The Blazing Star

Summer 2017, Volume 18, Issue 3

A Publication of the North American Native Plant Society

Native Plant to Know

Indian Tobacco

Lobelia inflata

by Madison Woods

Lobelia inflata is one of those wildflowers that only a dedicated plant enthusiast could love.

She has no outstanding attributes to draw the average eye. Her flowers are tiny and insignificant. At the peak of fecundity, with swollen seed-bellies, scraggly growth and browning leaf tips, she still isn't a pretty sight.

With a common name like puke weed, it's hard to muster appreciation. But the name is apt, since one of her actions is the ability to invoke powerful vomiting. Indian tobacco is the common name generally used, but there's nothing in the historical archives to suggest that Native Americans ever smoked this herb.

Most people don't even notice her enough to shrug or frown when they pass. But to an herbalist, she is treasured for the beauty she is.

Native to eastern North America, she ranges from southeastern Canada through the eastern United States as far west as Kansas. You'll find *Lobelia inflata* growing in dry waste ground in full sun or anywhere the ground has been disturbed. I seek her out each year alongside our shaded driveway and in the middle of old, overgrown logging roads in the dappled shade of our Ozark woodlands in Arkansas. I have never found her in the moist, loamy soils of the deep-shaded forests.

The plant consists of a single, coarse-haired main stem, which becomes branched. Sometimes more than one plant grows in the same space, making her appear to be a multi-branched plant. Total height averages about one to three feet (one-third to one metre) at peak growth. She dies back in winter. This plant is listed as biennial or annual. I've seen her referenced across sources as both, as if no one really knows for sure. She is self-fertile, with male and female flowers on the same plant.

Rough, oblong-shaped, serrated leaves grow in alternate positions. The leaves near the lower end are irregularly toothy and attached with short petioles, but the leaves near the top and on the flowering branches appear almost clasping. They have very short petioles, if any, and smaller, more uniform serrations or even undetectable serrations on the smallest leaves.

Indian tobacco produces tiny, light purple to whitish flowers in late summer. Two petals point up like long ears and three curve away below, with

Illustration by Brigitte Granton

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The *Blazing Star* is . . .

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NANPS Leads Rouge River Walk for CWF and HSBC

The North American Native Plant Society (NANPS) was asked by David DeRocco of the Canadian Wildlife Federation (CWF) to lead a walk in Rouge National Urban Park for National Wildlife Week (April 8 – 15). Employees of the Hong Kong and Shanghai Banking Corporation (HSBC) and their families would be joining the walk. NANPS agreed to the request and former NANPS president Tom Atkinson and I agreed to act as tour leaders.

Phase 1: The Reconnaissance

Tom and I did a reconnaissance tour of the Rouge River on April 1 to refresh our knowledge of the area's botany. There was not much greenery showing at that time

NANPS Hires Communications Coordinator

The North American Native Plant Society is pleased to announce that for the next few months we have a communications coordinator on staff – Danielle Tassie. Danielle lives in Peterborough, Ontario and joined the NANPS team in the spring. She grew up in east-end Toronto, surrounded by ravines, the beach and Lake Ontario and, contrary to the popular view of the city, she credits her hometown with instilling in her an appreciation for the natural world. Peterborough's Ecology Park inspired her love of native plants. Danielle is a graduate of Trent University's Environmental Studies Program and Fleming College's Ecosystem Management Program. Over the past 15 years she has volunteered and worked for environmental non-profit organizations and for the Ontario Ministry of Natural Resources. She was the coordinator of the Biodiversity Education and Awareness Network (BEAN) and project liaison with the Ontario Invasive Plant Council (OIPC), where she was responsible for communications planning, program delivery, funding proposals and day-to-day operations.

At NANPS, Danielle will be helping with communications planning, membership, the website, social media and monthly newsletters. You can reach her at dtassie@nanps.org.

NANPS ANNUAL GENERAL MEETING

Saturday, November 4, 2017
Noon – 4 p.m.
Toronto Botanical Gardens, Garden Hall
777 Lawrence Avenue
East at Leslie Street, Toronto

Dr. Jon Johnson, Department of Social Science, York University, Toronto and an organizing member of First Story Toronto, will be the keynote speaker. He is an interdisciplinary community-based scholar whose research has focused on Indigenous knowledge and the stories of Indigenous presence in the Toronto region since the last ice age to the present.

*Jack in the pulpit (*Arisaema triphyllum*) in seed.*

PHOTOGRAPH BY HAROLD SMITH

of year in the Greater Toronto Area (GTA), with the exception of conifers. Mercifully, there were no remnant patches of snow, but the ground was extremely wet from recent rains. We saw a few Christmas ferns (*Polystichum acrostichoides*) and one very small specimen of early meadow rue (*Thalictrum dioicum*).

