

PLANTING FOR POLLINATORS IN EAST TENNESSEE

Karl McKim, Research Assistant, Department of Ecology and Evolutionary Biology
 Laura Russo, Assistant Professor, Department of Ecology and Evolutionary Biology
 Amani Khalil, Research Fellow, Oak Ridge Institute for Science and Education
 Virginia Sykes, Assistant Professor, Department of Plant Sciences
 University of Tennessee

Pollination is an essential step in plant reproduction, beginning the process of seed and fruit production. Three-quarters of flowering plants are pollinated by animals, mainly insects. This process is critical to wild and agricultural ecosystems as many crops rely on animal pollinators.

Native pollinator populations, however, are currently in decline worldwide. The National Parks Service lists habitat loss and non-native species as two of the biggest challenges for native pollinators. Habitat and high-quality forage available for pollinators have been reduced by human development. Non-native plants, on the other hand, are becoming more widespread, often outcompeting native species more suitable for supporting native pollinators.

One way to support local pollinator populations is through home gardening. Home gardens made predominately of native plants can provide resources such as nectar and pollen for pollinators while also helping preserve natural biodiversity. Additionally, the inclusion of perennials in a home garden, instead of annuals, can provide habitat and floral resources to pollinators year after year.

Using three years of research monitoring pollinator preference in East Tennessee, we provide evidence-based recommendations for native garden plantings. These recommendations are for anyone interested in making their garden more attractive to the bees of Tennessee by planting native perennials.

Why Choose Native Plants?

- Native plants are adapted to local climates and soils requiring less inputs such as water, fertilizers and pesticides.
- Native plants are more resistant to native pests and diseases.
- Native plants are more suitable for providing native pollinators with nectar, pollen and habitat (Figure 1).
- Studies have found native plants to be up to four times more attractive to native pollinators than non-native ornamentals.



Figure 1. Left: A small carpenter bee (*Ceratina*) makes its nest in a hollow stem. **Right:** A metallic sweat bee (*Augochloropsis*) drinks nectar from short-toothed mountain mint (*P. muticum*). Photo credit: L. Russo.

Bees and butterflies prefer different floral colors and shapes. **Bees** are attracted to white, yellow, purple, violet and blue flowers of many shapes and sizes. **Butterflies** prefer clusters of white, yellow, purple, orange and pink flowers with flat tops. We show differences in the preferences of these two pollinators in Table 1.

Our Research

Tennessee is home to over 3,000 species of native plants and a diverse number of native pollinators. The goal of our research was to provide evidence-based recommendations for pollinator-friendly native perennials in eastern Tennessee. Beginning in 2019, we conducted weekly pollinator surveys on 18 species of native perennials, representing three large plant families: asters (Asteraceae), mints (Lamiaceae) and legumes (Fabaceae). Using these surveys, we determined the most preferred plants among our selected 18 species (Table 1). Our recommendations are based on these preferences and our experience maintaining these plants over a three-year period.

Table 1: Recorded pollinator visits (2019 and 2020).

| Pollinator visits (individuals) on selected native perennials in 2019 and 2020. The color gradient from dark to light indicates pollinator preference. Darker boxes show lower pollinator preference while lighter boxes show greater preference. | | | | | |
|---|-------------|------------|----------------|-------------|-------|
| Least preferred | | | Most preferred | | |
| Plant | Butterflies | Bumblebees | Honey Bees | Native Bees | Total |
| Mountain Mint | 81 | 21 | 307 | 1221 | 1630 |
| Rockcastle Aster | 38 | 86 | 14 | 715 | 853 |
| Western Sunflower | 99 | 3 | 10 | 610 | 722 |
| Hairy Sunflower | 56 | 57 | 33 | 399 | 545 |
| Virginia Water Horehound | 0 | 13 | 72 | 228 | 313 |
| Cumberland Rosemary | 4 | 0 | 1 | 292 | 297 |
| Richweed (<i>Collinsonia</i>) | 1 | 76 | 15 | 147 | 239 |
| Stokes' Aster | 3 | 70 | 16 | 116 | 205 |
| Yellow Crownbeard | 27 | 39 | 60 | 68 | 194 |
| Smooth Woodmint | 2 | 43 | 16 | 74 | 135 |
| Lanceleaf Coreopsis | 0 | 2 | 0 | 77 | 79 |
| Obedient Plant | 2 | 1 | 1 | 67 | 71 |
| Maryland Senna | 1 | 4 | 0 | 66 | 71 |
| Dwarf Indigo | 1 | 1 | 0 | 33 | 35 |
| Hairy Bush-clover | 4 | 0 | 0 | 27 | 31 |
| Yellow Wild Indigo | 0 | 0 | 0 | 6 | 6 |
| Spiked Wild indigo | 0 | 1 | 0 | 0 | 1 |



Figure 2. Above top and bottom: Asteraceae plot at the East Tennessee AgResearch and Education Center. **Right:** Floral timing of recommended species beginning in April. The color of each band corresponds to floral color and its length indicates time spent in bloom. The width of each band represents floral display size, with peak bloom occurring at a band's widest point (S.D.=1). A garden containing only these plants would bloom from late April into October and present a variety of plant families, sizes and flower types.

