Broad Benefits of Pollinator Habitat

Improving Crop Pollination & Pest Management with Habitat

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& USDA-NRCS East National Technology
Support Center, Greensboro, NC

Photo: Nancy Adamson

Xerces Society & NRCS partnering for conservation

Xerces-NRCS partner biologists support pollinator habitat creation and management, which benefits other beneficial insects and wildlife

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

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

www.xerces.org

meadow near Carthage, NC

Photo: Nancy Adamson

2008 & 2014 Farm Bill Pollinator Habitat Provisions

- **Pollinators a priority for all USDA land managers & conservationists**
- **Encouraging inclusion of pollinators in all USDA conservation programs--** *adding diversity to plant mixes & promoting IPM at NRCS*

sweat bee, *Agapostemon* sp.
on annual sunflower,
Helianthus annuus

Photo: Nancy Adamson

Talk Outline

- Pollinators matter!
- Basic bee & other beneficial insect biology (for providing habitat)
- Habitat to benefit agriculture
- Bee-friendly farming
- Farm Bill support for pollinators
- Additional resources

bumble bee on blazing star, *Liatris spicata*

Photo: Nancy Adamson

The Importance of Pollinators

green sweat bee
on blueberry

Photo: Nancy Adamson

Pollination and Human Nutrition

Food that depends on insect pollination

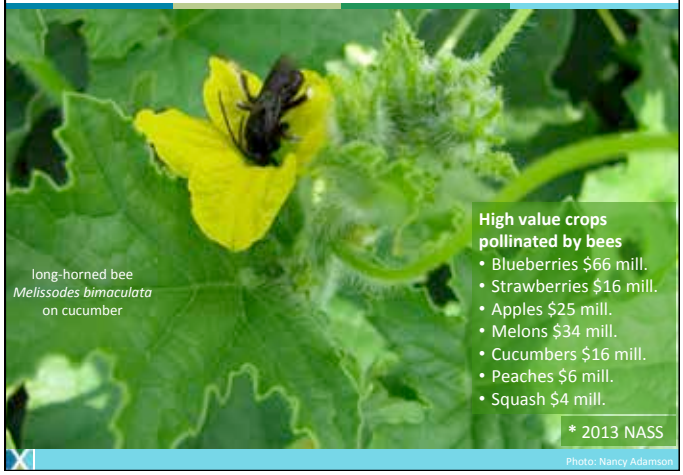
- 35% of crop production, worldwide
- Over $18 to $27 billion value of crops in U.S. ($217 billion worldwide)
- One in three mouthfuls of food and drink we consume

Morse RA, Calderone NW. 2000. The value of honey bees as pollinators of U.S. crops in 2000. Bee Culture 128: 1–15.
Klein et al. 2007. Importance of pollinators in changing landscapes for world crops. Proc. R. Soc. B 274: 303-313.

Photo: USDA-ARS/Peggy Greb

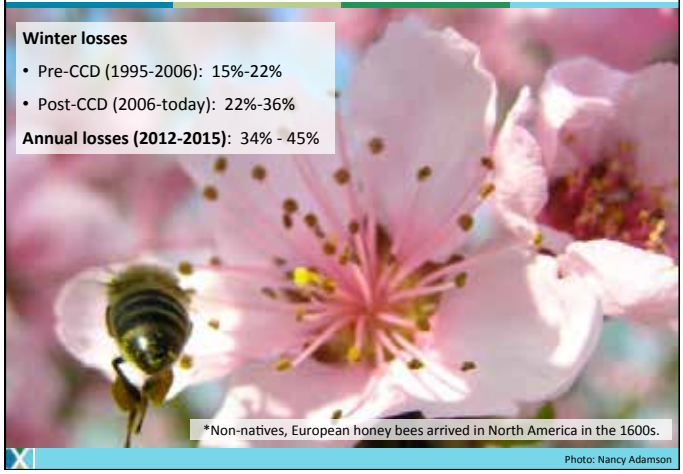
Annual Values of Insect Pollinated Crops

Importance of Pollinators: NC Agriculture*



Importance of Pollinators: NC Agriculture*

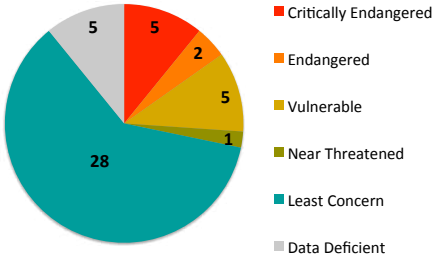
Honey Bees*: Colony Collapse Disorder



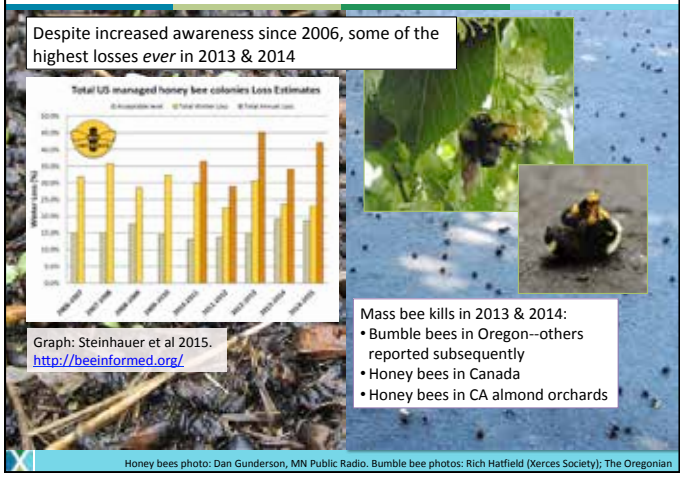
Other Bees in Decline

North America's Bumble Bees

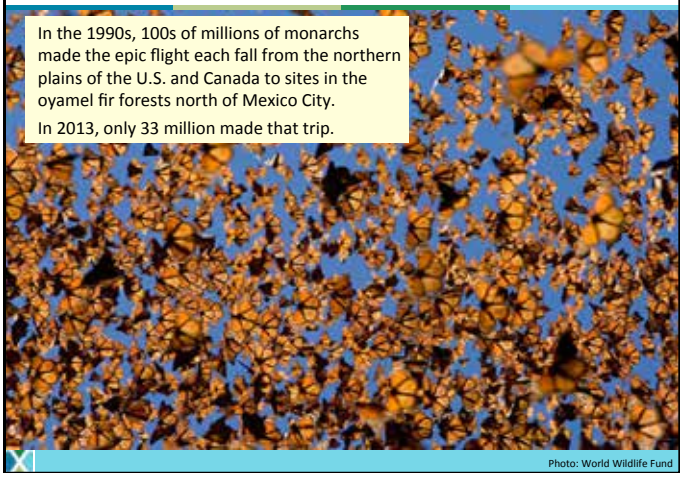
- 1-in-4 at risk of extinction today
- 2014 IUCN & Xerces Society Status Review