Rouge Park is enormous – more than 50 square kilometres (19 square miles) – and our tour would be limited to two hours so we had to keep this in mind. The starting point would be the Rouge Valley Conservation Centre just east of the Toronto Zoo. As we started out on our reconnaissance, we quickly made two observations: (1) the trail was inundated with water and (2) for about 500 metres (550 yards), our guests would see flat land, formerly farmed, with little of real botanic interest (unless you wanted to see invasive plant species). When we came to the naturally occurring forest, items of botanical interest picked up significantly. As a bonus, the trail was much drier.

Phase 2: The Tour

April 8 dawned sunny and cool with a delightful wind. We met David at the entrance to the park and found him to be open, welcoming, and a wonderful salesman for the CWF and nature in general. CWF Senior Development Officer Emily Stypulkowska also participated in the hike, assisting with coordination and directing volunteers along the trail.

Participants soon began arriving. With everyone assembled, David kicked the day off by explaining the goals of National Wildlife Week and CWF and describing the nature of the walk. I gave a summary of NANPS, who we are and what we do. Tom added a few comments about Rouge Park, keeping them brief so we could get walking.

We had a group of about 40 people, including four youngsters and what we saw initially was far from inspiring. The area's natural woods had been cut for farming and remnant stalks of native and non-native wildflowers were visible including goldenrods (*Solidago* spp.), asters (*Symphiotrichum* and other species), grasses, Queen Anne's lace (*Daucus carota*), and even the highly problematic purple loosestrife (*Lythrum salicaria*). White pines (*Pinus strobus*), Ontario's provincial tree, were seeding nicely. Paper birch (*Betula papyrifera*), aspen (*Populus* spp.), sumac (*Rhys typhina*) as well as invasive species such as purging buckthorn (*Rhamnus cathartica*), corkscrew willow (*Salix matsudana*), black locust (*Robinia pseudoacacia*) and the infamous non-native phragmites (*Phragmites australis*) were also present. The trail was very wet, such that some had to move off-trail to keep shoes relatively dry.

We were especially pleased with the enthusiasm shown by the young people on the tour. One mother had her daughter and young son with her. The latter asked what some green thing was and Tom identified it as moss. Well, moss was a hit with him! As we walked on, he was keen to point out just about every patch of moss he saw. Such enthusiasm is to be

PHOTOGRAPH BY DAVID DEROCCO

applauded! Tom noticed wasp galls on goldenrod stalks, so he broke a piece off with the gall, handed it to another young boy and explained what it was. The boy carried that stalk everywhere. A girl was fascinated with white pine needles. Her father had picked up a small pine branch and we explained that white pines have five needles to a bunch and red pines have three and you remember that by the number of letters in "white" and "red". Our experience of the day brings to mind the Jesuit motto of forming young minds. If I may be permitted artistic licence, I'd like you to contemplate this phrase: Give me a child until he is seven and I will give you a botanist.

In the forested area, the trail is on a ridge, with the ground falling steeply away on either side. Here we saw mostly conifers, specifically white pines, white cedar (*Thuja occidentalis*) and eastern hemlock (*Tsuga canadensis*), on the north slope and deciduous trees on the south. In one spot a

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NANPS Seed Exchange

Time to collect seeds for NANPS annual exchange. For collection tips, visit www.nanps.org/index.php/plant-sources/159-seedcollection-reaping-what-you-sow. Send your seeds, separated by species and identified with the source/parentage, to NANPS Seed Exchange, Box 69070, St. Clair P.O., Toronto, Ontario M4T 3A1. Email seeds@nanps.org if you have questions. ***Thank you!***

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white pine, a sugar maple (*Acer saccharum*) and a hemlock were all growing together in a circle of less than a metre (three feet) in diameter. All were mature trees and seemed quite healthy.

Deciduous trees included red maple (*Acer rubrum*), sugar maple, red and white oak (*Quercus rubra* and *alba*), bitternut hickory (*Carya cordiformis*), black cherry (*Prunus serotina*), ash (*Fraxinus* spp.), alternate-leaf dogwood (*Cornus alternifolia*) and blue beech (*Carpinus caroliniana*). Surprisingly, there was no bur oak (*Quercus macrocarpa*); this is a tree species you would typically see in a river valley or moist bottomland such as Rouge River Valley. The loathsome purging buckthorn made its appearance at this stage, especially after the trail descended to the floodplain of the Rouge River. Aspens appeared again, along with some willows (*Salix* spp).

As warmer weather prevails, we'll be able to see spring ephemerals such as trout lily (*Erythronium americanum*), trilliums (*Trillium* spp.), Canada mayflower (*Maianthemum canadense*), spring beauty (*Claytonia caroliniana*) and others where the trail moves from a ridgeline to a gentle slope. Ferns are abundant in this location as well.