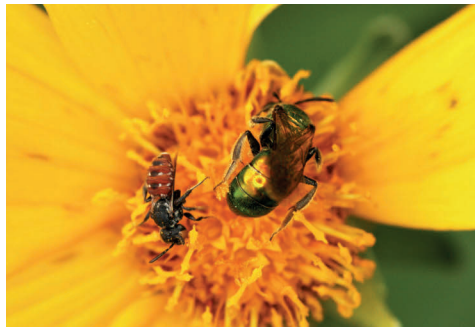
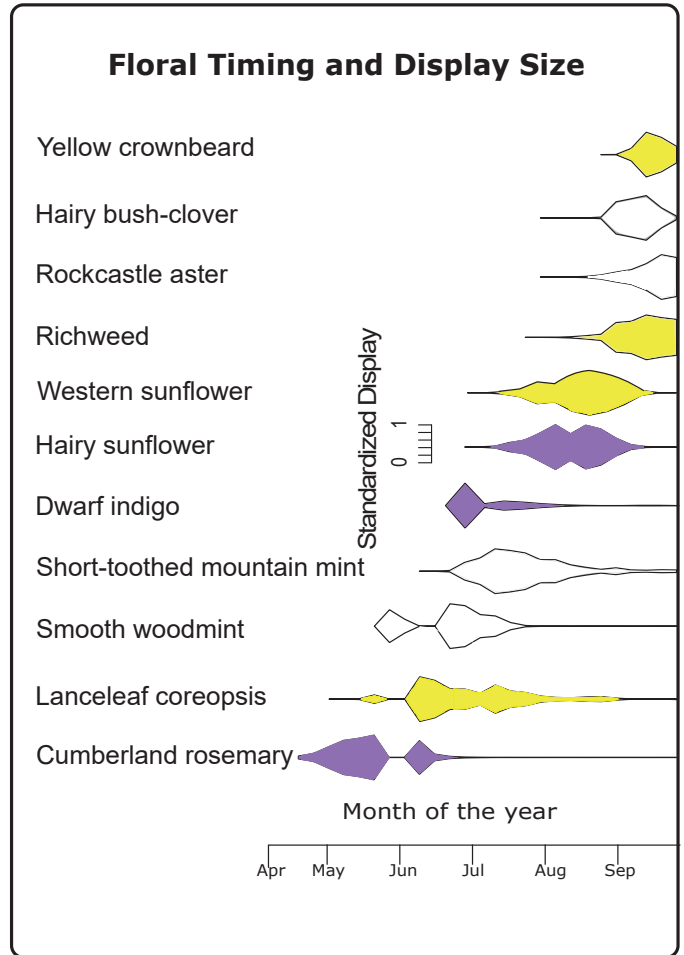


Figure 4. Top, left to right: Rockcastle aster (*E. saxicastelli*), short-toothed mountain mint (*P. muticum*) and yellow crownbeard (*V. occidentalis*) attract butterflies with groups of flat-topped flowers. **Bottom, left to right:** Bees visit the flowers of richweed (*C. canadensis*), lanceleaf coreopsis (*C. lanceolata*), and obedient plant (*P. leptophylla*) despite their differences in size and shape. Photo credit: K. McKim, L. Russo.

Asters

Including popular plants like daisies, marigolds and sunflowers, the Asteraceae family is known for its tall, colorful blooms. Plants in this family produce large amounts of high fat pollen. Aster flowers come in many colors including white, blue, yellow and purple. These flowers are made of many small flowers clustered together to give the appearance of a single flower (Figure 5). While attractive to butterflies, there are many species of bees that specialize on plants in this family. Some species in this family can grow over twelve feet tall.



Figure 5. Leaf-cutter bee (*Megachile*) on western sunflower (*H. occidentalis*). Photo credit: L. Russo.

