Common Native Bees and Habitat Management to Support Pollinators and Other Beneficial Insects

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Xerces Society & 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
USDA NRCS Implements Farm Bill Programs

Help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters.

NRCS District Conservationist Carl Wright & Cypress Gardens Gardener Elizabeth Vaughn learning about and planting a pollinator meadow at Dirt Works Incubator Farm. Photo insert: Nancy Adamson

Dirt Works Incubator Farm is a project of Lowcountry Local First at Rosebank Farms on John’s Island near Charleston, S.C.

Photo: Amy Overstreet, NRCS

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
In May 2015, the White House announced the National Strategy to Promote the Health of Honey Bees and Other Pollinators

1. Reduce honey bee colony losses to economically sustainable levels;
2. Increase monarch butterfly numbers to protect the annual migration; and
3. Restore or enhance millions of acres of land for pollinators through combined public and private action.

Also in May 2015, USDA & Department of Interior released Pollinator-Friendly Best Management Practices for Federal Lands
http://www.fs.fed.us/wildflowers/pollinators/BMPs/
Talk Outline

- Pollinators matter!
- Native bee diversity & common bees in NC*
- Planting for pollinators & other wildlife (briefly)
- Farm Bill programs that support pollinators
- Additional resources

Photo: Nancy Adamson

The Importance of Pollinators

bumble bee on blazing star, *Liatris spicata*

Photo: Nancy Adamson

green sweat bee on blueberry

Photo: Nancy Adamson
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

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

Multiple Benefits of Pollinator Habitat

Conservation Biological Control
Flowering plants that support pollinators also support predatory and parasitic insects.

- Soldier beetle
- Parasitoid wasp
- Syrphid fly drinking raspberry nectar
- Ladybird beetle

Photos: Mace Vaughan, Paul Jepson, Mario Ambrosino

Photo: Jeff Vanuga, NRCS

Photo: Terry Spivey, USFS
Insect Pollinators Are Ecological Keystones

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


Bees: The Most Important Pollinators

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

New study re value of non-bee pollinators: Rader et al. 2015. Non-bee insects are important contributors to global crop pollination. PNAS www.pnas.org/cgi/doi/10.1073/pnas.1517092112
Bees evolved from wasps into vegetarians!

Bees evolved to better collect pollen & nectar

- Branched hair
- Long tongues
- Scopa: pollen-carrying hairs
  (on abdomen of megachilid bees; on hind legs of most species; bumble bees & honey bees have pollen baskets, corbicula)

Photos: Ralph Hozenthal, Mace Vaughan, Steve Buchmann

North America’s Bumble Bees

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

Other bees in decline (along with honey bees)

- Critically Endangered
- Endangered
- Vulnerable
- Near Threatened
- Least Concern
- Data Deficient

Photos: © Leif Richardson, © Jen Knutson
Mass bee kills in 2013 & 2014:
• Bumble bees in Oregon—others reported subsequently
• Honey bees in Canada
• Honey bees in CA almond orchards

Despite increased awareness since 2006, some of the highest losses ever in 2013 & 2014


Bee Diversity: Slow down and smell the flowers to see diverse bees!

green sweat bees, maybe Auguchlora pura or Augochlorella, on Helen’s flower, Helenium sp

Native Bee Diversity

~4,500 native bee species in North America—most are solitary, not colonial
~700 native bee species in the eastern US, ~3,600 in contiguous US
~400-500 in NC (http://www.discoverlife.org/mp/20q?guide=Apoidea_species)

southeastern blueberry bee
Habropoda laboriosa

Specialist bees eat pollen only from one genus or family, but may collect nectar from other plants.
Example: Blue Orchard Bee

- 250 to 750 females/acre compared to 1 to 2.5 hives of honey bees (10-20,000 per hive)
- 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

Some Native Bees are Solitary (vs Social/Colonial)

Some bees only collect and feed their offspring pollen from one to a few related plants (oligolectic).

callirhoe bee, *Melissodes agilis*, sunflower pollen specialist

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

http://www.illinoiswildflowers.info/flower_insects/
http://jarrodfowler.com/specialist_bees.html

Native Bee Pollen 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

67% of 87 sites studied across the U.S. had all pollination needs met by squash bees


Photo: Nancy Adamson
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 still need honey bees since we can manage them and move them to crops.


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


Photos: Nancy Adamson
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

Video:
Native plants of the mid-Atlantic support diverse pollinators
https://www.youtube.com/watch?v=HhC5iY0ijJM
How can we better support pollinators?