Current State of Bee Health



Monarch Butterfly Decline



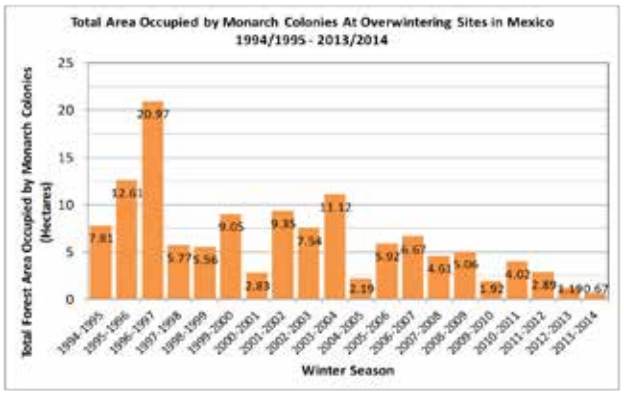
In the 1990s, 100s of millions of monarchs made the epic flight each fall from the northern plains of the U.S. and Canada to sites in the oyamel fir forests north of Mexico City.

In 2013, only 33 million made that trip.

Photo: World Wildlife Fund

Monarch Butterfly Decline

North American monarchs are at an all time low.



Area of forest occupied by colonies of hibernating monarchs in Mexico. (Graph courtesy of the Monarch Joint Venture).

Insect Pollinators Are Ecological Keystones

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

Ollerton, J., R. Winfree, and S. Tarrant. 2011. How many flowering plants are pollinated by animals? Oikos 120: 321-326. doi: 10.1111/j.1600-0706.2010.18644.x.

Potts, S.G., J.C. Biesmeijer, C. Kremen, P. Neumann, O. Schweiger, and W. E. Kunin. 2010. Global pollinator delines: trends, impacts and drivers. Trends in Ecology and Evolution. 25(6): 345-353.

Photo: Eric Mader

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
- Pollinator habitat is directly compatible with the needs of other wildlife, such as songbirds

Bear photo: © Sierra Vision Stock. Other photos: Nancy Adamson

Multiple benefits of pollinator habitat

Fruits and seeds are a major part of the diet of many insects, about 25% of birds, and many mammals

Photos: Marie Reed, USDA ARS

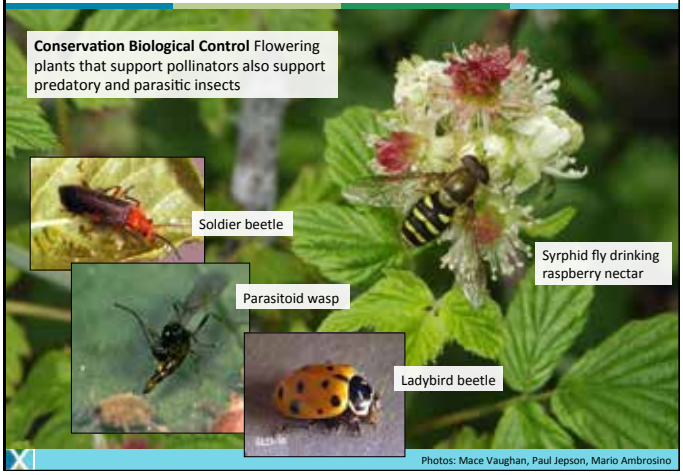
Multiple benefits of pollinator habitat

Pollinators and other insects are food for wildlife, including 89% of birds

Photo: Terry Spivey, USFS

Photo: Jeff Vanuga, NRCS

Multiple benefits of pollinator habitat



Photos: Mace Vaughan, Paul Jepson, Mario Ambrosino

Meet the Pollinators: Butterflies

Photo: Judy Stierand, NC Native Plant Society

Meet the Pollinators: Moths

Photo: Nancy Adamson

Meet the Pollinators: Flies

Photo: Nancy Adamson

Meet the Pollinators: Wasps

Photo: Nancy Adamson

Meet the Pollinators: Beetles

Photo: Nancy Adamson

Bees: The Most Important Pollinators

Bees are the most agriculturally important pollinators
- Bees actively collect and transport pollen
- Bees exhibit flower constancy
- Bees forage in area around nest

bumble bees & honey bees collecting squash nectar

Photo: Nancy Adamson

Native Bees Vital for Agriculture

4,000 native bee species in North America—most are **solitary** species, not colonial
~700 native bee species in the eastern US
~400-500 in NC

southeastern blueberry bee
Habropoda laboriosa

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

Photo: Sam Droege, USGS, Bee Inventory and Monitoring Lab, www.flickr.com/usgsbiml

Most Native Bees are Solitary (vs Colonial)

Example: Blue Orchard Bee
- 250 to 750 females/acre compared to 1 to 2.5 hives (25-50k) of honey bees
- Make contact with anther and stigma on almost every visit
- Active at low light levels and low temperatures
  - 33+ hours foraging in 5 days
  - 15+ hours by honey bees

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

Photos: Eric Mader, Mace Vaughan

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[1]
- 67% of 87 sites studied across the U.S. had all pollination needs met by squash bees[2]

1.Tepedino, V. J. 1981. The pollination efficiency of the squash bee (*Peponapis pruinosa*) and the honey bee (*Apis mellifera*) on summer squash (*Cucurbita pepo*). *Journal of the Kansas Entomological Society* 54:359-377.
2.Jim Cane (USDA ARS Logan Bee Lab). 2011. Personal communication

Photo: Nancy Adamson

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.