Mints

The Lamiaceae family includes many common herbs such as basil, sage and rosemary, as well as other familiar plants like catnip and bee balm. These aromatic plants have flowers of various sizes and shapes which contain large amounts of nectar, making them highly attractive to a variety of pollinators (Figure 6). Plants in this family are easy to cultivate, but some will spread quickly and dominate available space.



Figure 6. Cumberland rosemary (*C. verticillata*) attracts the smallest native bees. Photo credit: L. Russo.

Recommended plants

Asters

Lanceleaf coreopsis (*Coreopsis lanceolata*): May-Sept., 24-48 inches, yellow flowers, manageable growth can bloom all summer, attracts native bees

Hairy sunflower (*Helianthus hirsutus*): July-Sept., 48-144 inches, yellow flowers, tall and aggressive growth, attracts all pollinators

****Rockcastle aster** (*Eurybia saxicastelli*): Aug.-Oct., 24-48 inches, white flower clusters, manageable growth, attracts large numbers of all pollinators

Western sunflower (*Helianthus occidentalis*): July-Sept., 24-60 inches, yellow flowers, aggressively spreads along ground before producing tall blooms, attracts butterflies, native bees

Yellow crownbeard (*Verbesina occidentalis*): Sept.-Oct., 60-144 inches, yellow flowers, tall and aggressive growth, attracts all pollinators

Mints

Cumberland rosemary (*Conradina verticillata*): April-July, 12-18 inches, purple flowers, short shrub, good for early-blooming garden borders, attracts small, native bees

Richweed (*Collinsonia canadensis*): Aug.-Oct., 36-60 inches, yellow flowers, tall with broad leaves, requires ample space but is easily managed, attracts late-season bumblebees and native bees

Smooth woodmint (*Blephilia subnuda*): May-July, 12-36 inches, white flowers, grows in clumps, easy to manage, attracts early-season bumblebees and native bees

****Short-toothed mountain mint** (*Pycnanthemum muticum*): June-Sept., 24-48 inches, white to purple flowers, aggressive but manageable growth, study's overall most pollinator-attractive plan, a large patch is highly recommended

Legumes

Dwarf indigo (*Amorpha herbacea*): June-July, 12-36 inches, purple flowers, easily managed shrub, attracts small native bees

****Hairy bush-clover** (*Lespedeza hirta*): Aug.-Sept., 24-48 inches, white flowers, attracts native bees, mainly leaf-cutter bees (*Megachile*) (Figure 9)

****Top three recommended plants**

Legumes

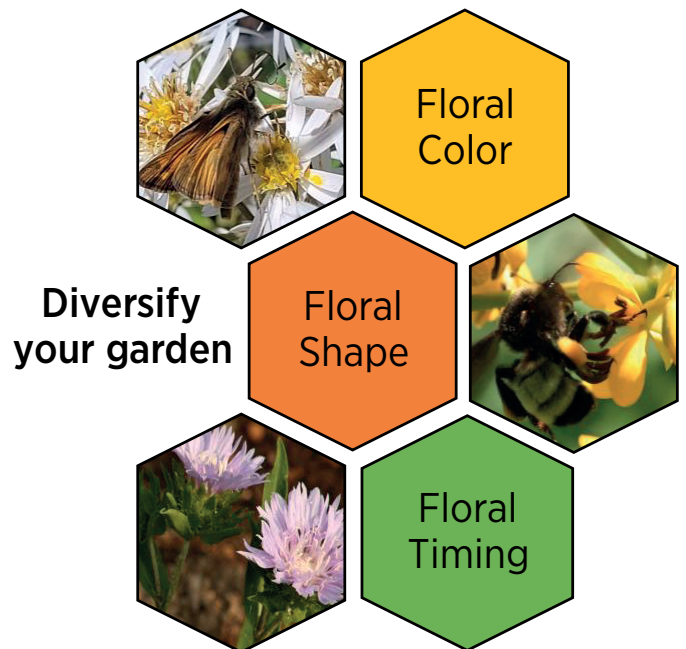
Known for their fruit or pod, the Fabaceae family includes not only food crops such as peas and beans but also shrubs and trees. Legume pollen is high in protein and their flowers exhibit a variety of colors and shapes (Figure 7). Some of these floral shapes limit access to pollen while others are self-pollinating, not requiring pollinators for fertilization. Plants in this family may take longer to establish and flower than those in other families.



Figure 7. The purple flowers of dwarf indigo (*A. herbacea*) grow on long stalks, or racemes. Its bright orange pollen is some of the most vibrant in the garden. Photo credit: L. Russo.