We were very pleased with the interest that the HSBC employees and their families showed in nature. One never knows quite what to expect when meeting people new to nature, but they showed rapt attention and asked excellent questions. One lady was able to identify white oaks simply by their bark after a quick tutorial.

Would we participate in a walk of this kind in future? You bet!

Adam Mohamed
Adam is the vice-president of NANPS and their social media coordinator. He has worked for the Toronto and Region Conservation Authority, Credit Valley Conservation and the City of Toronto. He is currently working at Humber Nurseries.

Exploring and Mapping our Landscape

by David d'Entremont

The sun still hides behind a high forested ridge in the verdant Caledon countryside as my survey partner and I head out far from the Credit Valley Conservation Authority head office and press into the thick, shrubby edge of a roadside forest. Wearing tall rubber boots and armed with datasheets, field guides, binoculars, collection bags, a compact insect net, a soil auger and a seemingly random assortment of tools, we press through the dew-laden thicket edge and into the forest. We are greeted by a dawn chorus of birds; robins, chickadees, vireos and sparrows make good use of the morning hours before it gets hot and humid. The day is perfect for new discoveries.

From the road, you wouldn't think much of a concession block like this one in southern Ontario. Jumbles of non-native plants like mullein (*Verbascum thapsus*), knapweed (*Centaurea stoebe* ssp. *micranthos*), smooth brome (*Bromus inermis*), common buckthorn (*Rhamnus cathartica*) and many others mix with a handful of common native goldenrods (*Solidago* spp.), asters (*Symphyotrichum* and other spp.) and common milkweed (*Asclepias syriaca*) to line the road edges with modest meadow strips, progressing into disturbed forest edge, scrubby field or a small marsh. The plant communities of this historically heavily farmed region have been strongly disturbed by human presence; from a natural heritage perspective, it would be easy to write many of them off as average. The edges of these blocks – while not without beauty – seem predictable. Another forest, another field, another stream.

The edges, however, often hide huge surprises and hidden gems. Unique plant communities, unusual habitats, rare and endangered species, uncommon geological features, clean springs and seeps – you never know what to expect! These blocks may have been "mapped" in the grand regional sense of the word, but, more often than not, their contents are not fully known, even to those who own the property. And yet these are the crucial pieces of our natural heritage worth

PHOTOGRAPH BY DAVID D'ENTREMONT

Rich mossy banks border a small, cold-water creek as it snakes out of the swamp through nearby forested land. Creeks like this are not only ideal moss and fern habitat, but deliver the wetland-filtered water downstream without heating it up, a crucial function for downstream wildlife like fish and insects.

admiring, protecting and building upon. Some of our most spectacular habitats are hidden in the middle of privately owned concession blocks surrounded by country houses.

How do you go about quantifying, analyzing, mapping and comparing these amorphous, complex, connected natural systems? How do you express to the world the uniqueness and importance of the communities you are seeing, plan localized conservation strategies or assess land ecological value in a development zone? The answer for such a complex question, unsurprisingly, varies from place to place. In Ontario, the standard developed for mapping these natural landscapes is ELC.

ELC stands for Ecological Land Classification, developed by Ontario's Ministry of Natural Resources and Forestry (MNRF) as a way of categorizing ecological communities. ELC outlines these categories into a structured hierarchy based on features such as soil type, hydrology and plant communities – the backbones of what makes a habitat distinct. Just as plants are categorized into families, genera and species based on how many features they have in common, ELC categorizes Ontario ecosystems into functional, nested groups like system, community class and community series based on shared commonalities.

It sounds complicated, but many tiers of the system have recognizable elements. Community class examples include forest, swamp, talus, etc. At the community series level we get more specific: deciduous forest, coniferous swamp, open talus. The ultimate classification end-point, the vegetation type, represents a known kind of community that appears again and again on our landscape when the right conditions occur: perhaps a Dry-Fresh Sugar Maple-Beech Deciduous Forest (FOD5-2), a Tamarack-Black Spruce Organic Coniferous Swamp (SWC4-1) or a Dry-Fresh Carbonate Open Talus (TAO1-1).