Strengthen habitat & pesticide protection to support diverse pollinators
Plant & conserve native plants (or cover crops)

Native Bee Nesting–3 Broad Groups

ground-nesting bees (solitary)

polyester bee, *Colletes inaequis*

orchard mason bee, *Osmia lignaria*

cavity-nesting bees (solitary)

bumble bees (social)

*bombus impatiens*
Life cycle of a bumble bee colony

**Winter:** Hibernating queen

**Spring:** Nest establishment and egg laying

**Summer:** Colony peak

**Fall:** Mated queens seek overwintering sites

**Fall:** New queens leave the nest and mate

**Fall:** Old queen dies

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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*
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!*

Artificial nests ineffective (but mouse pee helps!)

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Roughly 70% of bee species build nests underground (often aggregate nests)—

Provide forage, scout for nests, conserve sandy soil & bare ground

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*Photos: Mace Vaughan, Matthew Shephard, Bonnie Carruthers, Nancy Adamson*

*Little bluestem*

*Photos: Jim Cane, Dennis Briggs*

*Andrena barbara*

*Photo: Florrie Funk*

*Photo: JNancy Adamson*

*Photo: Art Cane, Dennis Briggs*
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.

Photos: Dennis Briggs, Nancy Adamson

Ground nesting: Mining or digger bees

*Andrena*  
- Early spring (generally)  
- Nest in well-drained soils, aggregate  
- Important for tree fruit and berries  

*Scout for & conserve nesting sites*

- apple
- blueberry

males often smaller than females

Photos: Nancy Adamson, Eric Miller, Jim Cane, International Pollination Services
Ptilothrix bombiformis
- Eats and provisions nests only with pollen from the hibiscus family—hardy hibiscus, okra, rose-of-Sharon, and cotton (in the mid-Atlantic).
- Nests in hard-packed soil near water, which females use to moisten and soften soil, excavating burrows with chimneys of mud surrounding the entrance.

Melitoma taurea, mallow bee

Melitoma taurea is a morning glory specialist and the males stake out their territories.

on wild sweet potato, Ipomoea pandurata (aka manroot, man-of-the-earth, wild potato vine, wild rhubarb)
Ground nesting: Squash bees

*Peponapis pruinosa, Xenoglossa strenua & X. kansensis*

- Specialize on cucurbit pollen: summer & winter squash, melon, cucumber
- Nest in or near crop
- Active early a.m., summer

**Avoid deep tilling whenever possible**

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Ground nesting: Long-horned bees

*Melissodes, Eucera, Svastra*

- Long antennae (males)
- Hairy, with conspicuous hairy legs (scopa)
- Some are aster family pollen specialists, incl. sunflowers

**Conserve nesting sites & avoid deep tilling**
Ground nesting: Green sweat bees

Agapostemon, Augochlora pura*, Augochlorella, Augochloropsis

• Generalists, short-tongued, buzz
• Some nest communally, but each female builds and provisions her brood cells

*Augochlora also nests in rotting wood

Conserve nesting sites & avoid deep tilling

Ground nesting: Sweat bees

Halictus & Lasioglossum/Dialictus

• Small, black, dark green, dark blue, with bands of white on abdomen
• Solitary, communal (aggregate nests) to semi-social (daughters help care for young)
• Many generalists, active all season

Conserve nesting sites & avoid deep tilling

Halictus ligatus on yarrow, Achellia millefolium

serviceberry, Amelanchier sp.

swamp rose, Rosa palustris

melon

Photos: Nancy Adamson
**Ground nesting: Polyester, plasterer, cellophane bees**

**Colletes spp.**
- Line brood cells with waterproof cellophane-like secretion
- Heart-shaped face, short tongue
- Small to medium, pale banded
- Many are pollen specialists

Conserve bare ground & avoid deep tilling

*C. latitarsis*, specialist on groundcherry, *Physalis*

**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

*Southeastern Blueberry Bee, Habropoda laboriosa*
Ground nesting: anthophorid bees

Anthophora sp.

- Photo: Nancy Adamson

on poke milkweed, *Asclepias exaltata*

Cavity or tunnel nesting solitary bees

- Roughly 30% nest in hollow plant stems, or old beetle borer holes—Provide forage, conserve snags, brush piles & pithy-stemmed plants. Leave dead plant material over winter.

