

On The Fringe

Journal of the Native Plant Society of Northeastern Ohio

Program Schedule – Fall 2017

Saturday, September 23, noon – 3:00 pm – Monarch Tagging – North Kingsville Sand Barrens, Ashtabula County. Join Judy Semroc as we seek, tag and record monarch butterfly information at the Cleveland Museum of Natural History preserve. Weather dependent; rain date is September 24. **GPS:** N 41° 55' 52.4316", W 80° 38' 50.0208".

Sunday, October 15, 1:00 – 4:00 pm – Fantastic Fall Fungi – West Woods Nature Center.

Walt Sturgeon of the Ohio Mushroom Society will present a power point introduction to the diverse wild mushrooms of Ohio. Mushrooms will be on display, and participants are encouraged to bring mushrooms from their area. A limited-participation foray into the field to look for specimens with Walt follows. Bring wax paper or paper bags. **Pre-registration required:** Call the Park District at 440-279-0880 after September 20. **GPS:** N 41°27'29.5", W 81°18'13.9".

Saturday, October 28, 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. Randy Mitchell. He is a Professor of Biology at the University of Akron. Dr. Mitchell grew up in central California farming country, and became interested in nature at an early age, learning about entomology and beekeeping in 4H. He studied at the University of California Davis (BS) and UC Riverside (MS, PhD). He continued studies and research in New Mexico, Wisconsin, Colorado, and Australia and came to the University of Akron in the mid 90's. Dr. Mitchell's research interests include pollination, bees, and wetland restoration. Dr. Mitchell will be speaking to us about Bumblebees of Ohio and the Great Lakes: The Role of Native Plants.

Saturday, November 18, 2:00 pm – Winter Wildflower Workshop – West Woods Nature Center. After the colorful petals are gone, many of the summer wildflowers are still identifiable by their unusual seed pods. Learn how to tell many of these plants using a winter weed finder booklet. **Pre-registration required:** Call the Park District at 440-279-0880 after September 20. **GPS:** N 41°27'29.5", W 81°18'13.9".

Website:

New Study Strengthens the Need to Conserve and Plant Trees: Since the Start of Human Civilization the Earth Has Lost 46% of Its Trees

This sobering statement is based on a newly published study led by researchers at the Yale School of Forestry and Environmental Studies. The study, *Managing tree density at a global scale*, published in September 2015, found that the Earth has more than 3 trillion trees. While this is a greater number of trees than the scientists involved in the research expected, it still reflects a loss of 46% of the Earth's trees since the start of human civilization. We continue a gross loss of more than 15 billion trees annually. The researchers also believe that though perhaps 5 billion new trees grow each year, yet there is still a net reduction in the global tree population of 10 billion per year.

Nelson Henderson once said:

The true meaning of life is to plant trees, under whose shade you do not expect to sit.

To read the entire article go to <https://environment.yale.edu/news/article/Yale-study-reveals-there-are-3-trillion-trees-on-earth/>.

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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.



Top photo: early leaf striping symptoms of BLD.

Bottom photo: later stages of BLD resulting in leathery, curled leaves.

Forest Health Pest Alert**Beech Leaf Disease**

By John Pogacnik and Tom Macy

Hosts and Distribution

Beech leaf disease (BLD) affects American beech, *Fagus grandifolia*, and possibly European beech, *Fagus sylvatica*, and no causal agent has yet been identified. BLD was discovered in Lake County, Ohio in 2012. It seems to have spread quickly, especially to the east, and has been documented in the northeastern Ohio counties of Lake, Ashtabula, Geauga, Cuyahoga, Portage, and Trumbull as well as Crawford County Pennsylvania. BLD has also been reported from other areas of Ohio, NW Pennsylvania, and SW New York.

Symptoms

Symptoms of BLD have only been noted on leaves and buds. Striping or banding on several leaves on an otherwise healthy-appearing tree is the first noticeable symptom. The striping is formed by a darkening between leaf veins giving the leaf a distinctive striped appearance. This striping is often most apparent when viewing from below, looking upwards into the canopy. The darkened leaf area is raised and slightly thicker than the rest of the leaf tissue. Eventually, lighter, chlorotic striping may also occur

in the spring. Most leaves will remain on the tree until autumn. Very little premature leaf drop occurs. Later stages result in heavily shriveled, discolored, deformed leaves clustered near the branch tips as well as reduced leaf and bud production. Buds that are produced are small and weakly attached to the twig. Mortality has been noted, mainly in saplings

Disease progression varies with tree size. In sapling-sized trees, the progression from a few striped leaves to severe decline is rapid and may only take one to two years. In larger over story trees, disease progression has been slower, usually moving from lower branches upwards. Some foliage and branches that appear to be unaffected may persist on an otherwise heavily affected tree.

Biology and Spread

BLD appears to spread rapidly. Incidence of BLD does not appear to be influenced by slope, aspect, or soil conditions. In established areas, the proportion of American beech showing symptoms has been nearly 100%. Symptomatic trees may show a wide variety of other insects and pathogens, including beech blight aphid, *Grylloprociphilus imbricator*, European beech scale, *Cryptococcus fagisuga*, erineum patches produced by eriophyid mites, *Acalitus fagerinea*, and leaf fungi such as anthracnose, *Discula umbrinella*. All appear to be independent of BLD.



Clockwise from top left: advanced stages of BLD showing deformed leaves, loss of leaves and lack of bud production, and branch dieback resulting in a more open understory.

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The Eastern Wahoo of the Dugway Brook Watershed

By Jean Loria

An urban stream named Dugway Brook runs along the south border of my property in Cleveland Heights. It's a perennial stream steadily clawing its way north since its formation about 14,000 years ago during the last glacial period. It flows through portions of seven different communities east of Cleveland, tumbling down the Portage Escarpment to empty into Lake Erie. Some days the water is clear, shimmering in places where the sun touches it through the tree canopy. Other days, carrying sediment and pollution from work repairing water mains or construction of another shopping center, a murky brown tide spills over rocks and boulders. With a heavy rain, a dangerous torrent of stormwater run-off scours and channelizes the streambed. Whatever its condition today, this stream, beloved by many, is a physical and metaphorical connector for people, animals, and plants.

