On The Fringe

Journal of the Native Plant Society of Northeastern Ohio

Program Schedule – Fall 2018

Sunday, September 16, Noon – 3:00 p.m – Monarch Tagging at North Kingsville Sand Barrens – Ashtabula County. Join Judy Semroc as we seek out and tag and record monarch butterfly information at the Cleveland Museum of Natural History preserve. Weather dependent; check website for weather cancellation: www.nativeplantsocietyNEO.org. GPS: 41°54'28.4"N 80°41'28.9"W.

Saturday, September 22, 9:00 am – Noon – Goldenrods of Northeast Ohio – The West Woods Nature Center, Geauga County. Jim Bissell, Curator of Botany with the Cleveland Museum of Natural History and co-author of the new goldenrod guide, *The Goldenrods of Northeast Ohio*, presents an introduction to identifying goldenrods. Books are available at the program for $10 each. An indoor session will be followed by an outdoor search for goldenrods. Preregistration through the Geauga Park District, 440-279-0880.

Saturday, October 6, 2018, 1:00 – 2:00 pm – Fall Is For Planting – Geauga West Library, Geauga County. Consider using some of our beautiful native plants when planning your garden or designing your landscape. Kathy Hanratty, Native Plant Society of Northeast Ohio President, shares how natives give our landscape a sense of place and promote a more biologically rich region. A limited number of native plants may be available for sale after the program. 13455 Chillicothe Rd., Chesterland, Ohio.

Saturday, October 27, 2017, 10:00 am – 1:00 pm – Ohio Moss Workshop, The West Woods Nature Center, Geauga County. Janet Traub and Jim Toppin with the Ohio Moss and Lichen Association give an introduction to our local mosses. An indoor session with samples to view will be followed by a lunch break before a field foray in search of examples. Bring lunch and a hand lens. Preregistration after September 20th through Geauga Park District, 440-279-0880.

Saturday, November 3, 5:30 pm – 8:30 pm – Annual Meeting.
The Annual Meeting of the Native Plant Society of Northeastern Ohio will be at the Pine Lake Trout Club, 17021 Chillicothe Rd., Chagrin Falls, OH 44023. Our guest speaker this year will be Dr. Jeffrey Corney. He serves as the Executive Director of The Wilderness Center in Wilmot, Ohio where he oversees a broad and diverse range of educational programs and land conservation initiatives. Dr. Corney also teaches at the College of Wooster as Adjunct Faculty in the Environmental Studies program. His primary area of interest focuses on the human dimension of natural resource management, particularly how to best inform and educate citizens about challenging environmental and sustainability issues toward better decision making. Dr. Corney is preparing a special presentation that will entail native plants of Ohio.

Fall is a great time to plant natives!!!

a special members-only offer:

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The Mission of the Native Plant Society of Northeastern Ohio is to promote the study, appreciation and conservation of the native plants and plant communities of Ohio.

Request for Proposals for 2018 Annual Grant

The Native Plant Society of Northeastern Ohio is accepting applications for our 2018 Grant(s). We will consider projects that demonstrate excellence in research, conservation, or education that clearly support the mission of the Native Plant Society of Northeastern Ohio. The amount of each grant will be up to $500. The number of grants available will be dependent on funding. Submissions must be received by 5:00 PM Friday, September 16, 2018. The grant(s) will be awarded at the Annual Meeting of the Society November 3, 2018. For more information on the grant and how to apply please see our website www.NativePlantSocietyNEO.org or contact Kathy Hanratty at nativeplantsocietyneo@gmail.com.

Can the Study of Botany and Mycorrhizae Lead to Fewer Occurrences of Lyme Disease?

We all know the deleterious impact of the non-native invasive garlic mustard, *Alliaria petiolata*, on other plant species, and the concern that it is taking over native plants and their habitats. A 2006 study suggests that the allelopathic chemicals shown to be secreted from the roots of garlic mustard also interfere with the growth of mycorrhizal fungi.

The June society of the Botanical Society of Western Pennsylvania meeting hosted speaker Christopher Kubiak, Director of Education at Audubon Society of Western Pennsylvania. In his talk titled "Plants and Climate Change in Western Pennsylvania," he spoke about this study.

According to study author Rachel Rollins (of Concordia College at the time), one such naturally-occurring soil-borne fungus that the allelopathic chemicals of garlic mustard interfere with is *Beauveria bassiana*, an entomopathogen that has shown promise for controlling the black-legged tick. Lyme disease in humans is just one of the illnesses this insect transmits to humans and animals.

The study stated that occurrences of this fungus in soil are not consistent, and it is not clear how much contact occurs naturally between it and the ticks, so the author points to the need for more research on this relationship.

To read the entire article go to: www.caryinstitute.org/.../files/public/reprints/Rollins_2006_REU.pdf

Information taken from *Wildflowers*, a bulletin of the Botanical Society of Western Pennsylvania, July-December 2018.

Hunting For the Ancient Lost Farms of North America

By Annalee Newitz



At Ash Cave in Ohio, archaeologists discovered an enormous cache of seeds from lost crops, including domesticated native goosefoot (similar to quinoa). These seeds were so far from their wild habitats that they had clearly been domesticated

2,000 years ago, people domesticated these plants. Now they're wild weeds. What happened?

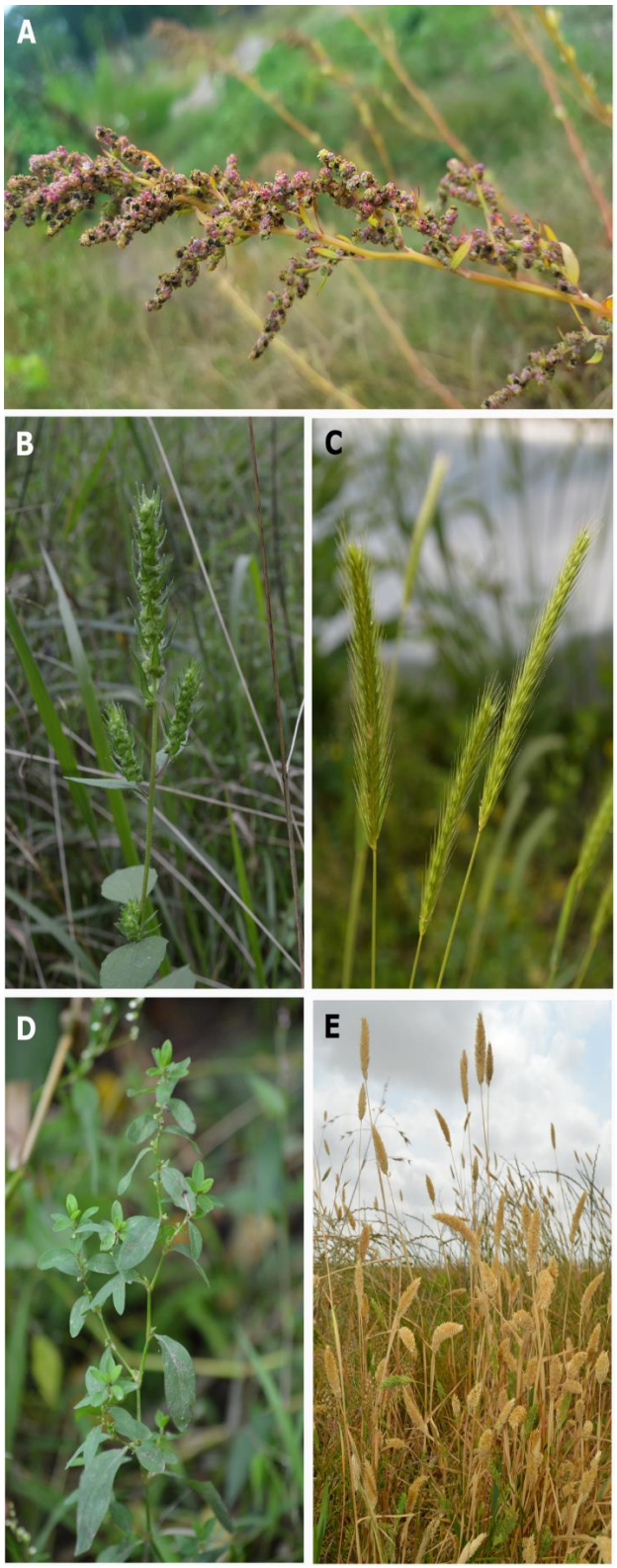
Adventurers and archaeologists have spent centuries searching for lost cities in the Americas. But over the past decade, they've started finding something else: lost farms.