We need honey bees since we can manage them and move them to crops when needed--better protecting native bees benefits all bees…

Garibaldi, L. A. et al.. 2013. Wild pollinators enhance fruit set of crops regardless of honey bee abundance. Science 339 (6127) : 1608-1611.

Photos: Nancy Adamson

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=I_etyEdu9fQ

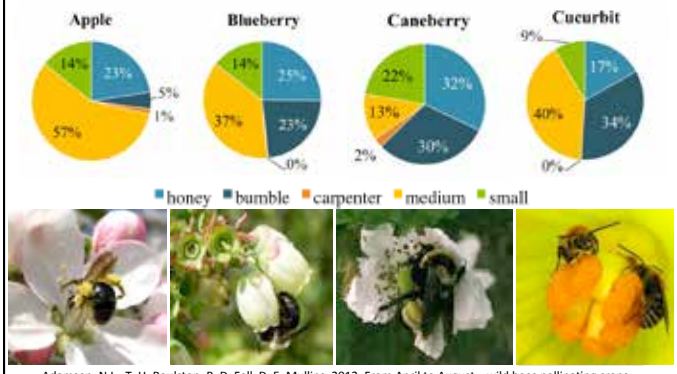
Greenleaf, S. S.,and C. Kremen. 2006. Wild bee species increase tomato production and respond differently to surrounding land use in Northern California. Biological Conservation 133:81-87.

Sungold tomatos photo: Anne Berblinger. Bee photos: Nancy Adamson

Video online highlights buzz pollination:
https://www.youtube.com/watch?v=I_etyEdu9fQ

Native (Wild) Bee Abundance in Crops

SW VA Study 2008–9: Three quarters of flower visitors were native bees



Adamson, N.L., T. H. Roulston, R. D. Fell, D. E. Mullins. 2012. From April to August—wild bees pollinating crops through the growing season in Virginia, USA. Environmental Entomology 41 (4):813–821.

Photos: Nancy Adamson

How can we better support pollinators?

Strengthen habitat and pesticide protection to support *diverse* pollinators—

- Plant & conserve native plants (or cover crops)
- Reduce pesticide use

Photos: Nancy Adamson

Biological Farming: Multiple Benefits of Diversity

Greater plant diversity
- Increased forage
- Less herbicide use
- Greater insect diversity

Lower pesticide use
- More beneficial insects
- Better crop pollination
- Fewer pest outbreaks on diversified farms

Nesting & refuge from harvest & pesticides
- Patchwork habitat
- Patchwork disturbance

Photo: Matthew Shepherd, Xerces Society

Native Bee Nesting–3 Broad Groups

ground-nesting bees (solitary)

cavity-nesting bees (solitary)

bumble bees (social)

Photos: Elaine Evans, Steve Javorek, Eric Mader

Life cycle of a bumble bee colony

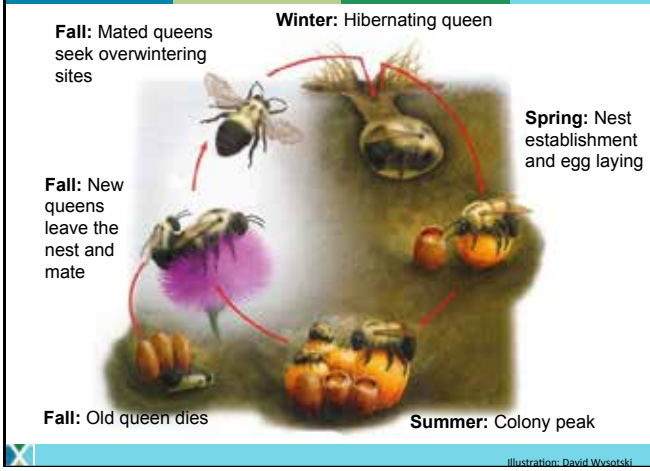
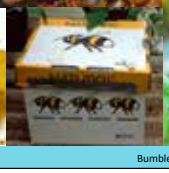


Illustration: David Wysotski

Bumble bees, *Bombus* spp.



- 45 species in U.S.,~26 in East, ~17 in NC
- 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

Bumble bee nest photos: Elaine Evans. Bumble bee on clover photo: Nancy Adamson

Shelter for Bumble Bees

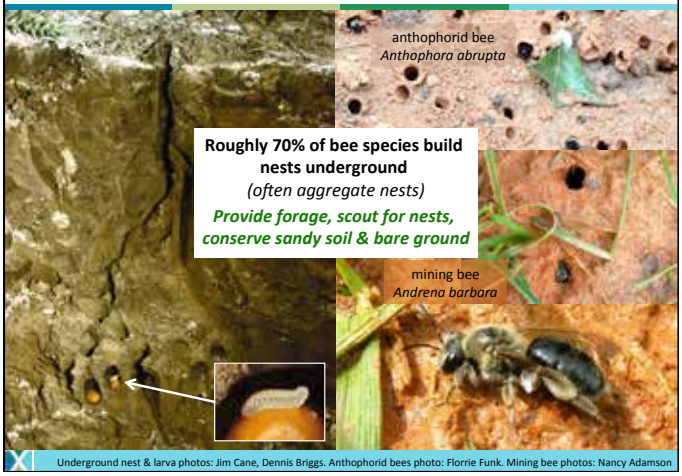
Conserve undisturbed or unmowed areas; protect possible overwintering sites for queens

- Cavities such as old rodent holes
- Under brush piles & overgrown areas
- Under bunch grasses

Excellent habitat for groundnesting birds, too!

