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## Eastern Hemlock (*Tsuga canadensis*): Profile of an Indiana Glacial Relict

By Collin Hobbs

When it comes to trees, Indiana is most famous for its world-class deciduous hardwood forests. And rightfully so, as Indiana is the heart of the Central Hardwood Forest ecoregion. Unlike the mixed northern forests of the Great Lakes, or the Appalachian forests to the east and south,

Indiana's forests consist almost exclusively of deciduous tree species. Excepting the ubiquitous red cedar, most of Indiana's counties lack any native conifer populations. But here and there one can find tucked away in narrow valleys, clinging to precipitous sandstone cliffs, or blanketing steep north-facing slopes, stands of what might be the most beautiful of native conifers, the eastern hemlock.

Eastern hemlock (*Tsuga canadensis*) belongs to a genus containing ten species, six of which are found in Asia and four in North America. Of the

two eastern North American species, Carolina hemlock (*T. caroliniana*) is found only in a limited region of the Southern Appalachian Mountains. Eastern hemlock is more widely dispersed, growing from Nova Scotia to Minnesota and southward along the Appalachian Mountains to northern Alabama. In Pennsylvania the species has been designated as the state tree, the equivalent of Indiana's tulip poplar (*Liriodendron tulipifera*). Eastern hemlock has beautiful foliage

composed of dark green needles about 1/2" (12 mm) long arranged in a flattened plane along the twigs. Unlike pine, the needles attach individually to the twig rather than in clusters. The seed cones of hemlock are reminiscent of



Collin Hobbs

The foliage of eastern hemlock consists of flattened sprays of blunt-tipped needles that bear delicate cones.

### Inside

Book Reviews	12, 15
INPS in Action	3, 9
Native Edibles	7, 9
Native Plant Profiles	1, 6
Nature Experiences	10, 11
Plant This, Not That	4
Preserving Nature	16

pinecones, only much smaller at a diminutive 1/2 to 3/4" (12 to 20 mm) in length. Besides making lovely specimen trees in the right setting (avoid dry, exposed areas, especially if the soil is alkaline), the dense foliage allows hemlocks to be trimmed into hedges.

Across much of its range hemlock serves as a forest climax species. It is slow growing and very shade tolerant, meaning that it can germinate and grow in the shade of itself and other trees. As noted on vPlants (see *Tsuga canadensis* on [midwestherbaria.org](http://midwestherbaria.org)) seedlings are often found growing on rotting logs and moss-covered rocks. Individual plants can persist for 50-100 years in the shaded forest understory until an opening allows them to reach into the canopy where they can continue to thrive for centuries. In forests where hemlock dominates, the accumulation of its fallen needles and twigs acidifies the soil. This, in

*Hemlock* — continued on page 2

## Hemlock — continued from front page

combination with the tree's dense shade and absorption of soil moisture, discourages most plants from growing beneath it.

With time mature hemlocks can reach massive proportions. Eastern hemlock holds the record for largest tree by volume east of the Mississippi and, depending on who

you ask, the second tallest (after white pine) with the current record holder at 175 ft or 53 m (see the 2021 National Register of Champion Trees). Most of these giant hemlocks are found in the Smoky Mountains and almost all of them have, sadly, died within the last twenty years because of infestations by hemlock woolly adelgid.

Indiana is situated on the fringe of hemlock's geographic range. Charles Deam noted in his 1940 *Flora of Indiana* that our hemlocks are found in small, well-defined populations in parts of southern Indiana. The work of John Potzger, another Indiana botanist (see INPS Journal, Fall 2022), demonstrated that Indiana once had extensive coniferous forests shortly after glaciers receded northward about 12,000 years ago. This has led botanists to propose that Indiana's hemlocks are glacial relicts, hanging on as isolated "islands" surrounded by a sea of deciduous trees.

While that hypothesis makes sense it is not the only explanation for Indiana's hemlock "islands". Our region went through a rather warm, dry period about 8000 years ago known as the hypsithermal, and this may have driven moisture sensitive hemlocks to extinction locally. Since that time, long-distance dispersal of hemlock seeds from the species' main range may account for the small, scattered populations in our state. In recent years new genetic tools have made it possible to revisit these competing hypotheses. In my research (Hobbs & Clay 2013, Hobbs 2013), I investigated the genetic diversity of Indiana's hemlock populations and compared them against populations from the main distribution in the Appalachians and Great Lakes regions. After analyzing the genetic resources of 470 trees from 24 different populations, I concluded that the patterns of genetic diversity best fit the relict population hypothesis. These populations are survivors, not recent invaders!