Over 2,000 years ago in North America, indigenous people domesticated plants that are now part of our everyday diets, such as squashes and sunflowers. But they also bred crops that have since returned to the wild. These include erect knotweed (not to be confused with its invasive cousin, Asian knotweed), goosefoot, little barley, marsh elder, and maygrass. We haven't simply lost a few plant strains: an entire cuisine with its own kinds of flavors and baked goods has simply disappeared.

By studying lost crops, archaeologists learn about everyday life in the ancient Woodland culture of the Americas, including how people ate plants that we call weeds today. But these plants also give us a window on social networks. Scientists can track the spread of cultivated seeds from one tiny settlement to the next in the vast region that would one day be known as the United States. This reveals which groups were connected culturally and how they formed alliances through food and farming.

Natalie Mueller is an archaeo-botanist at Cornell University who has spent years hunting for erect knotweed across the southern US and up into Ohio and Illinois. She calls her quest the "Survey for Lost Crops," and admits cheerfully that its members consist of her and "whoever I can drag along." She's published papers about her work in *Nature*, but she also spins yarns about her hot, bug-infested summer expeditions for lost farms on her blog. There, photographs of the rare wild plants are interspersed with humorous musings on contemporary local food delicacies like pickle pops.

Native to the Americas, erect knotweed grows in the moist flood zones near rivers. It's a stalky plant with spoon-shaped leaves, and it produces achenes, or fruit with very hard shells, to protect its rich, starchy seeds. Though rare today, the plant was common enough 2,000 years ago that indigenous Americans collected it from the shores of rivers and brought it with them to the uplands for cultivation. Archaeologists have found caches of knotweed seeds buried in caves, clearly stored for a later use that never came. And, in the remains of ancient fires, they've found burned erect knotweed fruits, popped like corn.



Here you can see some of the lost crops of North America: a) goosefoot, *Chenopodium berlandieri*; b) sumpweed/mars helder, *Iva annua*; c) little barley, *Hordeum pusillum*; d) erect knotweed, *Polygonum erectum*; e) maygrass, *Phalaris caroliniana*.

Mueller said that erect knotweed was likely domesticated on tiny farms on the western front of the Appalachians. There are clear differences between it and its feral cousins. After years of comparing the ancient seeds with wild types, Mueller has found two unmistakable signs of domestication: larger fruits and thinner fruit skins. We see a similar pattern in other domesticated plants like corn, whose wild version with tiny seeds is almost unrecognizable to people chomping on the juicy, large kernels of the domesticated plant.

Obviously, bigger seeds would make the erect knotweed a better food source, so farmers selected for that. And the thinner skin means the plants can germinate more quickly. Their wild cousins evolved to produce fruits tough enough to endure river floods and inhospitable conditions for over a year before sprouting. But farm life is cushy for plants, so these defenses weren't necessary for their survival under human care.

Still, even the domesticated fruits of the erect knotweed have skins so tough that Mueller has not been able to crack them using the stone tools typical of the Woodland era. Working with a team at Cornell, she's been trying to reverse engineer how they could have been eaten.

"The fruit coat is really hard, and it would have been necessary to break through it," she mused. "It's like buckwheat—the sprouts are nutritious. So maybe they ate the sprouted version."

As for whether early Americans ate popped knotweed like popcorn, she was less certain. "The only way to preserve it is to burn it, so [the remains we find] could have been accidents while cooking. It might have been for drying." But yes, people from long ago might have munched on popweed.

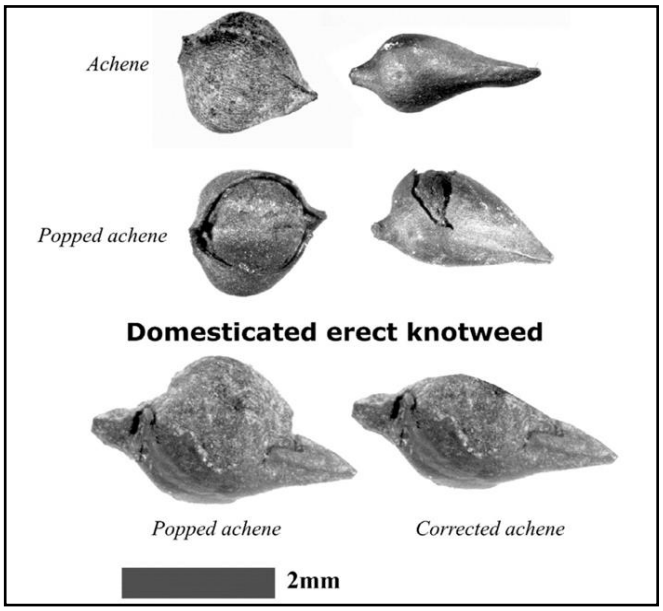
Another possibility is that the seeds were soaked in lime before being turned into a hominy-style porridge. Ancient Americans used lime—the chemical, not the fruit—to soften the hulls of maize before cooking it, in a technique called nixtamalization. It's very likely the Woodland peoples used this prehistoric form of culinary science on other plants, too. So people 2,000 years ago may have been eating a rich, knotweed mush.

Mueller is currently cultivating her own erect knotweed to test various forms of preparation, but she's not quite ready to go into the kitchen yet. "I'm trying to be a good farmer and put my seeds back first," she said. "In five years of looking, I've only found seven populations of this plant. I want to conserve the seeds as much I can." She's going to accumulate a sizable cache of seeds before wasting them on dinner.

A history of civilization in food

Because ancient people in North America built mostly with perishable materials, traces of their farms are all we have left of their civilizations. With a few exceptions, they didn't leave monumental pyramids behind or sprawling plazas. But their ability to domesticate plants is as much a testimony to their cultural sophistication as any stone temple.