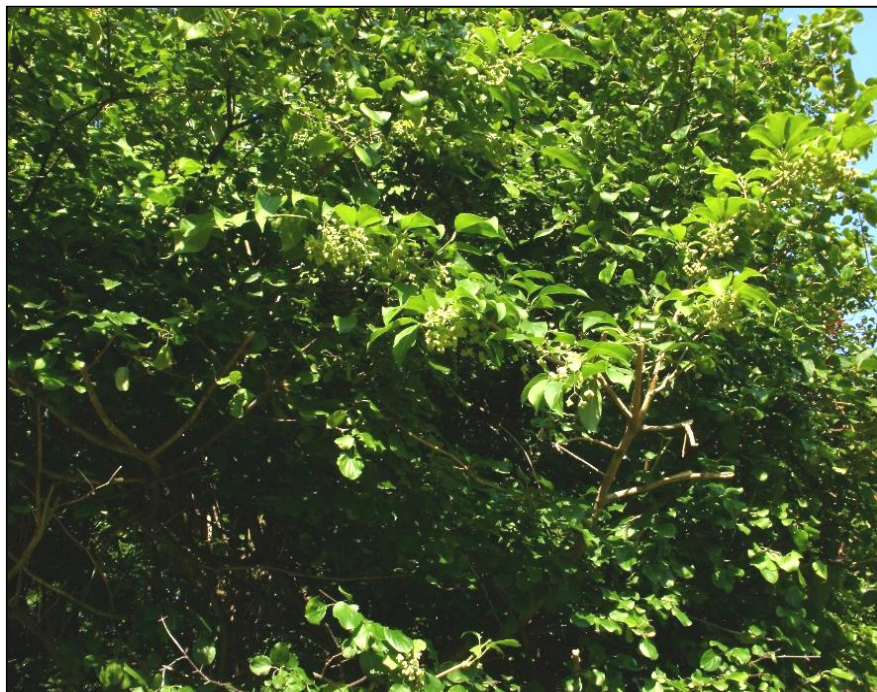
Years ago, when I first explored the brook's ravine span of a couple blocks in my neighborhood, I took note of remnants of a basketball court, makeshift ice-skating pond and overlook patios, as well as plants that survived partial landfill of the ravine during the 1930's. George Wilder, Ph.D., a former member of the Native Plant Society of Northeastern Ohio, in response to my request to the Society, did a plant survey of that particular above-ground stretch of the brook (see table). Sadly, this is the longest stretch above ground through private property of the brook's 8.7 square-mile drainage area. In his survey summary Dr. Wilder states:

Although it is filled with alien species and eroded in places, the area is worth restoring. Ample native vegetation remains of trees, shrubs, and herbs. For example, there remain nice specimens of Sugar Maple, Red Oak, American Beech, American Linden and Red Maple. But it must be protected by removing alien species. I saw no rarities.

Years later during a stream walk in the Cumberland Park stretch of the brook, we encountered a plant, though not rare, of interest: a single mature specimen of Eastern Wahoo, *Euonymus atropurpureus*, its trunk at the edge of the stream ravine, spreading its canopy to the sun. It was a very pleasant discovery!

The genus *Euonymus* has species scattered across the globe—northern temperate regions, tropical Africa, and

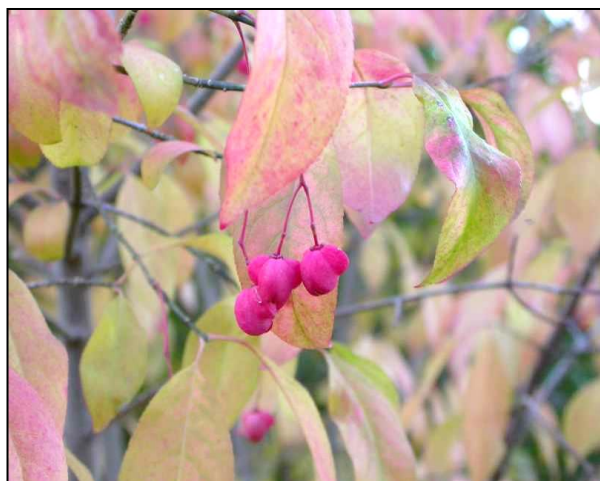
Australia, with distribution centered in the Himalayas and eastern Asia. The invasive non-native species, *Euonymus alatus*, originating from eastern Asia, is a familiar sight in our landscapes. Commonly known as Burning Bush, it has winged and corky stems. The leaves turn a striking translucent pink in the fall. Of a genus having at least 175 species, three are native to eastern North America—*Euonymus americanus*, Bursting Heart; *Euonymus obovatus* Nutt., Running Strawberry-bush; and *Euonymus atropurpureus* Jacq., Eastern Wahoo. *Euonymus atropurpureus* (*E. atropurpureus*) is a deciduous tree-like shrub typically six to ten feet in height and occasionally in some regions as tall as 25 feet. The distribution range is from Southern Ontario and Western New York south



Cumberland Park Eastern Wahoo. Photo by Jean Loria

to Alabama and Florida and as far west as Montana. It has been found in every county in Northeastern Ohio and grows in moist soils of forest, ravines, and stream bottoms. Eastern Wahoo is often found in the company of other members of the *Celastraceae* family, Bittersweet and Sumac. Other common names for this native plant are Burning Bush, Indian Arrow, and Bitter Ash. Wahoo is derived from the Dakota word “*waⁿhu*” meaning arrow wood. As this suggests, branches of *E. atropurpureus* were used in the making of hunting arrow shafts.

The tree tends to have a flat-topped irregular crown, and its elegant symmetry of branches is most notable in winter. The bark is smooth ashy gray. The branches are roundish and twigs somewhat 4-angled. Leaves, also typical of other *Euonymus* species, are opposite and simple. They are 1 ½ to 5 inches long,



dark green, thin textured, smooth above, and occasionally pubescent beneath. The petiole is 1/3 to 2/3 inches long, differentiating it from *E. americanus*, Bursting Heart, whose leaf is almost stalkless. The leaves turn a deep scarlet in fall (hence its name “*atropurpureus*,” meaning “dark purple”).

The tree blooms May–June with dark purple, wavy, ovate, 4-petaled flowers 1/3 inch in diameter. Loose, slender-stemmed clusters of 5 to 15 flowers suspended from the leaf axil are eye-catching. One of the most beautiful aspects of the plant is the very unusual fruit, which ripens in October. Four crimson, deeply cleft, smooth, flattened lobes each contain 1 or 2 seeds. By contrast, the capsules of *E. americanus* are rough and warty. The fruit appears to burst from the top of the red false aril (fleshy seed coat), disclosing the seed, but remaining

attached to it. It looks like a piece of brightly colored popcorn on a toothpick! The seeds are brown, while non-native *Euonymus* have orange arils and white seeds.

Insects attracted by the Eastern Wahoo flower and that feed on the nectar include small, mostly short-tongued, bees and miscellaneous beetles and flies. The showy red fruits are consumed by the Northern Flicker, Brown Thrasher, Catbird, Eastern Bluebird, Cardinal, Eastern Towhee, and turkeys, which disperse the seed to new locations. Caterpillars of the moths Saddleback Looper, Pyralid Moth sp., and American Ermine Moth feed on the foliage. White tailed deer browse on leaves and young shoots.

By way of warning, it's important to note that leaves, bark and fruit of Eastern Wahoo are considered poisonous. However, Native American knowledge of Eastern Wahoo root bark as medicine was extensive and is well documented. Tribes belonging to the Siouan linguistic family—from which the word “wahoo” originated—include the Dakota, Assiniboin, Omaha, Ponca, Kansa, Osage, Kwapa, Iowa, Oto, Missouri, Winnebago, Mandan, Hidatsa, Crow, Biloxi, Catawba, Tutelo, Sapna, and Occaneechi. Their territories



Pictures this page from www.missouribotanicalgarden.org.



encompassed a region we now know by the name of states stretching from Montana to South Carolina.

European colonists learned about Eastern Wahoo from the Native Americans and quickly adopted use of the bark of the root to treat various ailments. Physicians employed it as laxative, a diuretic, and for its tonic effects. During the 19th century, medicinal properties were exploited for chest and lung congestion, indigestion, and treatment of malaria and fever. A decoction of the bark was used to stimulate bile flow. In 1885, Euonymin, the name for a dried-powder solid extract used as a cardiotonic, was obtained from *E. atropurpureus*. Its physiological action corresponds closely to that of digitalis. Other significant phytochemicals are found in the plant, bark, and root of *E. atropurpureus*. It has been suggested that some of the plant's medicinal properties are consistent with the definition of an adaptogen, a compound that is able to prevent the effects of stress.