Photos: Mace Vaughan, Matthew Shepherd, Bonnie Carruthers, Nancy Adamson

Ground-nesting Solitary Bees

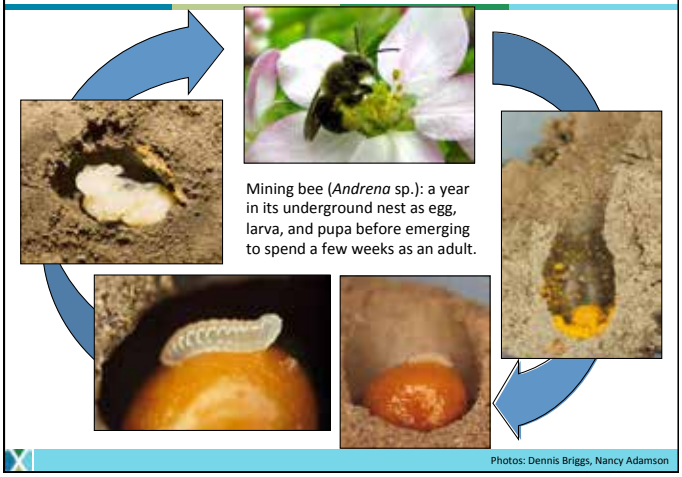


Underground nest & larva photos: Jim Cane, Dennis Briggs. Anthophorid bees photo: Florrie Funk. Mining bee photos: Nancy Adamson

Cavity or Tunnel-nesting Solitary Bees

Tree snag photo: Matthew Shepherd. Larva & adult photo: © Edward Ross. Adult in blackberry: Nancy Adamson

Life cycle of a solitary bee

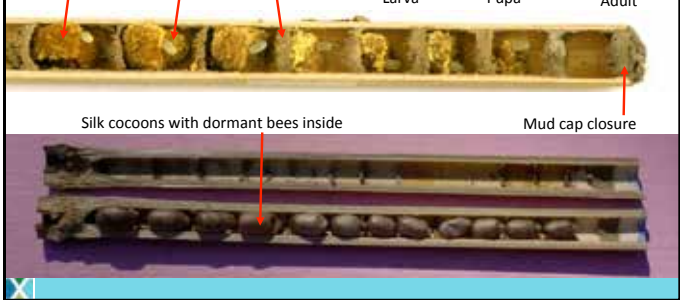


Photos: Dennis Briggs, Nancy Adamson

Cavity or tunnel nesting bees

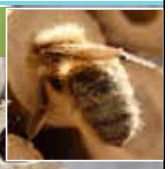
Hollow stem example:

Cross-section of silk cocoons



Shelter for cavity-nesting bees

Bamboo and other plants can be cut--*back end solid and front open*--to provide nests for cavity-nesting solitary bees (& solitary wasps)



mason bees, *Osmia cornifrons* (introduced from Japan)
Introduced species utilize these nests more than native species

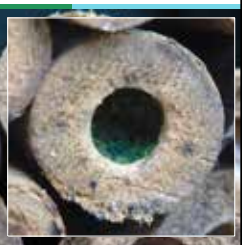
pupae in bamboo (split open)

Providing natural nesting opportunities—snags, hedgerows with pithy-stemmed plants, wood piles, woods—is best to support native species.

Photos: Nancy Adamson

Other cavity-nesters & parasitoids

Summer nesting leafcutter bee (*Osmia* sp.) using the smaller tubes (<3/16"). **Provide tubes ~1/8" to 3/8"**



Osmia sp., mason bee/leafcutter bee

Photos: Nancy Adamson

Other cavity-nesters & parasitoids

Leafcutter bees and predatory wasps use the cavities later in the season. Parasitoids may seek prey in the nests.

parasitoid wasp

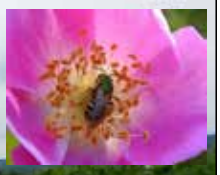
predatory wasp

Photo: Nancy Adamson

Photo: Nancy Adamson

The Value of Natural Areas

The amount of natural habitat on or close to the farm has a direct influence on pollinator diversity and abundance.

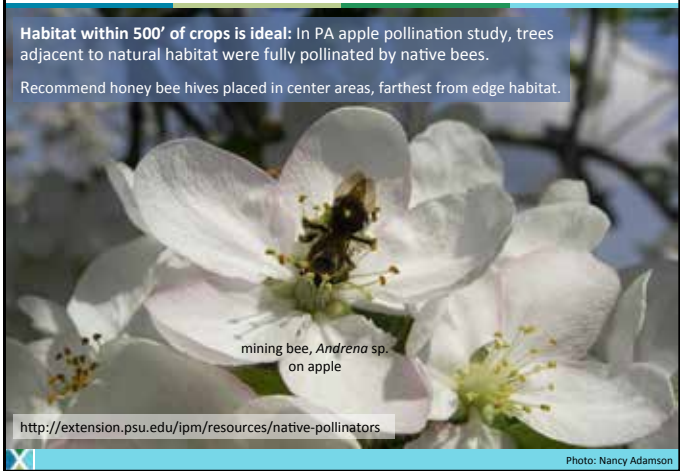


Photos: Paul Jepson, Bruce Newhouse

How far will pollinators travel?

Habitat within 500' of crops is ideal: In PA apple pollination study, trees adjacent to natural habitat were fully pollinated by native bees.

Recommend honey bee hives placed in center areas, farthest from edge habitat.



mining bee, *Andrena* sp. on apple

http://extension.psu.edu/ipm/resources/native-pollinators

Photo: Nancy Adamson

Restoring Pollinator Habitat

A Spectrum of Approaches

Easy

Less Easy

- Protecting naturally diverse areas (not exactly easy…)
- Managing for early successional habitat (fallow, mowing to maintain native wildflowers/shrubs/berries, timber thinning, prescribed fire)
- Diverse flowering cover crops
- Establishing native hedgerows
- Establishing native wildflower meadows

Photo: Nancy Adamson

Is seeding appropriate based on resource concerns?*

What is the history of the site? Was it previously cultivated?
If not, the **existing seed bank** may be the most appropriate seed source.

Donahue pine flatwood in South Carolina

*For help determining if planting is appropriate, see Norman Melvin's "decision sequence keys" in ***Wetlands Restoration, Enhancement, and Management*** http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_010838.pdf

Photo: Sudie Daves Thomas, SC NRCS

"Daylight" the seed bank

Bringing in sunlight by thinning & burning may be the best restoration strategy.