In a recent paper for the *Journal of Anthropological Archaeology*, Mueller describes finding the earliest known example of domesticated erect knotweed, at a site called Walker-Noe in central Kentucky. She found it mostly by accident. She had assumed, based on previous studies, that knotweed was domesticated in Illinois, possibly about 1,200 years ago. But then she spoke with a Kentucky museum curator who told her about a mysterious grave from the 2,000-year-old Hopewell culture, found stuffed with seeds.



The top two rows are wild erect knotweed. The wild plant produces two kinds of achene, also called fruit: on the left is one form, with a thick, wrinkled skin; on the right is a fruit with smoother, thinner skin. The domesticated strain in the bottom row—popped and unpopped—resemble the smooth form of the wild fruit. You'll notice also that it's generally bigger. Mueller experimentally carbonized the wild fruit to see how its popped form would match the popped domesticate.

Examining the seeds, Mueller identified them as domesticated erect knotweed. This find makes the plant's domestication roughly a millennium older than previously thought. But given that these fruits probably came after generations of breeding by farmers, it hints at a much older date.

Mueller believes that the Hopewell shared their seeds throughout many communities where people tended farms along the skein of rivers that connect the American South with the Midwest. But it also seems likely that the erect knotweed was domesticated at least twice: once in the Kentucky region where she found her sample, and once about a thousand years later in Illinois when the great pyramid city of Cahokia stood at the center of the Mississippian culture.

Many of these early farmers appear to have counted crops among their greatest creations. Crops were valued trade goods and shared with allies in the same way jewelry, projectile points, and fine pottery were. And, of course, they were placed in graves alongside other precious funeral goods. Farming was a science and key to survival, but it was also an art. Food and feasting were central to indigenous cultures in the Americas, just as they were to civilizations in Europe and Asia. Serving guests a delightful meal with many kinds of grains, breads, and oils would have been a source of pride and pleasure.

Losing a crop

Perhaps the strangest part of this story is the fact that people simply stopped cultivating so many crops that were central to their diets. Imagine what would happen if we decided to abandon wheat to the wilderness. Suddenly, there would be no more baguettes and pastas—not to mention cakes. Sure, we could make delicious breads from corn and tasty noodles from rice or beans. But for many of us, it would feel like an incredible loss of a comforting staple. No doubt, that's how the loss of knotweed felt to aboriginal Americans, too.

It's likely that the Eastern Agricultural Complex (EAC)—a catch-all term for the lost crops of North America—faded away slowly. Though we can't be sure what triggered its decline, Mueller thinks it may have suffered its first blow from one of the most popular crops in the Americas: maize, which came north from Mexico about a millennium ago.

"Maize is an amazing crop," Mueller said. "All over the world, when it arrives, people give up their old crops and start growing it. It's productive and has lots of sugar so it gives you quick energy." By the time Cahokia was at its height in the 1000s, maize was already edging out crops like erect knotweed.



A beautiful sample of wild erect knotweed, found in Kentucky along the Red River.

But the death knell for erect knotweed probably came from Europe. Archaeologists find no more examples of domesticated erect knotweed after colonists began to settle the Americas in the 1400s, destroying local civilizations as they went. "There was so much displacement, disease, and warfare over the next couple hundred years that a lot of knowledge was lost," Mueller explained.

Still, a lot can be learned from America's lost crops, and it's not just about finding the next quinoa for health-food nerds. Mueller has been working with Smithsonian Institute anthropologist Logan Kistler to sequence the genomes of lost domesticates. He's fascinated by how many of these crops went through an entire cycle of domestication and re-wilding in the past few thousand years. Most plants that we eat, from wheat and barley to dates and beans, were domesticated more than 10,000 years ago and never went back. The EAC offers an unprecedented glimpse at what happens to plants when we turn them into food crops. And these domestication events are recent enough that we can get good genomic material from samples.

We have a fairly good sense of how domestication affects animal species over time. Domesticated pigs, horses, dogs, and even humans have all undergone physical changes, often described as "paedomorphosis," which means retaining infantile body features (softer faces, smaller bodies) throughout life. But we're just starting to understand plant domestication. "These crops have a good archaeological record that's well preserved," Kistler said. "It gives us a chance to study domestication in real time, with a good record of what comes in between wild and domestic varieties."

The EAC is also exciting for Kistler because it represents a diverse group of plants. Until recently, archaeo-botanists looked mostly at domestic plants emerging in the Fertile Crescent over 10,000 years ago during the Neolithic—but these are just grasses and legumes. In the Americas, Kistler explained, "We've got five good domesticated species. They're taxonomically extremely diverse and yet grown in same fields and harvested at the same time. It builds in a little bit of control for looking at multiple species."

Once he's been able to sequence these crops, we may begin to see common domestication patterns across plant species. Likely they'll be things like fast germination and larger fruit size, but we may find some surprises, too.

For Mueller, the search for erect knotweed isn't just about understanding the mechanisms of domestication. It's also about coming to terms with everything we've lost.

"I want to identify as many populations of these species as possible before they go extinct, because they are all threatened," she said. She's learned about how ancient Americans encountered these plants and how they incorporated them into their lives. But she's also learned about how much the American landscape is still changing.

"I was out from October to November, driving around looking for populations of these plants. Partly it's based on records from botanists going back at least 100 years. Sometimes plants are still growing where they were a century ago, she said, "but sometimes they aren't."

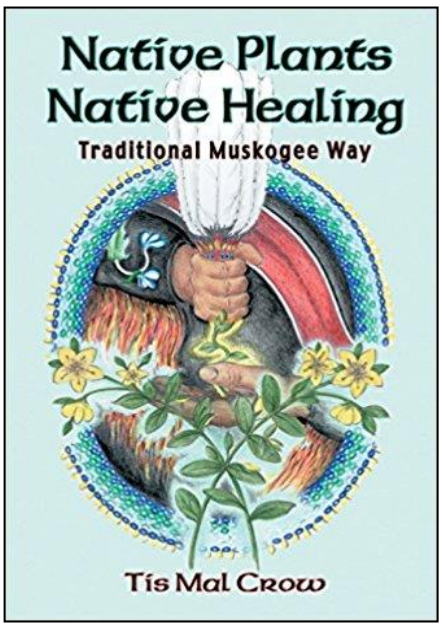
"You realize how much the land has changed even in 100 years," Mueller reflected. "There are so few places for native species to grow."

Article taken from https://arstechnica.com/science/2018/01/hunting-for-the-ancient-lost-farms-of-north-america/.

Book Review:

Native Plants, Native Healing Traditional Muskogee Way

By Tis Mal Crow



Publisher: Book Publishing Company
Published January 1st 2001 by Native Voices (first published October 31st 2000)
Pages: 146 pages
ISBN-13: 978-1570671050
ISBN-10: 1570671052
Paperback, Kindle
Package Dimensions: 10.2 x 8.2 x 0.8 inches
Price: $12.95, kindle $8.69

"Our medicine way teaches the interconnectedness of ALL things, and it celebrates and respects all living things. It teaches us to harvest plants with respect by taking only what we need. It teaches us to give back and to live in balance with nature."