In 1909, Alice Henkel, Assistant for Drug Plant Investigation, authored a Bulletin of Plant Industry titled "American Medicinal Bark."

In this document, she described the dried bark of the root of *E. atropurpureus* as quilled pieces of irregular size; outer surface furrowed and ridged; ashy or light brownish gray color with a few dark patches of soft cork; a distinct odor and sweetish bitter, somewhat acrid taste. At that time, the root bark was sold for 9 to 20 cents per pound. Only the root bark of *E. atropurpureus* was recognized officially in the U.S. Pharmacopeia. It was listed in the National Formulary until 1947.

During a Northeastern Ohio Native Plant Society walk in Geauga Park District's Swine Creek Reservation in Middlefield, Ohio, we identified an Eastern Wahoo tree growing on the slope of a ravine. It's in an intact ecosystem showing off its graceful habit, and is certainly worth a visit.

From A.D. 900 to 1650, the area of Northeast Ohio between the Conneaut River in eastern Ashtabula County and the Black River in Lorain was inhabited by a culture named the Whittlesey Focus. (The location of each of the Eastern Wahoo trees mentioned in this article is within this area.) Much is known about this North American indigenous group from archeological data. But it is a "Pre-Contact" culture and, in fact, no European material has been documented from any Whittlesey context. After 1658 A.D., the entire south shore of Lake Erie was unoccupied. We do know that the Whittlesey hunted with bow and arrows. It's not unreasonable to speculate that they used the Eastern Wahoo for arrow shafts as well as medicine. But we'll never know their "living language" words for their people or this unusual woodland tree.

Good news! The Eastern Wahoo tree we admired during that walk along Dugway Brook in Cumberland Park in 2008 still stands, producing flowers and seed. It certainly isn't in a glamorous setting—crowded up against a chain-link fence at the entrance to a series of culverts that cloak the stream underground hundreds of feet before it enters Forest Hill Park. But apparently, the tree is protected.

Several miles upstream in my own back yard, I planted a young but already flowering and fruit producing Eastern Wahoo. Birds will drop Wahoo seeds here and there. Some will gain purchase along the Dugway Brook ravine, germinate, and grow to make a connection in an urban riparian corridor struggling to survive.

Jean Loria lives in Cleveland Heights and is a long-time member of the Native Plant Society of Northeastern Ohio. Jean Loria: upstreampermaculture@gmail.com.

Pictures on this page are of *E. atropurpureus* and were taken at Swine Creek Reservation by Tracey Johnson.



**Plant Survey of Dugway Creek, Washington
to Thayne, in Cleveland Heights
July 2, 2001**

TREES	
<i>Acer platanoides</i>	Norway Maple
<i>Acer rubrum</i>	Red Maple
<i>Acer saccharinum</i>	Silver Maple
<i>Acer saccharum</i>	Sugar Maple
<i>Aesculus hippocastanum</i>	Horse Chestnut
<i>Ailanthus altissima</i>	Tree of Heaven
<i>Carpinus caroliniana</i>	Ironwood or American Hornbeam
<i>Carya ovata</i>	Shagbark Hickory
<i>Catalpa speciosa</i>	Indian Bean Tree native or Northern Catalpa
<i>Fagus grandifolia</i>	American Beech
<i>Fraxinus americana</i>	White Ash
<i>Liriodendron tulipifera</i>	Tulip Tree
<i>Maclura pomifera</i>	Osage Orange
<i>Magnolia acuminata</i>	Cucumber Tree
<i>Populus deltoides</i>	Eastern Cotton Wood
<i>Prunus serotina</i>	Wild Black Cherry
<i>Quercus rubra</i>	Red Oak
<i>Robinia pseudoacacia</i>	Black Locust
<i>Tilia americana</i>	American Linden or Basswood
<i>Tsuga canadensis</i>	Canadian Hemlock
<i>Ulmus americana</i>	American Elm
SHRUBS	
<i>Berberis thunbergii</i>	Japanese Barberry
<i>Cornus</i> sp. sterile ??	Dogwood
<i>Hamamelis virginiana</i>	Witch Hazel
<i>Hibiscus syriacus</i>	Rose of Sharon
<i>Ligustrum</i> sp. sterile	Privet
<i>Lindera benzoin</i> (yellow flowers, 2 sexes)	Spicebush
<i>Lonicera</i> sp. sterile	Honeysuckle
<i>Philadelphus</i> sp. sterile	Mock Orange
<i>Rhamnus cathartica</i>	Common Buckthorn
<i>Rhamnus frangula</i>	Glossy Buckthorn
<i>Ribes</i> sp. sterile	Gooseberry or Currant
<i>Rubus occidentalis</i>	Black raspberry
<i>Sambucus nigra canadensis</i>	Elderberry
<i>Taxus</i> sp.	Yew
<i>Viburnum</i> sp. sterile	Viburnum
<i>Viburnum dentatum</i>	Southern Arrowwood
<i>Viburnum opulus</i> var. <i>opulus</i>	Guelder-Rose or European Cranberry bush

HERBS	
<i>Aegopodium podagraria</i>	Gout Weed
<i>Agrimonia gryposepala</i>	Agrimony
<i>Ajuga reptans</i>	Bugleweed
<i>Alliaria petiolata</i>	Garlic Mustard
<i>Arisaema atrorubens</i>	Jack-in-the-Pulpit
<i>Boehmeria cylindrica</i>	False Nettle
<i>Carex amphibola</i>	Sedge
<i>Carex blanda</i>	Sedge
<i>Carex rosea</i>	Sedge
<i>Carex torta</i>	Sedge
<i>Circaea quadrisulcata</i>	Enchanters Nightshade
<i>Convallaria majalis</i>	Lily-of-the-Valley
<i>Cryptotaenia canadensis</i>	Honewort
<i>Epipactis helleborine</i>	Helleborine
<i>Equisetum arvense</i>	Field Horsetail
<i>Euonymus obovatus</i>	Running Strawberry Bush
<i>Fragaria</i> sp. sterile	Strawberry
<i>Geum canadense</i>	White Avens
<i>Glyceria striata</i>	Manna Grass
<i>Hedera helix</i>	English Ivy
<i>Hemerocallis</i> sp. sterile	Daylily
<i>Juncus tenuis</i>	Poverty Rush
<i>Leersia oryzoides</i>	Rice Cutgrass
<i>Lysimachia nummularia</i>	Moneywort
<i>Onoclea sensibilis</i>	Sensitive Fern
<i>Oxalis</i> sp.	Wood Sorrel
<i>Pachysandra terminalis</i>	Pachysandra
<i>Phytolacca americana</i>	Pokeweed
<i>Poa nemoralis</i>	Blue Grass
<i>Podophyllum peltatum</i>	Mayapple
<i>Polygonum cuspidatum</i>	Japanese Knotweed
<i>Prenanthes</i> sp. sterile	Rattlesnake Root
<i>Prunella vulgaris</i>	Self-heal
<i>Scirpus atrovirens</i>	Bulrush
<i>Solidago caesia</i>	Bluestem Goldenrod
<i>Thalictrum dioicum</i>	Early Meadowrue
<i>Tovara virginiana</i>	Jump seed
<i>Vinca minor</i>	Myrtle
<i>Viola</i> sp. sterile	Violet
VINES	
<i>Parthenocissus</i> sp.	Virginia Creeper
<i>Solanum dulcamara</i>	Climbing Nightshade
<i>Toxicodendron radicans</i>	Poison Ivy
<i>Vitis aestivalis</i>	Summer Grape
<i>Vitis riparia</i>	Riverside Grape

Folklore:**Bittersweet Nightshade, *Solanum dulcamara*****By Denny Garvin**

Look carefully at the plants climbing the fence or hedges in your yard. If you notice a small, green vine with tiny purple flowers containing a central yellow cone, you have found Bittersweet Nightshade. Its flowers resemble tiny lampshades. After pollination, the flowers are replaced by berries which turn brilliant red when mature.