Associated NRCS practices:

- **409** Prescribed Forestry
- **338** Prescribed Burning
- **528** Prescribed Grazing
- **643** Restoration and Management of Rare and Declining Habitats
- **647** Early Successional Habitat Development or Management
- **659** Wetland Enhancement
- **657** Wetland Restoration
- **644** Wetland Wildlife Habitat Management
- **381** Silvopasture Establishment

Carolina Bay in NC restored with thinning & burning

Photo: Nancy Adamson

Natural Areas: Fallow Cropland Case Study

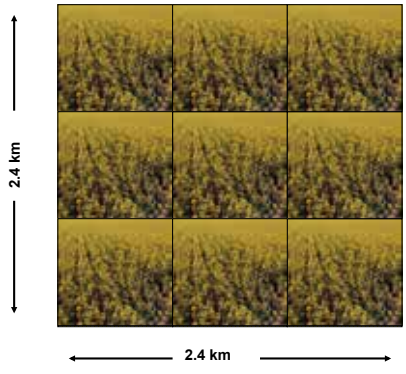
Example: Canola in Canada

In the absence of honey bees, canola growers make more money on their land if 30% is in natural habitat, rather than planting it all.

Morandin, L., and M. Winston. 2006. Pollinators provide economic incentive to preserve natural land in agroecosystems. Agriculture, Ecosystems and Environment 116:289-292.

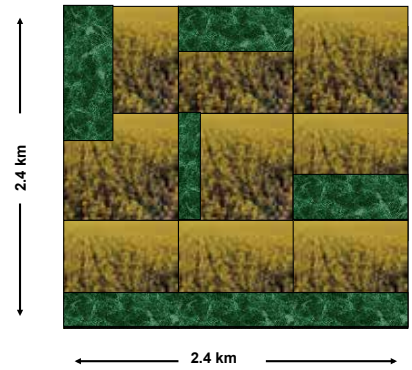
Photo: Mace Vaughan

Natural Areas: Fallow Cropland Case Study



Graphic courtesy of Lora Morandin

Natural Areas: Fallow Cropland Case Study



Graphic courtesy of Lora Morandin

Floral diversity also supports honey bee health

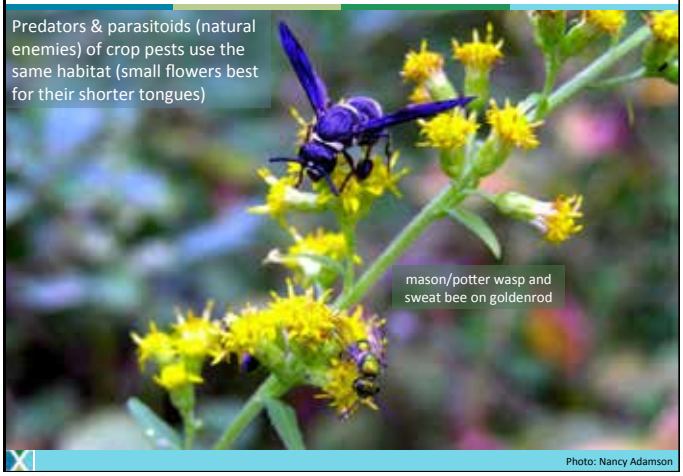
Honey Bee Health: Diverse wildflower diets enhance honey bee disease resistance

Alaux, C., Ducloz, F., Crauser, D. and Le Conte, Y., 2010. Diet effects on honeybee immunocompetence. Biology Letters, p.rsbl20090986..

Photos: Eric Mader, Toby Alexander

Pollinator habitat & IPM support other beneficial insects

Predators & parasitoids (natural enemies) of crop pests use the same habitat (small flowers best for their shorter tongues)



mason/potter wasp and sweat bee on goldenrod

Photo: Nancy Adamson

Biological Control ≠ Annihilation

Slow pest population growth rates

If both predator & prey are wiped out, it takes predators much longer to recover

wheel bug (assassin bug) nymph eating a Colorado potato beetle

Photo: Debbie Roos

Flowering Cover Crops Support Parasitoids

Nectar sources (milkweed) between peanut & cotton supported increased (5x!) parasitization of southern green stink bugs (Glynn Tillman, USDA ARS, Crop Protection & Management Research Lab, Tifton, GA)

Trichopoda feeding on milkweed nectar

Photo: Susan Day

Egg of *T. pennipes* on female southern green stink bug

Photo: Glynn Tillman

Photo: Marvin Smith (Wikimedia Commons)

Beneficial insect habitat (G. Tillman Study, GA)

Adding milkweed as a nectar source for a parasitoid fly led to 5X greater parasitization of southern green stink bug

Treatment	% Parasitization of SGSB adults by *T. pennipes*	Density of SGSB adults
Cotton w/ milkweed habitat	61.2	2.6
Cotton w/out milkweed habitat	13.3	3

common milkweed, *Asclepias syriaca*

tachinid fly, *Trichopoda pennipes*

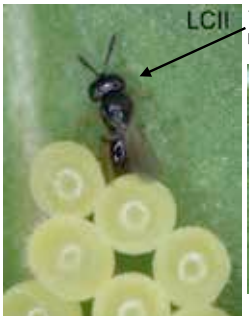
Tillman, P. G., & Carpenter, J. E. (2014). Milkweed (Gentianales: Apocynaceae): A Farmscape Resource for Increasing Parasitism of Stink Bugs (Hemiptera: Pentatomidae) and Providing Nectar to Insect Pollinators and Monarch Butterflies. Environmental entomology, 43(2), 370-376.

Photo: Nancy Adason

Tachinid fly photo: Marvin Smith (Wikimedia Commons). Milkweed photo: Nancy Adamson

Flowering Cover Crops Support Parasitoids

Nectar sources (buckwheat) in soybean supported increased (2½ times) parasitization of brown stink bugs (Glynn Tillman, USDA ARS, Crop Protection & Management Research Lab, Tifton, GA, manuscript in progress)



Telenomus podisi female parasitizing stink bug eggs

Photo: http://zoo.bio.ufpr.br/biocontrol/entomofauna.html Laboratorio de Controle Integrado de Insetos (LCII)

http://www.ars.usda.gov/research/projects/projects.htm?accn_no=420801

Beneficial insect habitat (D. Biddinger study, PA)

Pollinator plantings support sand wasps who feed brown marmorated stink bugs to their young (research in progress at Penn. State University)

Mountain mint (*Pycnanthemum* spp.) and spotted bee balm (*Monarda punctata*) as nectar plants for wasps

PENNSTATE College of Agricultural Sciences

Research by Dave Biddinger, Penn State University

Photos: Alex Suricia, Jennifer Hopwood, Scott Seigfried

Multiple benefits of pollinator habitat—even turf benefits!