This living philosophy underlies the teachings and healings that Tis Mal Crow, a Native American root doctor, herbalist and artist of Cherokee and Hitchiti descent, sets out simply and eloquently in his book *Native Plants, Native Healing, Traditional Muskogee Way*. Written with quiet authority and ancestral wisdom, this modest volume takes two dozen plants, the vast majority native to North America, and describes not only their healing properties but the potential dangers associated with using them (especially if used in conjunction with other plants in ways unresearched), methods of preparing them, and other traditional uses. Tis Mal Crow discusses the benefits of responsible wild harvesting over cultivation: "Having used herbs and observed their actions over twenty years, I find that those from the wild are superior to those that are cultivated. I think that the power of a plant is enhanced when it is allowed to grow freely where it chooses to grow. The nutrients that are essential for its health come from the soil that is fed by the other plants and animals that surround it in the wild." That said, he voices his strong concerns for the future of our forests and wetlands, describing how certain plants, especially those whose roots are used in medicinal preparations, are being decimated and their habitats irreparably damaged by thoughtless commercial interests. A prime example is black cohosh, *Cimicifuga racemosa*, the current panacea for menopausal complaints. This woodland plant is being harvested at an unsustainable rate, with few companies involved in this abominable practice bothering to reseed the plants. To add injury to injury, black cohosh is not appropriate for all menopausal symptoms, and if taken incorrectly, can have adverse effects. Tis Mal Crow teaches sacred harvesting.

"Remember the plants are sentient beings, and they know your intent… When we collect plants, we leave an offering of either tobacco or cornmeal as a sign of respect, a form of thanks, and a way to put something back into the earth where we have taken something. Careful observation twinned with respect help us discover not only the strongest medicine among the plants we are seeking but also protect the colony and keep it strong."

Reprinted from *The Blazing Star*, the Newsletter of the North American Native Plant Society, Summer 2012, Vol 13, No 3.

Pawpaw, *Asimina triloba (L.) Dunal*

By Robert L. Tener



Picture taken from http://www.statelykitsch.com/pawpaw

The Pawpaw, or Papaw as it is sometimes called, discovered me as a six-year-old on my uncle's farm during the depression in 1930. The farm had three Pawpaw trees growing on a small hill facing south where I used to tie my horse and dog, lean against the tree, and then sit and eat pawpaws for lunch. They tasted good. I did not know their name, but their odor made me hungry. When I asked my father what they were called, he said "Oh, they're the poor man's banana; they're common around here." But when we moved north, the Pawpaw trees ceased to be common. None of my friends in high school had ever heard of them let alone eaten one of their fruits. Nor did any of my high school teachers know about them. Since then I have read and read about Pawpaw trees and learned much more than I once knew, even that they can come in different varieties. Now, here at my High Hawk farm I have three small Pawpaw trees growing, including a variety called "sunflower."

The Pawpaw is also called the Papaw Tree, the North American Papaw, the Custard Apple Tree, the False Banana Tree, the Fetid Shrub, and the Common Pawpaw. The genus name, *Asimina,* comes as the Latin form of the Indian name for the tree: 'assimin.' Some specialists, however, believe that the term comes from 'Asimminier,' the old French colonial name for the tree. The species name, *triloba,* refers to the parted calyx and the double, three-parted corolla of the tree's flowers.

This is a small deciduous tree of the Custard Apple family, which is chiefly tropical; it ranges up to 40 feet, with a diameter up to 20 inches. It is gregarious and prefers ravine slopes, clear areas like pastures, and deep rich, slightly acid, moist soils. It is difficult to transplant, and its seedlings need shade to survive. One needs to plant several trees as most are self-infertile. It has no serious diseases. It is native to most of Ohio's counties except for a few clustered around Knox and Union. It makes an interesting ornamental plant for lawns and commercial places. Its wood is light, soft, green to yellow brown, coarse grained, spongy, and not used commercially. But in Arkansas, where it reaches its largest size, it is used for fence rails. Its tough inner bark was stripped by Indians in the spring and woven into ropes, fishnets, and mats. Its fruit is eaten by human beings, gray fox, opossum and raccoon.

The tree's alternate, toothless leaves are big and oval; the buds are brown; the fruits are green at first and then turn a yellow-red-purple in September. The seeds of the small banana shaped fruit are large, like those in watermelons. When the tree's stems are bruised, they release an unpleasant odor which causes cattle to avoid eating the branches and leaves. On the other hand, the highly scented flowers attract bees. The tree ranges from southern Ontario to the Gulf coast and west to Nebraska and Texas. It is the largest fruit tree native to North America.

The Pawpaw tree has an interesting history. It was introduced to Europe by DeSoto, who learned about it on his 1540 expedition to the New World. In 1736 John Bartram, the famous botanist, sent some samples to England. In 1917 the American Genetic Association had a 'best pawpaws' competition, and in 1988 the Pawpaw Foundation was founded by Neal Peterson. It is responsible for two orchards of some 1200 trees at the University of Maryland. Some research has been done on the use of the twigs to treat cancer and to form organic pesticides to kill nematodes, tobacco hornworms, bean beetles, and potato bugs. Some research is also done at Kentucky State University. There are three cultivars: "Davis," "Overleese," and "Sunflower". *A. pariflora* is a dwarf shrub, and *A. incana* is a flag pawpaw.

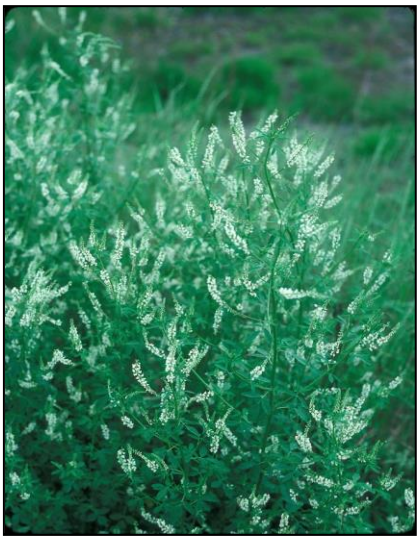
Robert Tener was a long-standing member of the Native Plant Society of Northeastern Ohio.

Invasive Plant:

White & Yellow Sweet-clovers
Melilotus alba & M. officinalis

Description

White and yellow sweet-clovers are erect, biennial members of the pea family. In their first year, the plants are small with a smooth multi-branched stem containing leaves divided into three finely-toothed leaflets. During the second year, the plant takes on a bushy appearance and develops a more extensive root system. White sweet-clover can attain a height of 2 to 7 feet, while yellow sweet-clover reaches 2 to 6 feet in height. Flowers are borne on irregular spikes at the end of elongated stems. The flowers are either white or yellow, the most obvious difference between these two species. Seeds are formed in small ovoid pods. These clovers are native to the Mediterranean region, central Europe and Asia. They were brought to the United States by early settlers, probably sometime in the 1600s, for use as forage and honey production. They are widely used as pasture crops for nitrogen enrichment of the soil and are still highly valued as honey plants for pollinators. Both species occur throughout Ohio.