- Photo: Matthew Shepherd

- Photo: Nancy Adamson

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### Cavity or tunnel nesting bees

#### Hollow stem example:

<table>
<thead>
<tr>
<th>Cross-section of silk cocoons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollen mass</td>
</tr>
<tr>
<td>Egg</td>
</tr>
<tr>
<td>Mud wall</td>
</tr>
<tr>
<td>Larva</td>
</tr>
<tr>
<td>Pupa</td>
</tr>
<tr>
<td>Adult</td>
</tr>
</tbody>
</table>

Silk cocoons with dormant bees inside

Mud cap closure

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### 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*
Cavity or tunnel nesting: Leafcutter bees

**Megachile**
- 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
- *M. mendica* on blackberry

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

**Megachile mucida**, megachilid or leafcutter bee
- Associated with goat’s rue and other legumes
- *M. mucida* on goat’s rue *Tephrosia virginica*
- *M. mucida* on yellow wild indigo *Baptisia tinctoria*
Managed tunnel nesting bees

Mason bee (aka blue orchard bee) (*Osmia lignaria*)

Alfalfa or lucerne leafcutter bee (*Megachile rotundata*), introduced from Europe

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)

There’s evidence that introduced species utilize these nests more than native species.

Pupae in bamboo (split open)
February 2015

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

Photo: Nancy Adamson
Leafcutter bees and wasps use the cavities later in the season.

Other cavity-nesters & parasitoids

In the east, we think of leafcutter bees mainly in the genus *Megachile*, but *Osmia* may also be leafcutters.
solitary bee & wasp observation box

Open door to view bees or wasps building nests with mud, leaf segments, or masticated leaves.

Made by fisheries biologist Mike Pinder, VA Department of Game and Inland Fisheries

Cavity or tunnel nesting: Large carpenter bees

*Xylocopa virginica & X. micans*

- Large size (largest of all insect eggs, 1/2 mom’s body size!)
- Usually excavate nest
- Long lived, overlapping generations for short times
- Shiny abdomen, scopa on legs
- Males with white patch, territorial

Photos: Nancy Adamson

Photos: John Pickering, DiscoverLife.org

passion flower, *Passiflora incarnata*

perennial pea, *Lathyrus sp.*

blueberry

white patch on male

smooth abdomen

scopa
Cavity or tunnel nesting: Small carpenter bees

**Ceratina**
- Small size, shiny body, dark metallic blue or green
- Usually excavate nest in pithy stems (box elder, elderberry, sumac, sunflower, blackberry…)
- Abdomen somewhat squared off
- Active all season

Photos: Nancy Adamson

![Ceratina photos](image1.jpg)

Cuckoo bees: Nest parasites (cleptoparasites)

Adults feed on pollen & nectar, lay eggs in host nest
- Slender, wasp-like
- Small to medium size
- Bodies not hairy, no scopa
- Coloration highly variable
- May have spiky projections
- Use sent to locate and evade host

Photos: Lloyd Spitalnik, David Gordon, Nancy Adamson
Bee Look-alikes & Under-appreciated pollinators

Syrphid fly (aka flower fly) on Barbara’s button’s, *Marshallia* sp.

Flower flies often sit still on flowers more than bees; their photographs have been mistakenly used on many bee publications and other media.

Bombyliid or bee flies

Some bee flies lay their eggs in mining bee (*Andrena*) nests by hovering above the ground nests & flicking their eggs in like golf balls.

On sandhill milkweed, *Asclepias humistrata*
Flies deserve a lot more appreciation for their role in pollination and as predators and parasites of crop pests.

Small wasps can be hard to tell apart from bees.

Photos: Nancy Adamson
chrysidid wasp
*Chrysis conica*

What people call bees are often wasps

scoliid wasp on dotted mint,
*Monarda punctata*
Providing Habitat

male sweat bees, *Halictus ligatus*, on wingstem, *Verbesina alternifolia*

Restoring Pollinator Habitat

A Spectrum of Approaches

- Protecting natural diversity (not exactly easy!)
- Planting a pot on your front porch
- Managing for early successional habitat (e.g. mowing, timber thinning, prescribed fire)
- Diverse flowering cover crops
- Establishing native hedgerows
- Establishing native wildflower meadows

Photo: Nancy Adamson
Habitat through the growing season

maple, *Acer*

false indigo, *Baptisia*

goldenrod, *Solidago*, *Oligoneuron*, *Euthamia*,

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

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

mountain mint, *Pycnanthemum*

blazing star, *Liatris*

ASTER, *Symphyotrichum*, *Eurybia*

willow, *Salix*

Assessing Land for Pollinator Value

Great learning/educational tools for reading the landscape from a bee or butterfly’s perspective (http://www.xerces.org/pollinator-conservation)
USDA Farm Bill Pollinator Habitat Provisions

(2008 &) 2014 Farm Bill

- 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

For pollinators & other wildlife

Diversity & blooms through the season are vital
Choose seed to fill gaps in bloom periods & provide specific nutrients or shelter

Sunflowers, *Helianthus* spp., provide excellent pollen, nectar, and oil-rich seeds that benefit diverse wildlife, including fall migrants.