This stream corridor supports scoliid wasp adults, who lay their eggs in grubs of Japanese beetles (that eat grass roots) in the ground

Riparian area left unmown to protect waterway and support beneficial insects at Super Sod Farm, Mills River, NC

Photo: Nancy Adamson

Multiple benefits of pollinator habitat

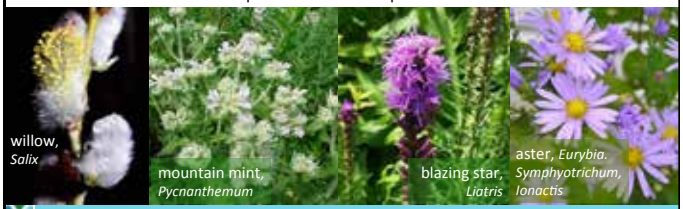
Scoliid wasps reduce Japanese beetle populations; adults lay their eggs in grubs and the wasp larvae eat the grubs from the inside out

scoliid wasps on marestail
Super Sod Farm, Mills River, NC

Photo: Nancy Adamson

Habitat through the growing season

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

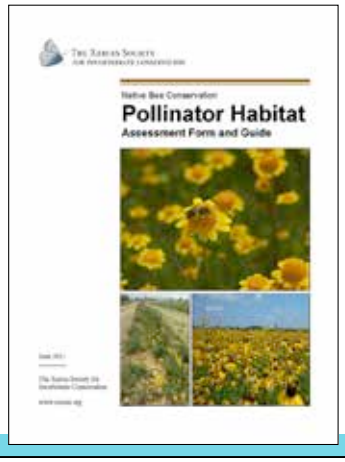


Photos: Elaine Haug NRCS, Matthew Shepherd; Mace Vaughan, Eric Mader, Jeff McMillan NRCS, Berry Botanic Garden, Nancy Adamson

The Habitat Assessment Process

Assessing Land for Pollinator Value

- A subjective process
- Quantify characteristics
  - Landscape-level
  - Site-level
- Xerces Habitat Assessment Guide



Will providing habitat increase pest pressure?

More diverse is better: Natural enemy populations are higher & pest pressure is lower in complex patchy landscapes with fallow fields, field margins, and/or wooded habitats

Pollinator planting at Dirt Works Incubator Farm, a project of Lowcountry Local First at Rosebank Farms near Charleston, SC

Bianchi, F. J. J. A., C. J. H. Booij, and T. Tscharntke. 2011. Sustainable pest regulation in agricultural landscapes: a review on landscape composition, biodiversity and natural pest control. *Proc. R. Soc. B* 273: 1715-1727.
Forehand, L. M., D. B. Orr, and H. M. Linker. 2006. Insect communities associated with beneficial inset habitat plants in North Carolina. *Environmental Entomology* 35 (6): 1541-159.

Photo: Nikki Siebert

How much habitat is needed?

Bigger is better for pollinators, predators, and parasitoids

- Larger wildflower plantings support greater biological control without increasing herbivore density (Blaauw & Isaacs 2012)
- Farmers can enhance diversity in marginal areas and field borders, while also increasing diversity within crops

Blaauw, B. R. and R. Isaacs. 2012. Larger wildflower plantings increase natural enemy density, diversity, and biological control of sentinel prey, without increasing herbivore density. Ecological Entomology. DOI: 10.1111/j.1365-2311.2012.01376.x.

Photo: Jennifer Hopwood

Wildflowers for Pollinators & Other Beneficial Insects

Example native North Carolina wildflowers with high pollinator value

Penstemon, blackeyed susan, wild bergamot, mountain mint, wingstem, goldenrod, Joe-pye weed, milkweed, sunflower, ironweed, aster

sunflower, *Helianthus* sp.

Photo: Nancy Adamson

Flowering Shrubs and Hedgerows

Example native flowering shrubs & trees with high pollinator value

Maple, willow, holly, redbud, blueberry, sourwood, indigobush, sumac, caneberry, swamp rose, elderberry

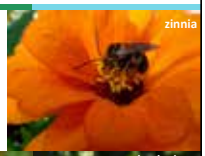
bumble bee on redbud, *Cercis canadensis*

Photo: Nancy Adamson

A Few Non-native Bee Plants

clover

Cover crops
- Red, white, crimson clover
- Buckwheat
- Austrian winter pea
- Alfalfa
- Hairy vetch
- Phacelia



zinnia

borage

buckwheat

Herbs
- Basil
- Borage
- Catmint
- Oregano
- Sage

sunflower

Annuals
- Annual sunflower
- Zinnia
- Cosmos
- Scarlet sage

clover

Photos: Nancy Adamson

Crops not needing pollinators may be habitat

Corn, pecans…

bumble bee loading up on corn pollen—many bees, including honey bees will gather the pollen

Photo: Nancy Adamson

Managing Insecticides

Pesticides cause significant damage to pollinator insect populations

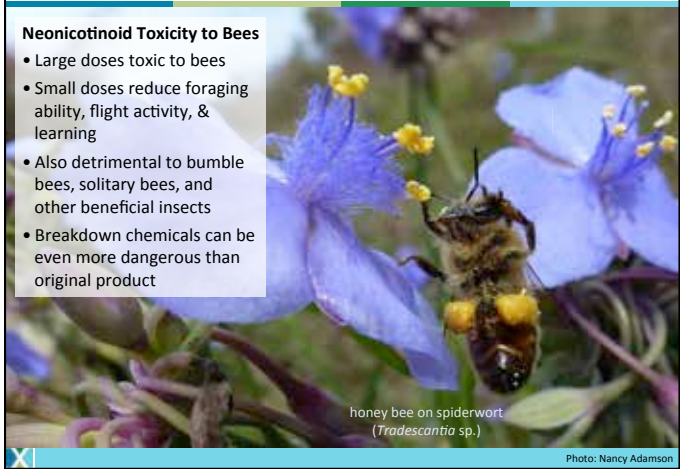
- Use active ingredients with least impact on bees
- Consider formulation
- Label guidelines only apply to honey bees
- Don't spray on plants in bloom
- Spray at night and when dry

http://extension.oregonstate.edu/catalog/abstract.php?seriesno=PNW+591

Protection from Pesticides: Neonicotinoids

Neonicotinoid Toxicity to Bees

- Large doses toxic to bees
- Small doses reduce foraging ability, flight activity, & learning
- Also detrimental to bumble bees, solitary bees, and other beneficial insects
- Breakdown chemicals can be even more dangerous than original product