Picture taken from www.gobotony.newenglandwild.org

Habitat

White and yellow sweet-clover grow in open, disturbed areas such as roadsides, old fields and utility easements. They are found in grasslands, savannas, alvars, barrens, dunes, and meadows.

Invasive Characteristics

The species can produce up to 350,000 seeds per plant, and the seeds are viable for more than 30 years. The plants are drought-resistant. During their second year, they tend to shade out native sun-loving species and out-compete native species for water and nutrients.



Picture taken from www.toronto-wildlife.com

Biological Control

Little research has been conducted for biological control of sweet-clovers because of their importance to the agricultural industry. However, several species of insects and bacteria cause damage to sweet-clovers. The most destructive is the sweet-clover borer, *Sitona cylindricollis*. The larvae of this insect feed on sweet-clover roots, while the adults feed on foliage. The bacterium *Rhizoctonia sp*. causes root rot in sweet-clovers, but it also infects soy beans, potatoes, sugar beets, ornamentals, and turf grasses.

Information taken from Invasive Plants of Ohio website; www.oipc.info/invasive-plants-of-ohio.html

Homegrown Shiitake

By Scott D. Appell



My first attempt to grow edible mushrooms at home was a disaster! As a young teenager, I purchased a mail-order button mushroom kit from Burpee. The kit consisted of mushroom spawn and compost in a growing box. The instructions said simply to add water and put the box in a cool, dark place. However, because I knew that commercial button mushrooms, *Agaricus* species, are cultured in horse manure, I decided to collect some dung from the bridle paths of Brooklyn's Prospect Park and toss it into the mix.

I also decided that the best place to put the mushroom kit was the cedar-lined closet where my father stored his woolen winter business suits. Two months later, in early November, after I'd completely forgotten about the project, a thunderous expletive rocked the apartment. My father had opened the closet and found that his entire winter wardrobe had picked up the unmistakable aroma of equine poop—and there weren't even any mushrooms to show for it.

Needless to say, I've been reluctant to grow mushrooms indoors ever since. That's not to say that you should be. These days, companies like Fungi Perfecti (www.fungiperfecti.com) sell preinoculated kits that allow you to grow everything from common pearl oyster mushrooms, *Pleurotus ostreatus,* to exotic cinnamon caps, *Hypholoma sublateritium,* indoors with relative ease.

Me, I like my fungus growing outside of the house. And I've found that an excellent candidate for this is the shiitake mushroom, *Lentinula edodes.* Humans have a lot of experience growing shiitake: The Japanese and Chinese have been cultivating it outdoors on wooden logs for at least a thousand years.

In its natural habitat, the shiitake grows on dead trees. It's what is known as a saprophytic fungus, exploiting only necrotic tissue (as opposed to a parasitic fungus, which acquires its nutrition from a living host). In cultivation, shiitake is often associated with the "shii" tree, *Castanopsis cuspidata,* hence the mushroom's common name. But it will grow on many other tree species.

Typically, you need a three-foot-long log, four to ten inches in diameter, cut from an oak, poplar, or other broad-leafed hardwood in early spring prior to bud break, when the sapwood is dense with carbohydrates. Then you inoculate the log with shiitake spawn.

Commercially packaged shiitake spawn consists of short, grooved, wooden dowels or pegs enveloped in living mycelium (a collective term for the hyphae, or vegetative bodies, of the fungus, which produce the fruiting bodies, or mushrooms). Great sources include Fungi Perfecti, Edible Landscaping (www.ediblelandscaping.com) and Mushroompeople (www.mushroompeople.com).

With an electric drill, bore holes in the log for the dowels to fit snugly into. Around 40 holes will suffice, and they should be evenly spaced, five inches apart, in a "diamond" pattern down the length and around the circumference of the log. Hammer the dowels into the holes with a rubber mallet. Then, using a small paintbrush, cap the holes with melted cheese wax—to keep harmful insects at bay and help prevent weather damage. Soak the log in water for a day and place it in a shaded spot in your garden. Shade will help the log retain moisture. During the inoculation period, the log should be sprayed with water for at least three hours per week, depending on the rainfall. In winter, cover the log with a burlap tarp.

Mushrooms may start to appear as quickly as six months, and there will be several crops or "flushes" annually for as long as six years. Harvest the mushrooms using a small, sharp knife, and use them in stir-fries, salads, soups, omelets, quiches, or whatever else takes your fungal fancy.

Reprinted from *Plants & Gardens News,* a publication of the Brooklyn Botanic Garden, Fall 2005/Winter 2006, Vol 20, No 3. Picture taken from http://www.shopterrain.com/product/shiitake-mushroom-log.

Color Comes Before the Fall: How Plants Prepare for Winter

By Patsy Cotterill

O wild West Wind, thou breath of
Autumn's being
Thou, from whose unseen presence the
leaves dead
Are driven, like ghosts from an
enchanter fleeing,
Yellow, and black, and pale, and hectic
red….
Ode to the West Wind

Percy Bysshe Shelley

Fall colors, red, yellow, orange and brown

The brilliant fall colors that we have experienced may have been enhanced by cool, overcast weather conditions. These colors appear when the green photosynthetic pigment chlorophyll begins to break down in leaves, unmasking less abundant pigments, the carotenoids, carotene and xanthophyll, and the flavonoid anthocyanin that are also present. Carotene produces the orange color in plant tissues, xanthophyll, the yellows, and anthocyanin is responsible for red, pink, blue, and purple colors. Low temperatures above freezing favor anthocyanin production, most typically seen in the red of maple leaves, and rain or cloud increases the intensity of all these pigments, which appear at their best on cool, clear, sunny days.

Carotenoids are complex organic molecules that occur in the chloroplasts of leaves and play a subservient role to chlorophyll, which absorbs the light energy used to drive photosynthesis. Carotene consists entirely of hydrocarbons, but xanthophyll also contains oxygen. Anthocyanin by contrast falls into a group of compounds called flavonoids; it is a water-soluble molecule that occurs in almost all tissues of higher plants, specifically in the cell sap, and imparts color to flowers and fruits as well as autumn leaves. Whether the hue is red, blue, purple or black depends on the pH of the cell sap, with red reflected under the most acidic conditions of low PH. Anthocyanin has an anti-oxidant role, protecting the plant against stresses such as UV light and extreme temperatures such as cold. In flowers, the color it imparts can serve to attract pollinators, in fruits to attract animal dispersal agents, and in leaves possibly to deter herbivores. Unlike carotenoids, which are present in leaves throughout the growing season, anthocyanins are only synthesized by the plant in late summer. (An exception to this appears to be our local wild sarsaparilla, whose first leaves in spring are a dark purple, changing to green as chlorophyll synthesis develops.) Anthocyanin also persists through the winter in some herbaceous evergreen leaves such as those of Bunchberry, *Cornus canadensis*. Sometimes a species' leaf color in the fall is the result of a combination of these pigments with chlorophyll-breakdown products, as in the brown of oak leaves.



