USDA National Agroforestry Center

AGROFORESTRY NOTES

AF Note —32 August 2006

Agroforestry: Sustaining Native Bee Habitat For Crop Pollination

Introduction

Over one hundred crop species in North America require a visit from an insect pollinator to be most productive. In the past, native bees and feral honey bees could meet the pollination needs of small orchards, tomato and pumpkin fields, and berry patches, because these farms were typically adjacent to areas of habitat that harbored important pollinators. Today, many farms are large and, at the same time, have less nearby habitat to support native pollinators. To ensure adequate pollination services, producers now rely on European honey bees. Research, however, shows that native bees can be important pollinators in agricultural fields as long as enough habitat is available.

Agroforestry connection

Whether growing a hedgerow or windbreak, managing a riparian buffer, or farming near forests, agroforestry practices can increase the overall diversity of plants and physical structure in a landscape and, as a result, provide habitat for native pollinators. This is especially true if consideration is given to the specific habitat needs of bees when designing an agroforestry project. For example, a wide variety of flowering trees and shrubs can be incorporated into a hedgerow, or a diverse understory of insect-pollinated plants can be used to augment a riparian buffer. Planting specific trees for timber can also provide habitat for pollinators; black locust and maple, for example, supply abundant flowers and are excellent hardwoods that

Windbreaks reduce wind speed and provide more favorable conditions for bee activity, which can increase crop pollination and yield. USDA National Agroforestry Center file photo.

Crops pollinated by native bees

- Alfalfa seeds
- Almonds
- Apples
- Avocados
- Blueberries
- Canola
- Cherries
- Chokecherries
- Cranberries
- Cucumbers
- Grapefruit
- Macadamia nuts
- Pears
- Plums
- Prunes
- Pumpkins
- Soybeans (hybrid seed production)
- Squash
- Sunflower seeds
- Tomatoes
- Vegetable seeds
- Watermelons

can at some time be harvested. Another simple way to provide pollinator habitat is to leave snags (standing dead trees or branches) since many important native bee species nest in a snag's old beetle tunnels.

Agroforestry plantings have indirect benefits for crop pollination as well. For example, agroforestry practices help reduce winds, making it easier for pollinators to fly and visit flowers. Less wind creates slightly elevated temperatures around plantings, which increases the time that pollinators can be active. Finally, research shows that windbreaks and other linear plantings can serve as buffers to drifting pesticides, which helps protect pollinators from chemicals used in adjacent fields.

The dirt on native bees

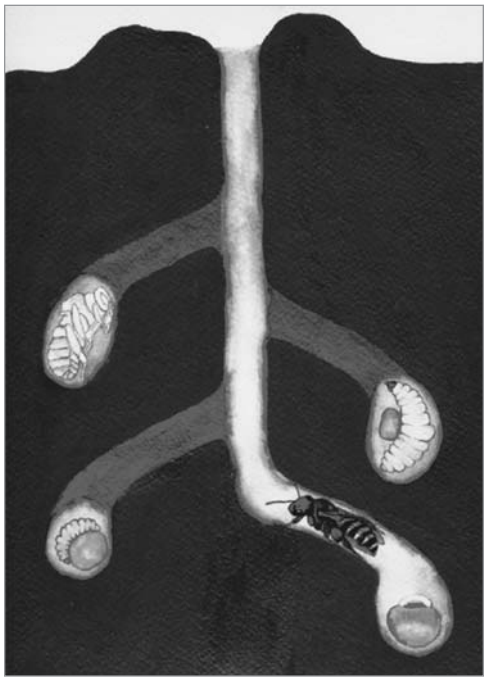
European honey bees and native bees are the most important pollinators of insect-pollinated crops in the United States. Bees are superior – and frequently the only – crop pollinators because they transport pollen and typically visit flowers from a single plant species during each foraging trip, which ensures that the correct pollen is transferred from plant to plant. Bees also forage out from a central nest and therefore stay in the area around a crop when their nests are close at hand. These behaviors set bees apart from butterflies and other pollinators, which tend to drift across the landscape visiting a variety of flower species to gather nectar.

This *Agroforestry Note* pertains to all bees, but emphasis is on providing habitat for native species, not the European honey bee. Given the demise of many managed honey bee colonies – from disease, parasitic mites, and Africanized bees – it is important to diversify the pollinators upon which many growers rely. Hundreds of species of native bees are available for crop pollination. These unmanaged bees provide a free and valuable service. Some native bee species, like mason and bumble bees, are active when conditions are too cold and wet for honey bees. In addition, native bees collectively are more versatile than honey bees. For example, some native species are able to buzz-pollinate flowers, which honey bees cannot do; this vibration releases pollen from deep inside the anthers of certain flowers. Plants, such as tomatoes, cranberries, and blueberries, produce larger and more abundant fruit when buzz pollinated. Finally, in some situations, like hybrid seed production, native bees may improve the efficiency of foraging honey bees by causing honey bees to move between rows of cultivars.