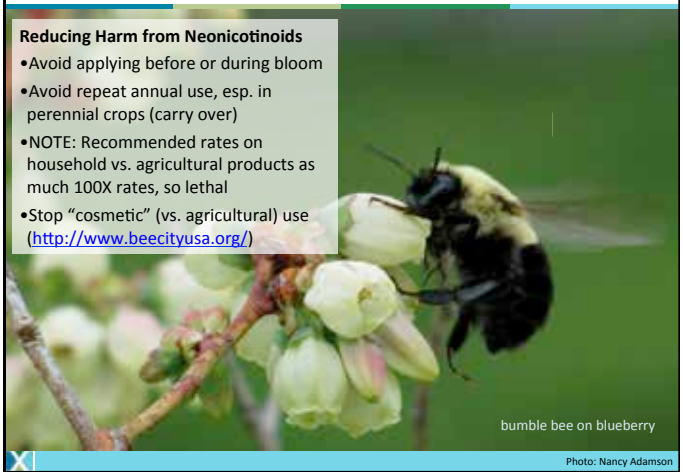
honey bee on spiderwort (*Tradescantia* sp.)

Photo: Nancy Adamson

Protection from Pesticides: Neonicotinoids

Reducing Harm from Neonicotinoids

- Avoid applying before or during bloom
- Avoid repeat annual use, esp. in perennial crops (carry over)
- NOTE: Recommended rates on household vs. agricultural products as much 100X rates, so lethal
- Stop "cosmetic" (vs. agricultural) use (http://www.beecityusa.org/)



bumble bee on blueberry

Photo: Nancy Adamson

Caution if using organic-approved pesticides

Even organic-approved pesticides aren't always safe for bees & other beneficials.

- Rotenone = Dangerous for Bees!
- Pyrethrins = Dangerous for Bees!
- Spinosad = Dangerous for Bees!
- *Beauveria bassiana* = Dangerous!

Okay when not directly applied to bees (i.e. non-blooming crops or at night):

- Insecticidal soap
- Horticultural oil
- Neem

Photo: NRCS/Toby Alexander

Weed Control

Protect Ground-Nesting Insects:

- Reduce tillage
- Plastic mulch: pros and cons

Photo: USDA-ARS

(2008 &) 2014 USDA Farm Bill Pollinator Habitat Provisions

- Pollinators are a priority for every USDA land manager and conservationist
- Encourages inclusion of pollinators in all conservation programs
- Identifies pollinator habitat as a priority for EQIP
- Requires that pollinators are considered in the review of Practice Standards

http://plants.usda.gov/pollinators/nrcsdocuments.html

bumble bee on blueberry

Photo: Nancy Adamson

Multiple benefits of supporting pollinators (NRCS focus)

Webinar: ***Conserving Pollinators While Addressing Other Resource Concerns*** **at** ConservationWebinars.net

Sudie Daves Thomas (SC NRCS), Kelly Gilkerson (Clemson University), and Angel Sams (SC NRCS) at Rosebank Farms near Charleston, SC

Several other pollinator webinars, including *Common Bees & Best Bee Plants of the East* can be viewed in the "Insects & Pollinators" and "Fish & Wildlife" sections

Photo: Nancy Adamson

Farm Bill Implementation: Watershed Protection

Agricultural Conservation Easement Program (ACEP)

- 2014 Farm Bill: combined formerly separate easement programs--the Wetland Reserve Program (WRP) and Grassland Reserve Program (GRP)—into ACEP
- Can cover 50% to 100% of the cost of restoration, depending upon the length and type of easement

Photo: NRCS

Farm Bill Implementation: Watershed Protection

- **Protect watersheds**
- **Provide wildlife habitat**--*especially species needing open, early-successional habitat*

Plantings around sinkholes, with technical support provided by Robin Mayberry, NRCS Area Biologist in Cookville, TN

Photo: Nancy Adamson

Natural Regeneration & Watershed Protection

Leaving vegetation around creeks helps clean and shade waterways; mid to late summer flowers are abundant in riparian areas when other areas are dry

NC Mountain Research Station, Waynesville. Visit all 18 NC Research Stations to see conservation techniques and plantings to support pollinators.

http://www.ncagr.gov/research

Photo: Nancy Adamson

Savvy Business Management & Watershed Protection

$200/month mowing transformed into protected diverse riparian corridor; *Former barren now utilized regularly by staff and visitors*

Carolina Mountain Land Conservancy
http://www.carolinamountain.org

Photo: Nancy Adamson

Farm Bill Implementation: Practices for Pollinators

Core Programs for Pollinators
EQIP, CRP, CSP

Agencies:
Natural Resources Conservation Service (NRCS)
Farm Service Agency (FSA)

Tech Note 78
Using Farm Bill Programs for Pollinator Conservation

Practices for Pollinators
- Tree/Shrub Establishment
- Conservation Cover
- Hedgerow Planting
- Field Border
- Restoration and Management of Rare or Declining Habitats
- Upland Wildlife Habitat Management
- Integrated Pest Management
- Early Successional Habitat Development/ Management
- *many others*

http://plants.usda.gov/pollinators/NRCSdocuments.html

Conservation Practices for Pollinators

Cover Crop (340)
Crops for seasonal cover and other conservation purposes

PURPOSE
- Reduce erosion
- Increase soil organic matter
- Capture and recycle nutrients
- Promote nitrogen fixation
- Suppress weeds
- Manage soil moisture
- Minimize soil compaction

CONSIDERATIONS FOR POLLINATORS
- "Cocktails" may have more benefits than single species
- If possible, allow flowering before terminating
- Provide other pollen and nectar sources after terminating