Bunchberry

Simple observation of species in the fall allows one to speculate which pigments predominate in which plant or group of plants. For example, the leaves of most poplars and members of the birch family turn yellow, as do those of Green Ash, *Fraxinus pennsylvanica*, Manitoba Maple, *Acer negundo*, American Elm, *Ulmus americana*, and Larches, *Larix sp.*, while Red Osier Dogwood, *Cornus stolonifera*, Chokecherry, *Prunus virginiana*, Lowbush Cranberry, *Viburnum edule*, and Highbush Cranberry, *Viburnum opulus* var. *americanum*, are arrayed in striking hues of



Bur Oak, *Quercus macrocarpa*

pinkish-red, clearly indicating quantities of anthocyanin. While we cannot compete with Eastern Canada's native maples, our cultivated Amur Maples, *Acer ginnala,* are known for putting on striking displays of red leaves. Flower color may give a clue as to pigment content, too, and presage autumn hues: senescing leaves on Fireweed, *Chamaenerion angustifolium*, reflect its pink flowers of summer, and many of the asters which have blue, purple or white flowers show purplish coloration in their leaves come September. Roses can be pink, yellow or orange in the fall, suggesting a combination of pigments, as can European Mountain-ash, *Sorbus aucuparia*, and Saskatoon, *Amelanchier alnifolia*.

Being deciduous

In temperate climates plants undergo a number of physiological changes as they prepare for the onset of dormancy during winter. Breakdown of chlorophyll occurs during the autumn in deciduous plants prior to total leaf loss over a short period. Photosynthesis cannot occur during cold temperatures, and the leaves would be a liability in incurring water loss to the plant and snow damage in trees. (Further, although I have never read this in any literature, the replacement of leaves ravaged by insects during the growing season by a new set in the spring must surely confer a tremendous advantage!) Deciduousness is usually associated with broad-leaved trees (i.e., those having relatively large, thin, flat leaves) but some broad-leaved trees, especially those growing in milder climates, can also be evergreen. In this they resemble the conifers, shedding only some of their leaves at any given time. Judging by my back yard, however, which is now covered with pale needles in the vicinity of my White Spruce, *Picea glauca*, fall appears to be the time for maximum shed for conifers too, no doubt making way for the new leaves on shoots that will open from the growing tips in spring. Conifers are adapted to winter drought and cold by having smaller leaves with reduced surface areas: needle-like leaves (spruces, firs and pines) or small, flattened ones (the cypresses) with hard cuticles to reduce water loss during winter; being able to achieve some photosynthesis during warmer spells may confer an advantage. Absence of obstructive leaves in early spring benefits wind-pollinated plants such as poplars and willows which flower before leaf-break.

So, what causes leaves to fall?

Before the leaf dies, useful substances such as magnesium ions, amino acids and sugars move from the leaf into the plant stem and roots under the influence of plant hormones. In trees and shrubs two layers of cells are formed separating the base of the leaf stalk from the stem, an outer abscission layer and an inner (i.e., closer to the stem) protective layer of cells. The cell walls of the abscission layer are broken down and the protective layer, dotted with the remains of vein tissues, remains on the now leafless twig as a leaf scar.

Buds for next year

Since most woody plants produce next year's leaves and flowers during the growing season of the current year, protection of these embryonic shoots as buds during the winter is important for the plant's continued growth. A terminal bud forms at the end of the growing shoots, but most buds are axillary, nestled in the angles between the leaf stalk and the stem, and the tiny tissues inside are protected from desiccation and mechanical damage by a covering of modified leaves called bud scales. The resinous substance that



American Elms

gives Balsam Poplar, *Populus balsamifera*, its lovely balsamic fragrance in spring provides additional protection, particularly against water loss. Most buds are small and inconspicuous at this time of year, and will only swell and break at the onset of spring, using food reserves stored inside them. However, if you look carefully at birch family members such as Paper Birch, *Betula papyrifera*, and Beaked Hazelnut, *Corylus cornuta*, you will see next year's male catkins as narrow, slender buds projecting from the twigs.

Outsmarting frost

I have always been intrigued by how the above-ground stems of trees and shrubs manage to survive the brutal subzero temperatures of Canadian winters. Why doesn't every living cell freeze to death, with cell water turning to ice breaking the cell walls and killing the cytoplasm? Finding the answer hasn't been easy for scientists but research suggests three processes may operate: first, the usually rigid cell walls of stem tissues become more pliable, and water moves out of the cell into the spaces between the cells, where it freezes but in so doing does not harm the cell; second, the cells



Tamarack, *Larix laricina*

starch to sugars and concentrate them, forming a sort of antifreeze, so that freezing temperatures are lowered; and third, cell contents become viscous and capable of supercooling without freezing. I am not clear which of the three processes or all of them occurs in our climate, or whether it is species-dependent, so if anyone can enlighten me, please comment. Many of the cells in the vascular tissue (the wood, and sap transmitting cells) are already dead and function to transmit fluids or provide mechanical support, but clearly enough cells remain alive at the end of winter to allow their woody owners to resume growth in the spring! (I remember a grade 5 student telling me that trees "die" in the winter. I said, you know that can't be true, because they come alive again in the spring, and dead things can't come back to life!)



Highbush Cranberry

Laying up winter stores

Herbaceous plants employ a variety of strategies to survive the winter. Annuals persist not as individuals but as the next generation, as seeds, but the majority of our temperate plants are perennials, storing food in underground organs such as roots, tap-roots (think carrots and parsnips), horizontal underground stems (rhizomes), bulbs (collections of leaves, underground buds, if you like), corms (swollen stem ends), and tubers. The fact that such organs must store food to initiate the plant's growth the next spring, especially where no above-ground leaves remain to resume photosynthesis, has enormous beneficial consequences for animals, including ourselves, of course, who steal these food reserves to promote our own survival.

So, while we enjoy palettes of fall magnificence or shuffle through drifts of fallen leaves thinking of the winter ahead and how we are going to survive it, we should give a thought, too, to the physiological processes that are going on unseen inside these food-producing factories, and their amazing adaptations for survival.



Close-up of Tamarack

Reprinted from *Native Plant News,* the newsletter of the Native Plant Society of Saskatchewan, Fall 2017, Vol 22, No 3. Text and Photos by Patsy Cotterill.

Goll Woods State Nature Preserve



Eastern redbud in bloom at Goll Woods State Nature Preserve.

The oaks of Goll Woods stood tall when the Pilgrims scrambled ashore at Plymouth and when Native tribes stalked game beneath their branches. The oaks remind us of a time when the Ohio country was dominated by swamps, prairies, and forest groves. Goll Woods is a mature remnant of the "Black Swamp." This vast expanse of forests and prairies stretched from Lake Erie to Fort Wayne, hindering transportation, harboring disease, and defying settlement in northwest Ohio.

Let's look back 8,000 years to the retreat of the great Wisconsinan ice sheet at the close of the Pleistocene. Immense quantities of water were released by the melting ice. This water was dammed up since outlets to the east and the Atlantic were blocked by the uneven margin of the ice sheet. The lake thus created rose 200 feet above the present-day level of Lake Erie. This post-glacial lake eventually emptied as outlets were unblocked, exposing a vast plain of soggy soil. The new land soon was colonized by wet prairies and swamp forests. Thus, the Black Swamp was born.