Of this beautiful little vine's inviting fruit, Henry David Thoreau once wrote,

I do not know any clusters more graceful and beautiful than these. They hang more gracefully over the river's brim than any pendant in a lady's ear. Yet, they are considered poisonous; not to look at surely ... But why should they not be poisonous? Would it not be bad taste to eat these berries which are ready to feed another sense?



Conventional wisdom suggests that the entire plant is poisonous; however, there is considerable disagreement as to the accuracy of this belief. This common plant is not to be confused with Deadly Nightshade, or Belladonna. That extremely poisonous native of eastern and central Europe is rarely found in North America.

Bittersweet Nightshade is a native of Europe and Asia, but it has naturalized throughout North America. It prefers damp soils and is found in streambanks thickets, fencerows, hedges, tall weeds and gardens.

It is a vine. It cannot support its own weight and therefore it climbs objects taller than itself to reach sunlight.

Its flowers bloom from late spring to early summer. Its berries first appear in mid-summer. The mature red berries are attractive to many birds and their droppings often contain Bittersweet Nightshade's indigestible seeds, which fall onto the soils beneath fences and telephone lines.

Bittersweet Nightshade is a member of the world's largest genera of plants, which includes Egg Plant, Potato, Tomato and Tobacco. Its genus, *Solanum*, is Latin for "quieting" or "healing". It is the same

root from which our word "solace" comes.

The species name, *dulcamara*, refers to the flavor of the berries, at first bitter then unpleasantly sweet.

Despite this plant's alleged toxicity, it was once commonly applied as an external remedy for diseases of the skin and for sores and swellings, especially for those inflammations around fingernails and toenails known as felons. Modern pharmacologists have found that extracts from this plant do show antibiotic activity, explaining their traditional use in treating external sores and inflammations.

Modern research has discovered that Bittersweet Nightshade contains beta solamarine, a tumor-inhibiting agent that may offer promise in the fight against cancer.

Bittersweet Nightshade is also known as Felonwort, Fevertwig, Poison Berry, Scarlet Berry, Violet Bloom and Woody Nightshade.

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

Picture taken from www.commonswiki.org.

Encrusted saxifrage, *Saxifraga paniculata*

By Grant Dobson

Occurring on both sides of the Atlantic Ocean and from the Arctic regions of Canada south to rocky, high elevation areas of New England, encrusted saxifrage, *Saxifraga paniculata*, is a most interesting study in phytogeography. Also known as white mountain saxifrage, it is one of the easiest plants to grow in a native rock garden setting.

Saxifraga is an incredibly large and diverse genus, encompassing around 480 species of alpine and woodland plants. It was named for its supposed ability to open up cracks in the rocks it calls home.

The “encrusted” group have finely toothed leaf-margins edged with calcium carbonate (lime), giving the plant its characteristic silvery appearance. This lime is absorbed from water seeping through crevices in the rock and subsequently excreted through pores at the base of each tooth. The plant is easily identified by its distinctive, tight basal rosette of leaves one to two centimeters (two-fifths to four-fifths of an inch) long. Flowers containing both male and female parts are borne on stiff, arching stems 10 – 30 centimeters long (four inches to a foot) in early summer. The showy, five-petaled white flowers are finely flecked with purple dots.

Towards the end of our last glacial period, approximately 11,000 years ago in eastern North America, Lake Algonquin, the forerunner to our modern upper Great Lakes, had formed, draining south through the present-day Mississippi River system. As the Wisconsin Glacier retreated north, a lower drainage elevation called “Fossmill” (named for the nearby ghost town of the same name, just northwest of Algonquin Provincial Park) opened through the park and into the then Champlain Sea. This immense flow of water (some scientists suggest that it equaled a thousand Niagara Falls) sliced deep gashes into a southeast-trending fault line. Cliffs and canyons formed and, in the prevailing arctic-like conditions, encrusted saxifrage found a home. Leap ahead several centuries and a still lower outlet, now through the Ottawa Valley, opened up. Deprived of most of their water supply, the canyons became silent; a relatively short geologic period of spectacle and fury had ended.

Preferring cool, north facing, lime-containing rocky ledges, or narrow crevices, and often growing out of moss mats, this saxifrage remains as one of the few holdovers from another era. Not programmed to be a



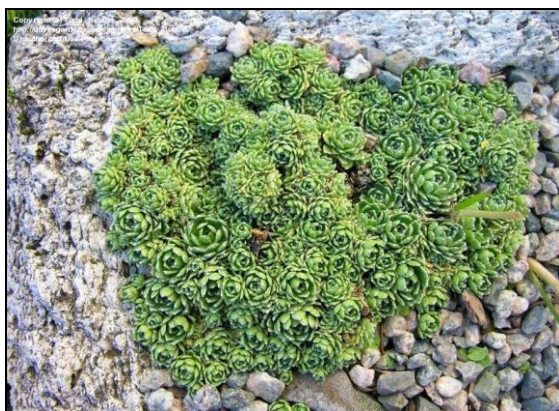
Picture taken from www.minnesotawildflowers.info

strong competitor to southern-ranging species, and with somewhat unusual habitat requirements, it has an exceedingly limited amount of suitable habitat. Listed as a Threatened species in most of its southern range, it occurs in only a handful of relict populations, widely separated from its main range. Next to the very localized sites of encrusted saxifrage near where I live, the closest location in Ontario is along the north shore of Lake Superior, hundreds of kilometers away.

On the positive side, *Saxifraga paniculata* is among the easiest perennials to propagate, comparable, in fact, to many species in the genus *Sedum*. The plant produces new rosettes every year, at the ends of horizontal stolons. These can be severed and pushed into moist rooting media. My wife and I use any standard soilless mix, amended with equal parts sharp sand.

After a usual three-to-four-week rooting period, we grow them in small eight-centimeter (three-inch) pots until they are planted out to the rock garden. We also grow them from seed; it's just as easy. Sow the seeds on the surface of the medium and place a loose piece of clear plastic over the tray.

This saxifrage makes an interesting addition to a native trough garden. With its propensity towards limestone, it works very well on tufa. However, most of our plants grow on a three-meter (10-foot) high cliff garden established five years ago. *Saxifraga paniculata* now self-seeds, naturalizing in combination with maidenhair spleenwort, *Asplenium trichomanes*, pale



Picture taken from www.davesgarden.com

Corydalis, *Corydalis sempervirens*, and slender rock brake, *Cryptogramma stelleri*.