Legumes like partridge pea, (*Chamaecrista*), bush clover (*Lespedeza*), tick trefoil (*Desmodium*) are rich in protein.
For conservation biological control (IPM*)

Refuge that includes nectar for predators & parasitoids when annual crops are harvested is vital. Plus, they need small flowers (for shorter tongues).

sand wasp on common milkweed, *Asclepias syriaca*—sand wasps collect stinkbugs to feed their young

*IPM stands for Integrated Pest Management

Reducing harm from neonicotinoids

• Avoid applying before or during bloom
• Avoid repeat annual use, esp. in perennial crops (carry over)
• Label rates on household products as much 100X ag rates (lethal at higher rates)
• Stop “cosmetic” (vs. agricultural) use (http://www.beecityusa.org/)

Photo: Nancy Adamson
Weed control: Protect ground-nesting insects

- Avoid deep tillage (>6"
- Reduce tillage
- Consider pros & cons of plastic mulch

Is seeding or planting the best restoration approach?*

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

*For help determining if planting is appropriate, see Norman Melvin’s “decision sequence keys” in Wetlands Restoration, Enhancement, and Management
“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

Conservation Practices for Pollinators

Watershed Protection (various NRCS & FSA conservation practices)
- Protect watersheds
- Provide habitat—especially species needing open, early-successional habitat

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

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
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.

Conservation Reserve Program (CRP) 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

*The NRCS provides technical support for the Farm Service Agency Conservation Reserve Program (CRP)
Many plant communities require periodic disturbance—fire, grazing, or mowing—to thrive. Some seed needs fire (smoke) to germinate.

For long term maintenance

Grasses have many roles in natural communities

Grasses are vital in fire adapted communities as fine fuel. They shelter groundnesting birds, bumblebees, and other wildlife. They are host plants for larvae of grass skippers and some true butterflies.

Gemmed satyr larvae (caterpillars) eat river oats, *Chasmanthium* spp.

Photo: Dennis Burnette, Carolina Butterfly Society
Bringing restoration seed into the trade

With growing interest in ecological restoration, particularly using local ecotypes, more regionally local seed is becoming available every day.

The Plant Conservation Alliance, consortium of public and private organizations and individuals working to conserve native plants http://www.nps.gov/plants

Additional Resources

gulf fritillary butterflies nectaring on chaffhead, Carphephorus bellidi; in SC as they migrate.

green sweat bee, Augochlora pura, on butterfly milkweed, Asclepias tuberosa

Photo: Nancy Adamson
Additional Resources: The USDA-NRCS

Natural Resources Conservation Service
Technical and financial assistance for conservation

Contact your local NRCS District

Three Steps You Can Take to Bring Back the Pollinators

1. Sign the Pollinator Protection Pledge.
2. Install a Pollinator Habitat sign.
3. Spread the word!

Photo: Buz Koot
SC NRCS restoration planting

Photo: Matthew Shepherd
The Xerces Society: Education and Training

Overwintering Monarchs

The Xerces Society: Citizen Science

Bumble Bees
Aquatic Invertebrates
Migratory Dragonflies

Overwintering Monarchs
CBT: Matching grants for community native plantings

Chesapeake Bay Trust model

http://www.cbtrust.org

Thank you NCWRC for all you do to support wildlife!

...and many excellent scientists, conservationists, and farmers!

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- NRCS East National Tech Center
- Turner Foundation
- Disney Worldwide Conservation Fund
- C.S. Fund
- Whole Foods Market & their vendors
- Organic Valley FAFO
- Organic Farming Research Foundation
- Nat’l Institute of Food & Agric., USDA
- Cinco
- Cliff Bar Family Foundation
- Alice C. Tyler Perpetual Trust
- Sarah K. de Coizart Article TENTH Perpetual Charitable Trust
- The Edward Corey Charitable Trust
- EarthShare (CFC #18380)
- Endangered Species Chocolate
- The Metabolic Studio
- The Ceres Foundation
- & many others...

anthophorid bee, *Anthophora* sp., on clasping milkweed, *Asclepias exaltata*
Questions?

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long-horned bee on lanceleaf coreopsis,
Coreopsis lanceolata

Photo: Nancy Adamson