...

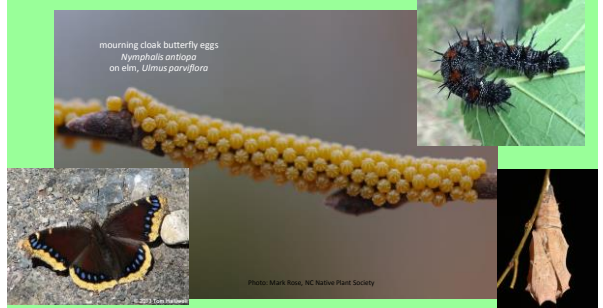
common buckeye butterfly caterpillar, *Junonia coenia*



**Lepidoptera nesting—as easy to miss as bees nesting...more fire sensitive**

mourning cloak butterfly eggs  
*Nymphalis antiopa*  
on elm, *Ulmus parviflora*

Photo: Mark Ross, NC Native Plant Society



**Overwintering strategies**

So, leaving "wild" or "natural" or "weedy" areas alone can help



<https://xerces.org/2017/10/06/leave-the-leaves/>



Management with periodic disturbance is needed—fire, grazing, or mowing. Some seeds need fire (smoke) to germinate. Rotational disturbance is best, leaving areas of refugia for insect larvae, pupae, and adults. Leave small unburned patches within the burned areas. Burn every 2-3 years. Implement prescribed burns outside the blooming period in foraging habitat (i.e., burn in late fall or early spring; March through May best for wild turkey; and early or late in the day).

Recommendation to burn areas in 1/3rds. Blocks of <60 acres best for ground nesting birds including bobwhite and wild turkey

NCTREX team burning a longleaf pine savanna, February 2015  
Photo: NCTREX

**Habitat protection: Reduce pesticide use**

**Pesticides cause significant damage to pollinator insect populations**

- Use active ingredients with least impact on bees
- Consider formulation
- Label guidelines only apply to honey bees
- Don't spray on plants in bloom
- Spray at night and when dry
- Scout crops, only use where needed, not on entire cropland

How to Reduce Bee Poisoning from pesticides

<http://extension.oregonstate.edu/catalog/object.php?seriesno=PNW+501>

A PACIFIC NORTHWEST EXTENSION PUBLICATION • PNW 501  
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**What you can do**

Provide/encourage plants native to the region flowering throughout the growing season

Host plants for Lepidoptera larvae (butterfly and moth caterpillars)

Nest sites for bees, Shelter and Structure for protection and overwintering

Spread the word!

Don't Use Pesticides

**NRCS Conservation Practices**

**Farm Bill Programs: Technical assistance**  
EQIP Environmental Quality Incentives Program  
CSP Conservation Stewardship Program

**Tree & Shrub (612) or Hedgerow (422) Establishment**

Plant flowering shrubs that bloom in succession. Design for multiple benefits, such as wildlife, IPM, visual screen, aesthetics, and erosion control. (Hedgerows intended as protection from chemical drift should not be designed to attract pollinators). Also for longleaf habitat restoration.

Photo: Johnnie O'Brien (Duck Society)

**NRCS Conservation Practices**

**Conservation Cover Practice Standard (327):** Establish permanent vegetation.

Photo: Lori Swisher

**Field Border Practice Standard (386):** Can include a diverse mix of native and low cost non-native plants

Photo: GSC Media

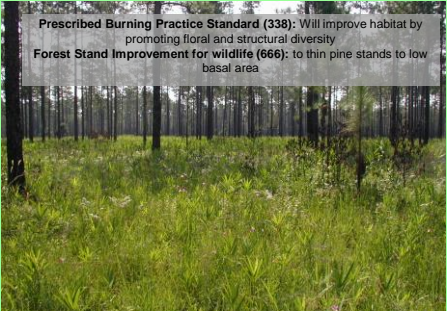
**NRCS Conservation Practices**

**Cover Crop Practice Standard (340):** Can include diverse flowering forbs such as clover, mustard, buckwheat, phacelia, oilseed radish

Photo: MGS/Tracy Johnson

**NRCS Conservation Practices**

**Prescribed Burning Practice Standard (338):** Will improve habitat by promoting floral and structural diversity  
**Forest Stand Improvement for wildlife (666):** to thin pine stands to low basal area



**Your Native Plantings Matter!**