Other than trimming off the seed stalks in late summer and removing extra stolons from time to time for propagation, encrusted saxifrage has taken no effort to maintain. Its perky evergreen leaves are always a welcome sight in a mid-winter thaw.

Habitat changes, due to climate change, make it imperative that we preserve the genetics of these relict populations and keep their story alive.

Grant Dobson and his wife Dorothy have more than 70 years of gardening experience between them and are now semi-retired from their greenhouse and garden center business. This leaves more time to pursue Grant's dual passions of developing a botanic garden of Ottawa Valley indigenous plants (www.connaughtnursery.com) and volunteering in the development of a nearby outdoor education center (www.shawwoods.ca).

Reprinted from the Blazing Star, a Newsletter of the North American Native Plant Society, Winter 2013, Vol 14, No 1.

Harvesting Seeds

By Cherry Dodd

September is the main seed harvesting month, and you will find that with a bit of practice it is easy to save the seeds from your favorite plants. Not all seeds ripen at the same time, so look at the stems and seed heads to determine if it's harvest time. The seed head should look dry and beige or brown, and sometimes the stem will look dryer or brown too. Of course there are exceptions to this rule.

Giant Hyssop seed heads often look purple, and tinged with patches of brown or green—very confusing. But if you just shake the seed head over your hand and you can see the tiny seeds, they are ready to collect.

You can use this method to test most plants with capsule seed heads. These species include Slender Blue Beardtongue, *Penstemon nitidus*, and other penstemons, Wild Bergamot, *Monarda fistulosa*, and Harebells, *Campanula rotundifolia*. In some

species with a capsule type of seed head, such as Blue-eyed Grass, *Sisyrinchium montanum*, Nodding Onion, *Allium cernuum*, and Wild Blue Flax, *Linum lewisii*, the capsule will open when it is mature, and you will be able to see the seeds inside, but they do not fall out easily. In the case of the violets, *Viola spp.*, the capsules pop out the seeds shortly after they open, so it is best to pick the closed capsules and let them open in a bag. Immature violet capsules are nodding and point towards the ground. Mature capsules point straight up in preparation for opening, so these are the ones you should pick.

Fluffy seeds are the easiest to collect. Daisy-like flowers such as the Asters, Arnicas, *Arnica spp.*, and Fleabanes, *Erigeron spp.*, all have fluffy seeds. The Goldenrods, *Solidago spp.*, Blazingstars, *Liatris spp.*, Groundsel, *Packera spp.*, Hairy Goldenaster, *Heterotheca*

villosa, and Pussytoes, *Antennaria spp.*, also have fluffy seeds. The seeds are ripe if they detach easily from the plant, so just gently pull them off and put them into a paper bag.



Buttercup seed head
Taken from www.pinterest.com

Grasses and sedges can usually be tested by pulling gently along the seed head. The seeds will detach easily when they are mature. Then just cut the stalks and place them in a paper bag.

A lot of species have unique seed heads. Low Milkweed, *Asclepias ovalifolia*, for example, has big fat pods which split open to reveal tightly packed white silken parachutes, each attached to a flat brown seed. Heart-leaved Alexanders, *Zizia aptera*, are members of the carrot family, and the seed heads look a bit like dill. The flower stem ends in a cluster of smaller stems pointing straight up. These smaller stems each support a cluster of seeds, also pointing straight up. The seeds are ripe when they are brown and detach easily. Gaillardias, *Gaillardia aristata*, seed heads form balls which are not particularly brown or dry. When the seeds are ripe, they will begin to detach and can be seen lying on top of the ball. The whole seed head can then be cut off, but be careful—Gaillardia seeds can be a bit prickly. Later in the season, when the Gaillardia seed head has lost the remains of the flowers and only the seeds are left, the seed head will finally be dry, and will look like a smaller silvery ball.

Gumweed, *Grindelia squarrosa*, lives up to its name. The seeds are hidden inside an aromatic brown cup that is gummy and very sticky. The seeds are mature when the stem is starting to brown and dry. The whole seed head can be cut off and put in a paper bag to dry. The Buttercups, *Ranunculus spp.*, have relatively large seeds that are often bright green or yellow when they are ripe, but they are also



Campanula silver bells seed heads
audaxdesign.co.uk



Pussytoes fluffy seed heads
www.friendsofthewildflowergarden.org



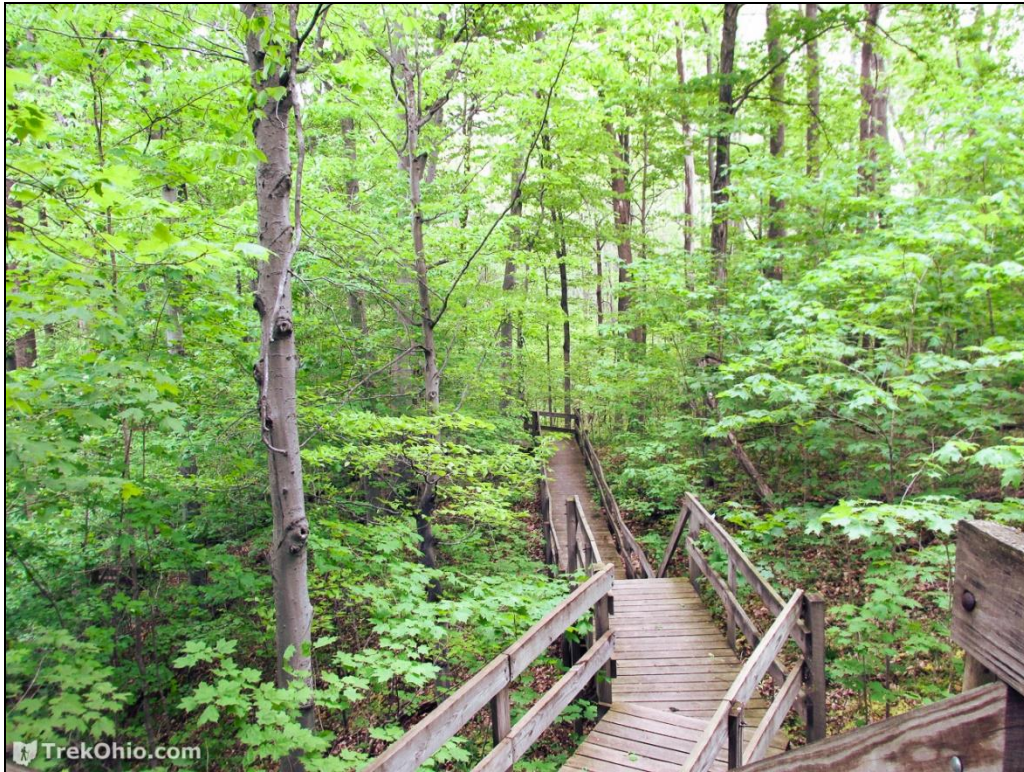
Common milkweed seed pod
www.extension.umaine.edu

sometimes brown. Run your fingers over the seed head. If the seeds fall off they are ready.