Attracting Native Pollinators

- Grow native plants in groups in the garden.
- Diversify your garden.
 - Plant trees, shrubs and flowers from a variety of plant families.
 - Grow plants that bloom at different times for continuous bloom.
 - Grow plants of various floral shapes and colors.
- Leave dry, hollow stems in the garden over the winter for wood-nesting bees.
- Avoid weed barriers in gardens to encourage ground-nesting bees.
- Provide a water source using a birdbath or bowl and place rocks throughout so pollinators can safely land and drink.
- Avoid pesticides, even those labelled safe for bees.



Conclusion

As pollinator populations decrease worldwide, it is important to ensure that native pollinators have access to the resources they need to survive. The home gardener can help support native pollinators by growing a diverse garden of native plants. Native plants are more appealing to native pollinators than ornamentals, and diversifying plant types and floral characteristics can help maximize this appeal. While we have only addressed a fraction of the 3,000 plants native to Tennessee, we hope that this guide can provide a framework for using research to establish a pollinator-friendly patch in your East Tennessee garden (Figure 8).



Figure 8. A leaf-cutter bee (*Megachile*) on hairy bush-clover (*L. hirta*). Photo credit: L. Russo.

Table 2. Each of the species included in our study. The table shows scientific and common names as well as floral color, and timing of peak bloom. The final column indicates species whose stems should be left in the garden as habitat for wood-nesting bees.

| Species | Common Name | Family | Flower Color | Peak Bloom | Bees Nest in Old Stems |
|--------------------------------|-----------------------------|------------|--------------|--------------|------------------------|
| <i>Amorpha herbacea</i> | Dwarf indigo | Fabaceae | Purple | Mid- Summer | No |
| <i>Baptisia albescens</i> | Spiked wild indigo | Fabaceae | White | Early Summer | No |
| <i>Baptisia tinctoria</i> | Yellow wild indigo | Fabaceae | Yellow | Mid- Summer | No |
| <i>Blephilia subnuda</i> | Smooth woodmint | Lamiaceae | White | Early Summer | Yes |
| <i>Collinsonia canadensis</i> | Richweed | Lamiaceae | Yellow | Late Summer | Yes |
| <i>Conradina verticillata</i> | Cumberland rosemary | Lamiaceae | Purple | Early Summer | No |
| <i>Coreopsis lanceolata</i> | Lanceleaf coreopsis | Asteraceae | Yellow | Early Summer | No |
| <i>Eurybia saxicastelli</i> | Rockcastle aster | Asteraceae | White | Late Summer | Yes |
| <i>Helianthus hirsutus</i> | Hairy sunflower | Asteraceae | Yellow | Late Summer | Yes |
| <i>Helianthus occidentalis</i> | Western sunflower | Asteraceae | Yellow | Mid- Summer | Yes |
| <i>Lespedeza hirta</i> | Hairy bush-clover | Fabaceae | White | Late Summer | Yes |
| <i>Lycopus virginicus</i> | Virginia water horehound | Lamiaceae | White | Late Summer | No |
| <i>Physostegia leptophylla</i> | Obedient plant | Lamiaceae | Purple | Mid- Summer | No |
| <i>Pycnanthemum muticum</i> | Short-toothed mountain mint | Lamiaceae | White | Mid- Summer | Yes |
| <i>Senna marilandica</i> | Maryland senna | Fabaceae | Yellow | Mid- Summer | Yes |
| <i>Stokesia laevis</i> | Stoke's aster | Asteraceae | Purple | Early Summer | No |
| <i>Thermopsis villosa</i> | Carolina lupine | Fabaceae | Yellow | Early Summer | Yes |
| <i>Verbesina occidentalis</i> | Yellow crownbeard | Asteraceae | Yellow | Late Summer | Yes |

Additional Resources

Lady Bird Johnson Wildflower Center, Tennessee Native Plants
<https://www.wildflower.org/collections/collection.php?collection=TN>

Tennessee Native Plant Society
www.tnps.org

Xerces Society for Invertebrate Conservation, Pollinator Conservation Resources for the Southeast Region
<https://xerces.org/pollinator-resource-center/southeast>

Acknowledgments

This research was supported in part by Bayer Crop Sciences LLC and an appointment to the Agricultural Research Service (ARS) Research Participation Program administered by the Oak Ridge Institute for Science and Education (ORISE) through an interagency agreement between the U.S. Department of Energy (DOE) and the U.S. Department of Agriculture (USDA). ORISE is managed by ORAU under DOE contract number DE-SC0014664. All opinions expressed in this document are the author's and do not necessarily reflect the policies and views of USDA, DOE, or ORAU/ORISE.



UTIA.TENNESSEE.EDU

Real. Life. Solutions.™