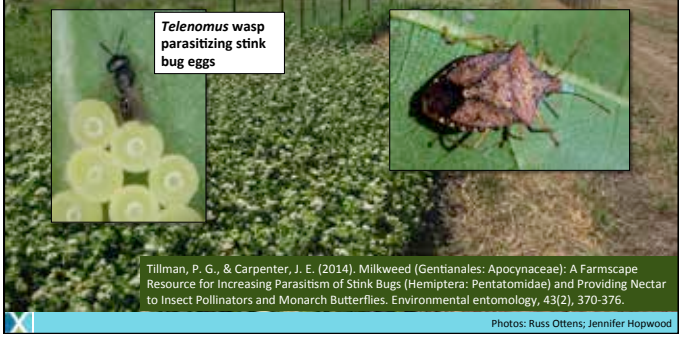
Crimson clover in Rowan County, NC

Photo: Ben Knox, NC Department of Agriculture

Conservation Practices for Pollinators

Cover Crop (340) – Cover crops also support pest management

Flowering cover crops near Mississippi soybeans (buckwheat) increased wasp parasitism of stink bug eggs by 2 ½ times.



Tillman, P. G., & Carpenter, J. E. (2014). Milkweed (Gentianales: Apocynaceae): A Farmscape Resource for Increasing Parasitism of Stink Bugs (Hemiptera: Pentatomidae) and Providing Nectar to Insect Pollinators and Monarch Butterflies. Environmental entomology, 43(2), 370-376.

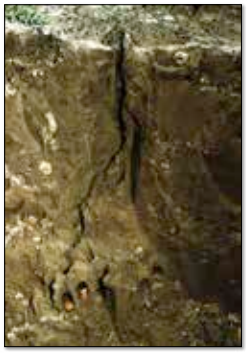
Photos: Russ Ottens; Jennifer Hopwood

Conservation Practices for Pollinators

No Till / Strip Till / Direct Seed (329)
Managing residue on the soil surface, limiting soil-disturbing activities to those necessary to place nutrients, condition residue and plant crops.

PURPOSE
- Reduce sheet/rill erosion
- Reduce wind erosion and particulate matter Improve soil organic matter content
- Reduce CO_2 loss from the soil
- Reduce energy use
- Increase plant-available moisture
- Provide food and escape cover for wildlife

CONSIDERATIONS FOR POLLINATORS
- Tillage reduction may protect ground-nesting bees



Excavated cross-section of an underground bee nest

Photo: Dennis Briggs

Conservation Practices for Pollinators

No Till / Strip Till / Direct Seed (329)
Squash bee example

Example: No-Cultivation Squash
- No-cultivation squash farms in Virginia hosted three times more ground-nesting squash bees than did conventional farms

Shuler, et al. 2005. Farming Practices Influence Wild Pollinator Populations on Squash and Pumpkin. *Journal of Economic Entomology*. 98(3):790-795

Photo: Nancy Adamson

NRCS Conservation Practices

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.

Photo: Katharina Ullmann (Xerces Society)

NRCS Conservation Practices

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

Photo: Eric Mader

Farm Bill Implementation: CRP

Conservation Reserve Program practices that support pollinator habitat

- CP-2 Native Grasses and Wildflowers
- CP-3A Hardwood Tree Planting
- CP-4B Permanent Wildlife Habitat
- CP-5A Field Windbreak
- CP-16 Shelterbelt
- CP-22 Riparian Buffer
- CP-23 Wetland Restoration
- CP-25 Rare and Declining Habitats
- CP-30 Marginal Pasture Wetland Buffer
- CP-31 Bottomland Timber
- CP-33 Habitat Buffer for Upland Birds
- **CP-42 Pollinator Habitat**

Photo: Eric Mader

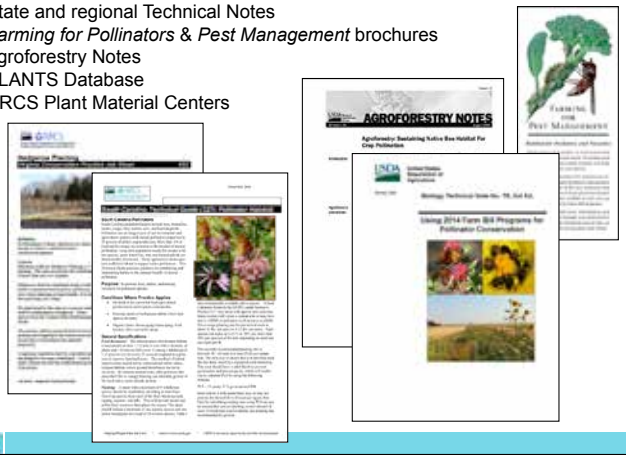
Additional Resources

bumble bee visiting silverbell

Photo: Nancy Adamson

USDA-NRCS Resources—Talk with your District Conservationist!

State and regional Technical Notes
Farming for Pollinators & *Pest Management* brochures
Agroforestry Notes
PLANTS Database
NRCS Plant Material Centers



NRCS Partner Biologists: NC Wildlife Resources

Further Information: the Xerces Society www.xerces.org

Thank you, Stanly County Beekeepers & Friends!

Remember:
- Wildflower-rich habitats support beneficial insects & other wildlife
- Manage for diverse forage & nesting sites, and reduce pesticide use

www.xerces.org
(follow links to pollinator program)

southeastern blueberry bee, *Habropoda laboriosa*, on redbud

Photo: Nancy Adamson

Thank You All!

…and many excellent scientists, conservationists, and farmers

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- Whole Foods Market & their vendors
- Organic Valley FAFO
- Organic Farming Research Foundation
- Nat'l Institute of Food & Agric., USDA
- Cinco
- Clif Bar Family Foundation
- Alice C. Tyler Perpetual Trust
- Sarah K. de Coizart Article TENTH Perpetual Charitable Trust
- The Edward Gorey Charitable Trust
- EarthShare (CFC #18360)
- Endangered Species Chocolate
- The Metabolic Studio
- The Ceres Foundation
- & many others…

andrenid bee on apple

Photo: Nancy Adamson

Questions or comments?

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megachilid (leaf-cutter) bee on sunchoke, *Helianthus tuberosus*

Photo: Nancy Adamson