Put your collected seeds into paper bags so that they can finish drying naturally. Sometimes it's easiest to cut off the whole seed head. Sometimes you can just shake the seed head over the paper bag. Use a different bag for each species, and be sure to label them or you will end up with "mystery seeds." It's important to use paper so the seeds can dry properly before storage. Once you have collected your seeds, let them dry for a few weeks before cleaning them and storing them.

Note: If you want to learn more about harvesting and growing native seed, there is an excellent book entitled *Cultivating Our Roots: Growing Authentic Prairie Wildflowers and Grasses* by Native Plant Society of Saskatchewan member and native plant and seed grower Nora Stewart. Her book is available in most bookstores as well as the online store at <http://www.npss.sk.ca>.

Reprinted from the *Native Plant News*, a Newsletter of the Native Plant Society of Saskatchewan, Vol 20 No 3, Fall 2015.

Collier (Howard) State Nature Preserve

An elaborate stairway/boardwalk descends toward the Sandusky River flood plain.

Howard Collier is a 115-acre state nature preserve located in Seneca County in northwestern Ohio. This natural area, located on the Sandusky State Scenic River, was originally acquired as a Scenic River area. In addition to the large wooded riverine corridor, with an excellent floodplain community containing large oaks, sycamore, ash, tulip and cottonwoods, the area also has an impressive rugged topography.

The trail follows the ridgetop and then drops dramatically over the hillside to the floodplain of the Sandusky River. The woods contain numerous large beech trees as well as a spectacular diversity of spring wildflowers including sharp-lobed hepatica, Dutchman's breeches, squirrel-corn, three trillium species, twinleaf, white and yellow trout-lily and marsh marigold. The display of marsh marigolds and skunk cabbage found in the floodplain is particularly striking in early May.

The site is named in honor of former state budget director, Howard Collier, who was instrumental in allocating funds for the acquisition of the park land.

The Collier preserve features a loop trail with an impressive staircase/boardwalk that leads down into the flood plain. The Sandusky River can be viewed from a couple of short side trails off the loop. There is also one more extensive side trail that leads to a township road that crosses the Sandusky River at Heck's Bridge. The total mileage for the hike is 1.56 miles.

Hike the loop trail clockwise, which allows you to start your hike by descending a lengthy wooden staircase down to the flood plain adjacent to the Sandusky River. Obviously if you go down you have to come back up again, but the dirt path leading back to the top seems gradual enough that it is not an issue.

Located approximately 3 miles northeast of McCutchenville at the southwestern edge of Seneca County. From McCutchenville, proceed 3 miles east on County Rd 58, then .5 miles north on Township Rd 131, and .25 miles east on Township Rd 38.

Information for this article taken from www.naturepreserves.ohiodnr.gov and www.trekohio.com.

Indian Pipes, *Monotropa uniflora*

By Stephen Johnson and Mary Stark

Over the centuries the plant we call Indian pipes, *Monotropa uniflora*, has had many common names, juggled taxonomic affinities, misunderstood ecological relationships and superseded therapeutic uses. It also inspired an American poet.

Indian pipes has been variously called corpse flower or death plant, suggesting that its appearance noted the place where a dead body has been buried. Pioneer herbalists may have named it convulsion flower or fits flower since they believed it cured spasms. The name ice plant comes from the apparent melting of the crushed stems when rubbed in one's hands. Whimsical names such as bird's nest and fairy smoke have also been bestowed upon this other worldly looking plant.

When shaded in its natural forest habitat, the plant appears to be made out of pure white candle wax. If you happen upon Indian pipes in a sun fleck, you will be treated to a diaphanous, crystalline display suggesting one of Peter Carl Faberge's finest amethyst flower pieces for Tsar Nicholas II.

Its taxonomy is in continuous flux. By some it is lumped with the Ericaceae, by others in the Pyrolaceae, and by yet others in its own family, the Monotropaceae. It's not uncommon among taxonomists to be moving plants from one family to another. For the genus *Monotropa* the changeable affiliation is enhanced by several features. First, many taxonomists demote the family Pyrolaceae to a subfamily of the Ericaceae. Also, wax flower, *Pyrola aphylla*, is usually leafless and has a mycotrophic

relationship similar to that of Indian pipes. Wax flower also shows how Indian pipes may have evolved from photosynthetic ancestors; a rare form of *Pyrola aphylla* produces green leaves.

There is also much confusion about Indian pipes' relationship with fungi. Some authors relate how *Monotropa* derives nutrition from rotting leaves but they do not implicate a symbiotic partnership with mycotrophic fungi. Others label Indian pipes as a saprophyte only indirectly associated with fungal breakdown of leaf litter. In fact, *Monotropa* is what is called an epiparasite and forms part of a triumvirate of tree/fungus/Indian pipes. The plant interjects itself into an existing symbiotic linkage between fungus and tree and is called a "cheater" by some. The one necessary part of the relationship is that Indian pipes only parasitizes fungi of the genus *Russula* or a few other members of the family Russulaceae. It is also part of the mycorrhizal relationship, at least the anatomical features of the relationship. That sets *Monotropa* and its close relatives apart from both the Ericaceae and Pyrolaceae. The fungal net around the roots of *Monotropa*

has particular sets of penetrating hyphae that give the relationship of fungi to *Monotropa* the term Monotropoid.

On glacially derived mineralized soil, Indian pipes typically appears in late summer or early autumn in the vicinity of white or red oaks, *Quercus* spp., and in the company of several *Russula* species. However, we have seen Indian pipes growing under dense pine tree cover (*Pinus* spp.) and obviously very acidic soil. Apparently soil pH is not a factor in growth; the only critical factor is the presence of a *Russula* species mycorrhizally associated with native trees. In dry years Indian pipes may not appear.

Deer are not attracted to Indian pipes because the plants contain several cardiac glycosides. But how can a non-photosynthetic plant make these carbon-rich glycoside molecules? While much of the carbon available to *Monotropa* comes from the tree by way of *Russula*, it seems that *Monotropa* has another trick up its botanical sleeve. To a small degree, *Monotropa* is capable of carbon fixation; it performs phosphoenolpyruvate (PEP) carboxylase activity. PEP carboxylase is a four-carbon (C4) atmospheric carbon-capturing molecule usually associated with tallgrass prairie dominant grasses. This presence of PEP carboxylase may also help to distinguish the Monotropaceae from the Pyrolaceae and the Ericaceae, which are both primarily three-carbon plants. The flowers, typically hidden, are equally diaphanous. In fact, the only visible non-white-tissue-paper features are the amber anthers. The relatively large flowers are chiefly visited



by bumble bees, although hover flies and paper wasps also come by to drink their nectar.

Humans have had an interesting relationship with Indian pipes. In the 19th century boiled concoctions of *Monotropa* were considered treatments for epilepsy (hence the name convulsion root) or eye problems. Also that century, naturalists such as the indefatigable polymath Constantine Samuel Rafinesque and many physicians prescribed Indian pipes for eye troubles. Sap from crushed stems was drizzled directly into painful, swollen eyes.

In the 1940's, Harvard botanist Merritt Lincoln Fernald, citing a previous attempt by a Nova Scotian to cook the plant for food, tried it himself expecting it to taste something like boiled asparagus. Instead, he had this reaction: "Our single experiment was not gratifying in its result."