Habitat needs of native bees

Crop-pollinating native bees have three basic habitat needs:

- First, they must have access to a diversity of plants with overlapping blooming times so that flowers are available to forage from early in the spring until late in the fall. And, because native bees come in a range of sizes, it is important to provide flowers of various sizes, shapes, and colors, in order to support a diverse community of bees.
- Second, they need places to nest. Most native bees are solitary, and none build the wax or paper structures we associate with honey bees or wasps. Most bees nest in small warrens of tunnels and cells they construct underground. Others nest in narrow tunnels often left behind by beetle larvae in dead trees, and a few use the soft pith in some plants. Bumble bees – the most familiar social bee group native to the United States – require small cavities, either in tree boles, underground, or under clumps of fallen grass. Often, they move into old rodent burrows. Whether underground or in snags, most solitary bees spend most of the year



Solitary ground-nesting native bees spend most of the year growing through the egg, larval, and pupal stages while hidden in their nest cells underground. Illustration courtesy Sarina Jepsen.

maturing in their nest (brood) cells. In these cells, they are vulnerable to mechanical nest disturbances such as deep soil tillage or tree removal. Bumble bees are different. Because their nests are started anew each spring by overwintering queens, bumble bees need both cavities to raise their young as well as undisturbed duff for queens to burrow and hibernate through the winter.

- Finally, bees need protection from most pesticides. Insecticides are primarily broad-spectrum and are therefore deadly to bees. Furthermore, indiscriminate herbicide use can remove many of the flowers that bees need for food.

Three-step approach to enhancing habitat for native bees

Know what exists

Many agroforestry practices naturally provide habitat for bees. For example, riparian forest buffers, hedgerows, and windbreaks probably already include bee-pollinated plants, stable untilled areas for ground nests, snags and pithy stems for tunnel-nesting solitary bees, and cover for bumble bee colonies. Understory plantings, like those found in forest farming or silvopasture, also may provide forage or stable ground with patchy bare areas. Certain trees – such as black locust, maple, black cherry, horse chestnut, yellow (tulip) poplar, persimmon, and basswood – incorporated into any agroforestry practice can be fantastic sources of pollen and nectar, as well as produce a harvestable wood product.

Also, keep in mind that other places – outside of those areas in agroforestry – may be providing these same habitat needs for crop pollinators. These areas might include fallow fields; natural areas; gardens; edges of ponds, ditches, fields, and roads; and temporary bee pastures (e.g., where inexpensive seed – like alfalfa, canola, or clover – has been planted specifically for bees or wildlife).

Observing pollinators and their habitat on a farm can be instructive. Try to identify plants that support the most bees. Observe flowers during sunny times of the day and watch for bumble bees and other insects. Also, look for bumble bee nests or in-ground nests of solitary bees. To find these sites, search for holes in the ground or bees flying low as if looking for something besides flowers.

Most native bees are unlikely to sting. Yellowjackets and wasps are not bees, nor are they significant crop pollinators. They are, however, fantastic predators of soft-bodied insect pests.

Protect

Once you know where bees are living and foraging, try to protect these resources from damaging disturbance and pesticides. For example, avoid tilling the surface during bloom and only till deeply when it is absolutely necessary; never apply insecticides to plants in flower; consider establishing a fifty-foot perimeter buffer of unsprayed crop area; apply herbicides in the most targeted way possible (e.g., spot spraying), and leave snags whenever they do not pose a hazard.

Enhance

To enhance habitat for native bee communities, increase the diversity and abundance of flowering plants growing on a site and add nesting habitat. Consider pollinator needs when choosing trees for windbreaks, riparian forest buffers, silvopasture, forest farming, or alley cropping operations. Other options include overseeding silvopasture with legumes or other flowering plants, or adding berry-producing shrubs to riparian forest buffers, windbreaks or hedgerows. Enhancing any agroforestry practice by erecting bee blocks, or removing vegetation from small patches of sunny, south-facing, well-drained soil will increase the likelihood of bees.

Conclusion

These techniques will help increase the diversity and abundance of crop pollinators, and will likely help crop pollination. One or more of these techniques can be incorporated easily into many existing agroforestry practices. They also provide habitat for wildlife and other beneficial insects, such as predators and parasites of pests. Finally, enhancing pollinator habitat is an opportunity to educate landowners and community residents about the value of this habitat for the ecosystem and for the bottom line.

Additional information

AF Note – 33: "Improving Forage For Native Bee Crop Pollinators," Vaughan, Mace and Black, Scott Hoffman, 2006. USDA National Agroforestry Center.

AF Note – 34: "Enhancing Nest Sites For Native Bee Crop Pollinators," Vaughan, Mace and Black, Scott Hoffman, 2006. USDA National Agroforestry Center.

AF Note – 35: "Pesticide Considerations For Native Bees In Agroforestry," Vaughan, Mace and Black, Scott Hoffman, 2006. USDA National Agroforestry Center.

"Farming for Bees: Guidelines for Providing Native Bee Habitat on Farms," Vaughan, M., M. Shepherd, C. Kremen, and S. Black. 2004. Xerces Society. 34 pp. *www.xerces.org/Pollinator_Insect_Conservation/Farm_Pollinator_Guidelines.pdf*

NRCS Pollinator Technical Note. *ftp://ftp-fc.sc.egov.usda.gov/NHQ/ecs/Wild/NativePolinators.pdf*

Xerces Society Pollinator Program, *www.xerces.org/Pollinator_Insect_Conservation/*

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