Unfortunately, our survivor of ancient forests now faces a modern threat in the form of a non-native insect. The hemlock woolly adelgid (*Adelges tsugae*) is a tiny aphid-like insect covered with white, cottony fluff. It is native to Asia, where it is a minor sap-sucking pest of Asian hemlock species, kept in check by natural predators and the adaptive defenses of its host trees. However, both eastern and Carolina hemlock are highly susceptible to it. It was introduced accidentally in Virginia in the 1950s, and has since spread north to Maine, south to Alabama, and westward to Kentucky and Ohio. The health of infected hemlock trees slowly declines, typically leading to death within 4-10 years. Mortality rates, especially in the warmer Appalachian region, can exceed 99% within a decade (Ellison et al. 2018).

The isolation of Indiana's populations has, so far, protected them from this devastating pest. The Indiana Department of Natural Resources has one report of the insect from 2012 in LaPorte County. Fortunately, this occurrence involved a cultivated specimen that likely originated from infected plant nursery stock. It was quickly recognized by the homeowner, treated with insecticide, and no other occurrences were observed nearby.

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Collin Hobbs

*In Indiana, eastern hemlock often hugs the face and upper edges of sandstone cliffs.*

# Ellen Jacquart Wins NAA Stewardship Award

The bullet may have been dodged ... for now! Although the isolation of Indiana's hemlock stands provides some protection, it may only be a matter of time before the adelgid arrives at a native population, either by hitchhiking a ride on birds or from infected nursery stock imported to our state. Some of Indiana's most treasured natural areas, such as Shades (Montgomery, Parke, and Fountain Counties) and Turkey Run State Parks (Parke County), Green's Bluff (Owen County), Hemlock Cliffs (Crawford County), and Trevlac Bluff (Brown County), would not be the same without hemlock trees. Chemical treatment of these forest patches would be difficult and biological control agents have, to date, shown only mixed results (NYDEC 2022).

Our story about eastern hemlock provides two "take-aways." First, make a goal to visit our relict populations of eastern hemlock. They enhance some of Indiana's most breathtaking natural areas and in winter these evergreens are easy to spot. Second, monitor hemlock trees and nursery stock in your own area, watching for tiny insects covered with white fluff. Report suspicious plants to the IDNR. You will do all lovers of native plants a huge favor.

## References

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*Collin Hobbs is an Associate Professor of Biology and Curator of the Fred Loew Herbarium at Huntington University. A native of Wisconsin, Collin earned a PhD at Indiana University and has since put down roots in his new home state. He is a member of the Northeast Chapter of the INPS.*

The Natural Areas Association (NAA) has announced its award recipients who demonstrate the highest standards of leadership and achievement in the natural area profession. Our own Ellen Jacquart is the 2022 winner of their Carl N. Becker Stewardship Award, which recognizes excellence and achievement in managing the natural resources of reserves, parks, wilderness, and other protected areas.

Ellen Jacquart, president of the Indiana Native Plant Society, recently retired after an impressive 40-year natural areas preservation and management career.

Early in her career, Jacquart spearheaded the creation of the Central Indiana Land Trust in 1990, which has protected more than 6,500 acres of natural areas.

Additionally, at a time when there wasn't a source for certain species of native plants for restoration projects at the Hoosier National Forest, Jacquart led efforts to create a native plant nursery, and seeds from that project continue to support Indiana's natural areas today.

The Natural Areas Association serves scientists and practitioners focused on the management of ecologically significant natural landscapes with the intent to protect biodiversity for current and future generations. Protecting nature requires quality science to inform practices on-the-ground and access to reliable resources that can advance the conservation and stewardship of land and water biodiversity. NAA curates and shares relevant and timely programs and resources with practitioners responsible for the ecological resilience and protection of natural areas in perpetuity.

We are proud that Ellen has been recognized for her outstanding contributions to the field. 🌿



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