Indian pipes was one of poet Emily Dickinson's favorite forest flowers from childhood. A devoted plant collector in her youth, she created an interesting pressed flower collection which included Indian pipes. Before she died, a friend painted a watercolour of Indian pipes

for Dickinson. She told her friend: "That without suspecting it you should send me the preferred flower of life, it seems almost supernatural, and the sweet glee I felt at meeting it, I could confide to none."

Whether you view it as a "preferred flower of life", an epiparasite or a "cheater", *Monotropa uniflora* may continue to flourish as long as trees abound in association with the critical fungi, the Russulaceae. But as we saw during the severe drought of 2012, it also takes sufficient rainfall to spark life into the triumvirate and bring forth the tiny Faberge jewel of the forest.

Mary Stark came to an appreciation of plants through literature. Stephen Johnson enjoys studying intricate symbiotic plant relationships such as the one involving Indian pipes.

Reprinted from The Blazing Star, the newsletter of the North American Native Plant Society, Fall 2012, Vol 13, No 4.

Picture taken from www.denniskalma.com.

Wild Cucumber, *Echinocystis lobata*

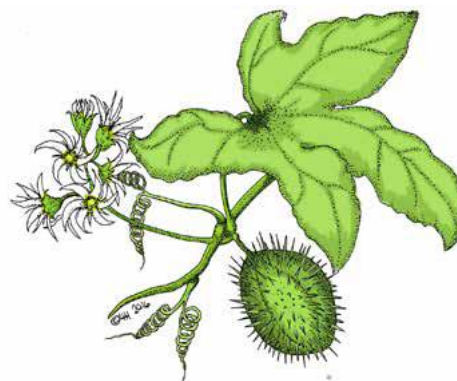
By Lorraine Kaufman

One late summer day at our farm, I was out looking for whatever I might find, knowing that interesting and unusual discoveries often appear when least expected. I glanced up into the branches of a cedar tree and saw there dangling before me a green, oval "something" about the size of an egg and covered with prickles. It wasn't hard to imagine that some woodland spook had been out playing tricks or had simply started its Christmas decorating early.

Not wanting to succumb to some superstitious notion, I went to my books and learned that the green, fleshy fruit I saw is called a pepo, and it is produced by the wild cucumber, *Echinocystis lobata*. Also called mock wild cucumber or wild balsam apple, this is a native annual vine that grows quickly in moist soil from seed to a 20-30-foot-long vine in a single season. It has long tendrils that curl around anything it contacts, enabling it to ascend trees, fence posts, or simply to blanket the ground when there is nothing to climb. The wild cucumber produces both male and female flowers, which bloom in late July and August, though the greenish-white male flowers are larger, fragrant and more conspicuous. Its green, fleshy fruit, the pepo, resembles a small rounded cultivated cucumber about two inches long but covered with long soft spines. When dry, the pepo puffs out, splits at the bottom, and drops its seeds to the ground. Unlike some plants' inscrutable genus names, the *Echinocystis* is quite descriptive in the Greek: "echinos" meaning "hedgehog" and "cystis" meaning "bladder."

This native vine and its pods can make attractive additions to dried arrangements when collected in the fall. Often considered a weed when climbing on trees, shrubs, or structures, it causes no harm and is a fascinating find when you encounter it. Neither endangered nor threatened, it is rare, so if you find it, congratulations!

Reprinted from the Newsletter of the Kansas Native Plant Society, April 2016, Vol 38, No 2.



Invasive Plant:**Ohio Invasive Plants Council**

With 41,000 miles of waterways and with more miles of road than any other Midwest state, Ohio is a cross-roads for people, commerce, for invasive species. The Ohio Invasive Plant Council (OIPC) has taken an active role in participating in efforts to address the threats of invasive species. One major effort has been to update the list of invasive plants in Ohio. OIPC is currently revising the list through the application of the Ohio Invasive Plant Assessment Protocol. Please see the OIPC home page for an explanation of this process, the assessments completed to date, and the schedule of plants to be assessed: <http://www.oipc.info/>.

Approximately 50,000 non-native plant and animal species have been introduced to the United States, which can cause more than \$34 billion a year in damage to the environment, forestry, agriculture, industry, recreation, and human health. At least half that number are plants.

Rapid growth, high reproductive rates, lack of natural controls, and an ability to tolerate a wide range of environmental conditions have helped some non-natives outcompete and displace native species. Invasive species reduce biological diversity, change food webs, and displace wildlife. At least 42% of the federally endangered and threatened species in the United States are at risk because of invasive species.

The introduction of many non-native plant species was deliberate and well-intentioned. Some had medicinal qualities, others were valued in horticulture, for forage, and for erosion control. Other species arrived by accident—stowaways in cargo and ballast. Potential for invasiveness was neither known nor considered. Human population growth, environmental alteration, and the vast increase in worldwide trade have created more opportunities for the introduction and spread of invasive species.

Of the approximately 3,000 plant species known to occur in the wild in Ohio, about 75% are native (present before the time of substantial European settlement—around 1750). Of the remaining 25% (more than 700 non-native plants), fewer than 100 are known to be problems in natural areas. The most invasive of these degrade Ohio's woodlands, wetlands, and prairies.

Some of the worst invasive plant species in Ohio's natural areas include:

Tatarian bush honeysuckle



Garlic mustard



Reed canary grass



European buckthorn



Purple loosestrife



Autumn-olive



Tree-of-heaven



Hungarian or smooth brome



Canada thistle

Information for this article taken from www.oipc.info. Photos from Ohio Department of Natural Resources. Only a sampling of its pictures was used for this article. Go to this website to see the full picture gallery.

Book Review:

Goldenrods of Northeast Ohio: A Field Guide to Identification and Natural History

By Judy Barnhart

Publisher: Cleveland Museum of Natural History (2017)

Pages: 80 pages

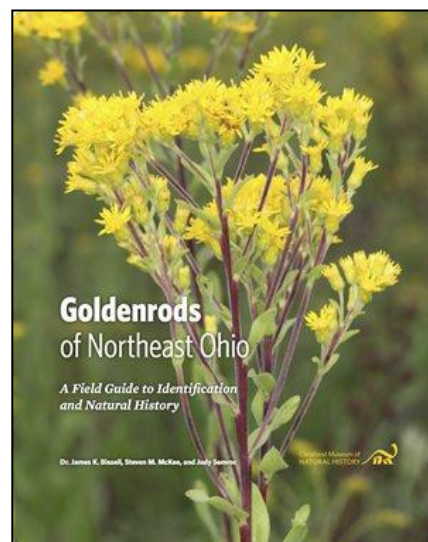
ISBN-10: 0692838136

ISBN-13: 978-0692838136

Spiral-bound

Price: \$12.99

Size: 10" x 8" x 0.2"



Just received my copy of the new goldenrod guide put out by the Cleveland Museum of Natural History. I waited a couple days for the goldenrods to start blooming, then tried it out. The guide begins with a description of the five contributors: James Bissell, Steve McKee, Judy Semroc, Lucy Williams, and Trish Fox. Sections include what is a goldenrod, where to look for goldenrods, the role of goldenrods in the ecosystem, allergy woes, goldenrod galls, definitions of plant parts, a simple 4-page dichotomous key, a section with colorful 2-page descriptions of the 19 species and a glossary. The ring binding on the left side and thick glossy pages made flipping easy.