Not until the 1830's did pioneers attempt to settle this swampland. In 1836 Peter Goll and his family journeyed from France to the Federal Land Office in Lima, Ohio. Goll purchased the land along the Tiffin River for $1.25 an acre.

The Black Swamp persisted until the 1850's and 1860's. Thousands of miles of drainage tiles were laid down, crisscrossing the land and robbing the swamp of its water. Forest and prairies gave way to fertile fields of corn, beans, and other agricultural crops. Within a few decades the Black Swamp virtually had vanished. Goll Woods is the largest and most mature fragment of the Black Swamp remaining in Ohio.

The terrain of Goll Woods appears flat at first glance. However the land surface undulates gently within a range of a few feet. The forest communities blend into one another with these subtle changes in elevation. Beech-maple and mesophytic oak forests grow on slightly higher and better drained sites. A mixed hardwood swamp occurs in the lower, wetter portions. At least five species of oaks are found—bur, chinquapin, swamp white, red, and white. Several of the bur and white oaks are more than 110 feet tall and have diameters of more than four feet. Other important mature tree species include box-elder, basswood, American beech, and ash. The American elms in the swamp died of Dutch elm disease many years ago.

Goll Woods is best visited in the spring when the wildflowers are many and the mosquitoes are few. Trilliums, cresses, buttercups, violets, and other showy plants make an impressive display. Two threatened plant species are especially noteworthy. Three-birds-orchid, *Triphora trianthophora*, may be seen along the woodland

trails in mid-August. Rock Elm, *Ulmus thomasii*, grows in the central portion of the swamp. This is one of only a handful of Rock Elm populations in the state.

Four generations of the Goll Family treasured the forest, protecting the big trees from insistent loggers. Only in 1916, during the lumber emergency of World War I, were a few large trees removed from the forest. The woods were acquired by the state from the descendants of Peter Goll in 1966. In 1969 Goll Woods was designated a National Natural Landmark and was dedicated as a state nature preserve in 1975.

Walk the trails of Goll Woods and gaze upwards into the high canopy of the mature oaks. Picture the Native people filing through the forest and the intrepid Peter Goll daring to settle this inhospitable country. Reflect on the drainage laws and the demise of the Black Swamp. Imagine the Goll family resisting the pressures to cut the valuable trees. Give thanks for the rare chance to glimpse Ohio's past among the oaks of Goll Woods.

Goll Woods State Nature Preserve is situated in Fulton County, approximately 3 miles north and west of Archbold, Ohio. From Archbold follow SR66 one plus miles to Township Road F. Follow TRF 3 miles west to Township Road 26. The parking lot is ¼ miles south on TR 26.

Reprinted from *ONAPA NEWS*, a publication of the Ohio Natural Area & Preserves Association, Spring 2018, Vol 5, No 2. Written by Allison W. Cusick, retired Chief ODNR Botanist.
Photo by Deb Platt; www.TREkOhio.com

A Rare Find: Sourwood, *Oxydendrum arboreum* (L.) DC.

By Marion T. Jackson



Picture taken from http://jeffpippen.com/plants/oxydendrum.htm

When the heath family, *Ericaceae*, is mentioned, we usually think of such broad-leaved evergreen or semi-evergreen shrubs as the beautifully flowering rhododendron, mountain laurel, or azalea, or such fruiting shrubs as blueberry, cranberry, huckleberry, or bearberry. Largely evergreen ground-layer herbs as *pyrola* or *pipsissewa* may also come to mind. In North America, *Ericaceous* tree species are few. Eastern U.S. has a single species, sourwood, not counting the occasional mountain laurel or rhododendron that reaches tree size. Three lovely madrone species are heath family trees in Western U.S., primarily in Texas, Arizona, and California.

Sourwood, also called sorrel tree, is a handsome native hardwood tree species that is rather widespread in Eastern U.S., ranging from Pennsylvania westward to southern Indiana and

Illinois, thence south across western Kentucky and Tennessee to Louisiana, Mississippi, Alabama, and the panhandle of Florida. Sourwood reaches its best development in the Great Smoky Mountains, southern Appalachians, and the Cumberland Plateau of eastern Kentucky and Tennessee, ascending to about 3,500 feet in the mountains.

In natural communities, it just reaches into Indiana in the two Ohio River border counties of Perry and Harrison. My good friend and outstanding Hoosier field botanist, Mike Homoya, informs me that the IDNR Division of Nature Preserves has record of only 12 present-day occurrences in Indiana, all but one in Perry County. Most populations are small, in the range of 10-50 individual trees. The largest stand (in Harrison County) has approximately 100-150 trees located on a sandstone cliff overlooking the Ohio River.

The species is typically found on dry-mesic to dry upland slopes and ridges, often on soils derived from sandstone, and often associated with oaks, hickories, gums, and occasionally American beech or hemlock. Rarely, if ever, a large member of the forest canopy—it is usually less than 60 feet tall and 20 inches dbh—sourwood is still a distinctive, lovely tree in all seasons.

In winter, its drooping, somewhat contorted branches and the gray bark tinged with red in the deep longitudinal furrows are somewhat reminiscent of sassafras, but the paniculate fruiting clusters that are often retained well into winter definitely say sourwood to the careful observer.

In spring the wondrously fresh-looking long (5-7 inch), strap-like, glossy yellow-green leaves that are entire (or nearly so) separate the tree from all others. Other leaf characteristics, incidentally, are the basis for the tree's common name, sourwood. The leaves are acidulous, hence cooling and refreshing to the mouth and tongue, and are sometimes chewed by hikers to quench their thirst during hot, humid treks. Teas from sourwood leaves, containing their natural coolant, were once used in mountain medicine to lower fevers in children.

In summer, sourwood trees are resplendent in blossoms. June or July is the time when the branch tips of the entire tree crown are covered with sprays of tiny lily-of-the-valley-like, urn-shaped, glossy white flowers. Their collective fragrance attracts multitudes of honey bees, whose combined hum announces the presence of sourwood long before you see the tree. Sourwood is one of the most prized of all wild honeys, quite the contrast to mountain laurel and rhododendron honeys, which are toxic.

A couple of years ago while visiting the Cades Cove Visitor Center in the Great Smokies, I found a pint jar of sourwood honey in the comb and savored it for weeks by careful rationing.

Autumn is when sourwood trees reach their greatest glory. In the long-slanted October sunlight, the long leaves turn the most vivid of scarlets. It is then that sourwood crowns fairly shout with color in preparation for the fall dance of gusty November.

The wood is quite hard and heavy (at 46+ pounds /cubic foot), comparable to several of the oaks and hickories, but it is little used because of the species' generally small size and the fact that it often occurs in small populations at a given site. It is used locally in turnery, for tool handles, and the red-brown, fine-grained wood makes a pretty paneling. In years past, it was the preferred wood for wooden machinery bearings, such as the "boxings" in which horse-drawn disk-harrows rotated, lubricated with axle grease.