To test the key from the side of the road, I grabbed a goldenrod that I already knew. Then I went through the key deciding: shape of the flower head (terminal or pyramid shape), arrangement of the flowers (one sided or axial), leaf shape and size, stem (smooth or hairy, round or angled), leaf thickness and degree of teething. My specimen easily keyed out to Early Goldenrod. Upon reading the detailed description, I discovered the large basal leaves gradually taper in size up the stem.

It's a beautiful start to the summer goldenrod season. The light weight of the guide makes it easy to carry into the field in a small back-pack. I highly recommend picking one up either by going online to Amazon.com or sending a check payable to Cleveland Museum of Natural History for \$18.00 (covers tax and shipping) to:

Botany Department
Cleveland Museum of Natural History
1 Wade Oval Drive
Cleveland, OH 44106

Judy Barnhart is Vice President of the Native Plant Society of Northeastern Ohio. She has been a naturalist for the Geauga Park District for 26 years.

Interesting Factoid:

Plant Blindness

The concept of plant blindness has been around for almost 30 years. It suggests a lack of attention to the abundance and importance of plant life surrounding oneself. Elisabeth Schussler and James Wandersee introduced the term ‘plant blindness’ in 1998 after years of discussion and research. Their definition is broad: “the inability to see or notice the plants in one’s own environment, leading to the inability to recognize the importance of plants in the biosphere and in human affairs,” in addition to the “inability to appreciate the aesthetic and unique biological features” of plants and “the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that they are unworthy of human consideration.”

Richard Louv argues that “our loss of connection to natural history represents a lost relationship,” and that this connection “is among the most important and least recognized needs of the human soul.” He quotes Harwell and Reynold’s *Exploring a Sense of Place*, which asks: “how many of us identify with and understand the beauty, wonder, and actual functioning of the natural ecosystem which supports us, and of which we are a part?”

Unlike people in rural areas who have more direct contact with plants, or indigenous communities which use plants for food and medicine, most urban populations don’t really notice plants around them or overlook them even if they are in their own environment. Why is this? The following offers support for this phenomenon.

Interesting Factoids:

- We tend to be “zoocentric” or “zoochauvinistic” because animals move around, catch our attention, and have more visual appeal. Multiple studies have found that people are automatically drawn to images of animals rather than plants, and more readily recognize and remember them. Plants don’t entertain or respond to us like animals do. They generally grow close together, do not move, and often blend together visually, so they often go unnoticed. We may notice them only if they are visually conspicuous as when they are in bloom.
- We learn plant blindness in our schools. For example, biology textbooks give much less space to plants than to animals, potentially leaving schoolchildren with the impression that plants don’t matter. A study of two nationally syndicated textbooks in the US showed that animals are given specific names like a lion or tiger or deer, whereas plants are generically called “trees” or “grasses.” Moreover, most curricula do not encourage direct contact with plants.
- Humans can only recognize visually what they already know. “*Inattention objects*” become “*attention objects*” only when they have acquired meaning for an observer. Our vision is shaped by our experiences. Children are more likely to notice individual plants, if they have engaged in prior plant related activities. Such activities shape the subsequent attention level they allocate to plants. Children who are involved in gardening at school or at home, for example, are much more likely to develop an interest in plants and will more likely grow up to learn the importance of plant and biodiversity conservation.
- Our visual information processing system is also responsible for how we see plants. Our brain combines plants visually, so we don’t see distinct plants or sets of leaves, but rather a “green blur.” Plants become the “backdrop.” When we watch a herd of elephants roaming across an African plain, for example, we see the elephants, but hardly think of the huge population of plants the elephants are moving among.



- Food invariably comes in prepackaged form; we no longer have to gather or grow food. This is especially true of urban populations, who have lost the connection with the entire lifecycle from planting seeds to growing a food crop and harvesting it.

People tend to notice and reflect on things in their environment that they can identify with. Many people do not identify with plants. Dr. Momsen says, “I do think the public disconnect from wild plants or agriculture is a symptom of the same problem: removal or distance from those ecosystems.” Most of us don’t see plants on the side of the road as medicines, dyes, fuel or food, as our great-grandparents might have, and the loss of that green heritage has a way of reinforcing itself.

Occasionally, plants break through this blindness to divulge a showy flower, provide a shady spot, clog sinuses or leave a thorn in our sides. In these fleeting moments when plants butt into our lives and force a relationship, we can see a hint of the dynamic beings they are. Plants scrap for survival just as relentlessly and creatively as any animal. They entice pollinators with scents ranging from the sweet smell of a rose to the rancid stink of a corpse flower, repel herbivores with thorns and poisons, and devour insects caught with sticky traps. But without someone pointing out how and why that plant is acting up—without compelling education and mentorship—the moment is likely to be lost.

That’s a shame, because that moment of awe hints at a deeper truth: we live in a green world. Plants shape ecosystems from the ground up, and indeed, form the foundation of life on earth, including us. They produce the energy that courses through wild and human food chains, and in the process let off the oxygen that we’re depending on right now, with each breath we take. They regulate temperature, slow erosion, and filter water and air. Plants are the fibers and the colors in our clothes, the medicine in our cabinets, the food on our plates, and the timber in our houses. It’s impossible to overstate how central plants are to our lives and our world, even if we often overlook them.

But plant blindness isn’t just a spiritual loss to be lamented; public disconnection from plants has contributed to major recruiting problems in agriculture and botanical sciences. Reflecting flagging interest, since 1998 the number of research universities offering botany degrees has dropped by half. The number of farmers is also at an historic low, putting strains on agriculture. The number of new farmers was down 20 percent from 2007 to 2012, the year of the USDA’s last “Ag Census,” and that year the average age of an American farmer had crept up to a little over 58 years old.

The dwindling supply of fresh blood in plant-based professions is particularly alarming as ecosystems around the world change at an unprecedented scale and rate.

As climate change progresses, droughts, floods, and temperature swings will shift how we grow crops in ways that are hard to predict. Now more than ever, we need people knowledgeable about plants to grow our food, protect our natural resources, and help humans diagnose and adjust to these changes. Global agriculture must meet the demands of a growing population with rapidly changing tastes in unpredictable conditions. And that’s all before even considering conservation of wild ecosystems and biodiversity. This is no time to be blind to plants.

So, have we seen a flower ... *truly* seen a flower? Have we studied the plant when its flowers have fallen and it is not in bloom? Have we raised it from seed and met its requirements for growth and flowering? Have we noted its similarities and differences with respect to the other flowers that we know? Have we identified it accurately by its suite of characteristics? Can we name its parts properly? Have we viewed that flower through the lenses of its structure, its foliage and stem, its floricultural history, its environmental stresses, its pollinators, our prior knowledge about it, its sociocultural significance, its evolutionary pathway, and its changes across geologic time? Have we compensated for the biases of our own visual observation system?

Maybe what many of us have really done up to now is akin to just glancing. Perhaps it might take each of us an entire lifetime to really SEE a flower.

This article was based on material taken from <https://igt.tilth.org/plant-blind>; www.ecowalkthetalk.com; theconversation.com; www.greenwagonfarm.com; and <https://news.mongabay.com>. Picture taken from www.drimgoeswild.com.



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