Mountain farmers also once used slender sourwood trunks as runners for their farm sleds, the natural crooks in the tree forming the upturned ends of the sled runners.

But the real promise for sourwood's future is its use as an ornamental tree. Its generally small size makes it suitable for most lawns or landscaping sites, and it is hardy at least as far north as Indianapolis, especially if given some shelter from cold north or westerly winds.

I know of one tree in Terre Haute that is about 8 or 10 inches in diameter, and some 20-25 feet tall. I drive by the site a few times each year just to admire this lovely tree.

Marion T. Jackson is Professor Emeritus of Ecology Indiana State University.

Reprinted from *INPAWS Journal*, Indiana Native Plant and Wildflower Society, Summer 2007, Vol 14, No 2.

Folklore:

Goldenrod, *Solidago spp.*

By Denny Garvin

Goldenrods paint the landscape with shades of yellow and gold from late summer through the autumn. They develop large clusters of tiny yellow flowers which take the shapes of plumes, spikes and flat-topped bunches. There are 125 species of Goldenrod world-wide, about 90 of which are native to North America. Many species of Goldenrod hybridize making the difficult job of identifying individual species even worse.

Goldenrods are found in many different habitat types: fields, wooded clearings, swamps and sea shores. The flowers of Goldenrods produce enormous amounts of nectar and pollen. This, in turn, makes Goldenrods attractive to many different kinds of insects.

Goldenrod nectar is eaten by honeybees, bumblebees and syrphid flies. The bees and many beetles also favor the pollen. Spiders and ambush bugs commonly prey upon the many insects that depend on Goldenrod for food.

Goldenrods also attract gall-making insects. A gall is a deformity created by insects that lay their eggs on the plant. As the insect larva matures and feeds upon its host, the gall forms around it.

The most easily recognized Goldenrod gall is called the *ball gall*. It is formed in the stem of a Goldenrod. At first glance, it appears the Goldenrod got a tiny ball stuck inside its stem. The ball gall is formed by a small fly. Other galls commonly found on Goldenrods are the *elliptical gall* formed by a moth; the *bunch gall* formed by a small fly called a midge; and *blister galls* formed on the surface of a leaf, also by a midge.



Picture taken from www.bygl.osu.edu.

Goldenrod is often cursed as the source of the pollen that causes hay fever. However, Goldenrod pollen is not airborne; rather, it is carried by insects from plant to plant. The plant responsible for hay fever is Ragweed, which blossoms at the same time as Goldenrod. Ragweed's small, inconspicuous flowers are wind-pollinated, saturating the air with its pollen.

Goldenrod has a significant place in American history. After American colonials demonstrated their opposition to British taxes [taxation without representation] by dumping a cargo of taxable English tea into Boston Harbor, the subsequent shortage of tea spurred the search for a substitute. "Liberty Tea" was brewed from the leaves of Sweet Goldenrod, *S. odora,* and became a favorite of the time. This tea was considered of sufficient quality to export to China.

Native Americans drank a tea of Goldenrod leaves to treat intestinal disorders. Tea made from its leaves and flower tops was a treatment for colic. Tea from Goldenrod flowers was consumed to ease urinary disorders and dropsy (edema). Early physicians used Goldenrod as a diuretic, a carminative (to ease gas pains), as an application for bruises and wounds and as a diaphoretic (to promote sweating).

Reprinted from the Ottawa Park Nature Education Center, City of Toledo Parks, Recreation & Forestry 2000 *Teachers' Resource Packet*.

Interesting Factoid:

Using the Airbnb Model to Protect the Environment

By Seema Jayachandran

As the world's population grows, so does demand for land. One upshot is that setting aside big tracts to protect endangered species and carbon-rich forests is increasingly expensive. Enter the Airbnb economic model. While it's not a panacea, it provides attractive solutions for conservation efforts.

Much as homeowners can use Airbnb and other services to turn their living space into pop-up hotels when demand warrants it, conservationists are creating "pop-up nature reserves" on idle land.

In environments as different as North America and Africa, new programs are preserving land through short-term and long-term deals that pay people to protect nature on their own land. The innovation makes it possible to transform a binary approach to land use—either devoting it to private development or turning it into a nature reserve—into something in between.

In the United States, the nonprofit, The Nature Conservancy, has been a pioneer in bringing the "sharing economy" business model to conservation. It has been temporarily expanding wetlands for migratory birds in California's Sacramento Valley since 2014. In early fall, when birds head south for the winter, and again in early spring on their return journey, birds need larger protected areas than the current mix of parks and nature preserves allows.



Interesting Factoids:

- In other parts of the world, governments and nonprofits are compensating people for preserving forests. A conservation group's program in Uganda made annual payments to farmers if they refrained from chopping down forestland that they owned. The approach turned out to be a remarkably inexpensive way both to protect forests and to reduce carbon emissions. The farmers continued to own the land, live on it and grow crops in already-cleared areas. In essence, the conservation outfit rented the trees from the landowner, while the owner held on to other land-use rights. Buying up the forest outright and turning it into traditional reserves not only would have cost more money, but it would have displaced thousands of people from their homes. Offering payment in exchange for conservation efforts and letting people choose whether to participate also has advantages over simply banning deforestation. In the Ugandan setting, a ban would deprive poor people of much-needed income generated by selling timber or using newly cleared land for agriculture.
- Climate change and society's expanding footprint are making this dynamic approach to conservation increasingly useful. Climate change might alter natural wetlands and when and where birds migrate. BirdReturns, the Nature Conservancy program that creates bird habitats at the time of year when birds need it most, can more nimbly adjust to those changes. The team predicts the birds' migratory paths using crowdsourced data from amateur bird-watchers and combines that data with satellite images of surface water, enabling the establishment of temporary wetlands at the right times and places. Short-lived nature preserves fulfill the needs of migratory birds, but long-lasting conservation efforts using private land are urgently needed, too. Many such efforts are underway. For example, the United States already enters into 30-year and permanent easement contracts with landowners to protect wetlands or to retire land from farming.

A host of political and demographic factors make it impractical to meet conservation goals solely through dedicated nature reserves; we are fortunate to have some alternatives. Innovative programs are demonstrating how land can do double duty and competing needs can coexist. With the help of market-based approaches, one can often enlist private land to serve nature's needs. Perhaps there is an opportunity with this model to protect native plants as well.

Information taken from *The New York Times*, December 29, 2017.



Chapters of the Ohio Native Plant Society

The Native Plant Society of Northeastern Ohio
Kathryn Hanratty
PO Box 1064
Chardon OH 44024-9639
oldefarm@windstream.net
http://www.nativeplantsocietyneo.org

Cincinnati Wildflower Preservation Society
Christine Hadley, President
445 Ward-Koebel Road
Oregonia OH 45054
513-850-9585
contact@cincywildflower.org
http://www.CincyWildflower.org

The Mohican Native Plant Society
Joanne Wrasse
1633 St.Rt.603
Ashland OH 44805
419-281-3690
jwrasse@zoominternet.net

The Botanizers
The Wilderness Center
Gordon T. Maupin
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