After a great deal of study, MNRF scientists created a detailed list of these vegetation types from regions across Ontario, comparing data and noting commonalities and correlations between vegetation communities that share features and species. The term "commonalities" may seem like a stretch when discussing variable and complex natural systems, but in broad strokes there is a demonstrable level of consistency to plant communities within a region. Landform, soil type, water persistence, slope aspect and cultural history conspire to make conditions at one site ideal for one community of plants (which proliferate), while an adjacent site with slightly different variables tends towards another community. Change the water level and a forest grades into a swamp. When changes occur to slope

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PHOTOGRAPH BY DAVID D'ENTREMONT

*A lush layer of ostrich fern (*Matteuccia struthiopteris*) sways quietly in the dappled sunlight of a hillside sugar maple (*Acer saccharum*) deciduous forest. The trees in most of the surrounding concession block were removed, leaving remnant patches of original sugar maple-dominated forest.*

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PHOTOGRAPH BY DAVID D'ENTREMONT

*Often under-appreciated, meadow marsh communities can put on quite a show. Many are lush with pollinator-friendly flowers such as swamp aster (*Symphyotrichum puniceum*), spotted Joe-Pye-weed (*Eutrochium maculatum *ssp.* maculatum*) and panicled aster (*Symphyotrichum lanceolatum*) that are positively buzzing with bees by late summer.*

and aspect, a forest filled with deciduous trees like sugar maples (*Acer saccharum*) may become interspersed with shade-loving eastern hemlocks (*Tsuga canadensis*) to form a mixed forest, with both coniferous and deciduous elements. With a careful eye, the intrepid surveyor learns to categorize, map and describe the plant communities in an area, while always on the lookout for unique sightings and rare features to record.

The essentials of the process include the following:

- Take a high-quality aerial image map of the area and draw lines around what appear to be consistent communities over 0.5 hectares (~1.24 acres) in size. Estimate where one community ends and a new pattern begins. This takes practice.
- Explore the area on foot. Within each vegetation community, determine the true boundaries on your map.
- Collect on-the-ground data for each community: Record vegetation lists, perform tree tallies, analyze soil cores, map "inclusions" (small distinct pockets of significantly different vegetation communities < 0.5 ha in size) and list habitat features, disturbances and the presence or evidence of animals.
- Describe the "layers" of vegetation. How much cover does the canopy provide and what are the top four species in it? If you had to order them from most abundant to least, which order would you use? Repeat for the sub-canopy, understorey, ground layer, etc.
- Categorize following the ELC hierarchy criteria: Is this a wetland, shallow aquatic or terrestrial site? Is it on bedrock or deep soils? Organic or mineral soil? Is there significant coverage of trees or shrubs? Are they coniferous or deciduous? Etc.
- Complete by choosing the most appropriate vegetation type code for the community.
- Finalize mapping and digitize maps and data.

ELC breaks hazy natural variation into manageable chunks and helps to characterize the landscape in meaningful ways while also collecting very useful site-specific data. A landscape that has been mapped and surveyed properly can be quantified and analyzed. Rare communities and unusual species inform conservation management practices and the landscape breakdown allows us to assess the rarity of whole communities at any scale. When land must be developed, what is lost is known in detail and reparations like offsets and habitat restoration can be more specific.

From a conservation perspective, sometimes the most valuable information you get during ELC surveys isn't the classification, but what you find simply by walking in with your eyes wide open. The discovery of a forgotten patch of swamp with deep, old organic soils, big trees, vernal pools and a lush ground layer packed with unusual

native species but lacking invasive plants may mark a piece of land that was largely spared from human use, with incredible habitat values and rare species. The spectacular appearance of endangered plants and animals like wild ginseng (*Panax quinquefolius*) or the Blanding's turtle flag crucial site-specific opportunities to support these species. Conversely, bland habitats full of common and invasive species indicate opportunities for improvement, but allow us to prioritize other, more sensitive areas in a world of limited manpower and funding.

On that early morning in the Caledon countryside, our team explored a beautiful block of property, split on one side by a power transmission corridor. Based on our top-down aerial imagery assessment, we went in expecting to find a coniferous swamp beside a bland predictable meadow strip under the power lines, maybe progressing into a basic meadow marsh where the power lines crossed lowland wet areas. What we found was so much more – a rich, old, mossy swamp of balsam fir (*Abies balsamifera*), white cedar (*Thuja occidentalis*), tamarack (*Larix laricina*) and scattered deciduous trees, with deep organic soils and an abundance of mosses, ferns, forbs and sedges (*Carex* spp.). It's true that the swath of open space created by the power corridor had basic meadow components. However, where it passed through the swamp, it opened up into a rich organic marsh with a profusion of Sphagnum mosses (4+ species), bog goldenrods (*Solidago uliginosa*), scattered willows (*Salix* spp.), marsh ferns (*Thelypteris palustris* var. pubescens) and, to our delight, one of the most robust (and one of the few) populations of round-leaved sundew (*Drosera rotundifolia*) in the Credit River watershed. The same power corridor would lead us to other unusual sightings – from orchids such as Loesel's twayblade (*Liparis loeselii*) to the discovery of a female clamp-tipped emerald – the Credit's rarest extant dragonfly, known only from one other locality. Given half a chance, nature will surprise you.

ELC helps to build a meaningful picture of our natural landscape.

Photograph by David d'Entremont

*Compared to its yellow-flowered cousin, common wood-sorrell (*Oxalis montana*) is (ironically) reclusive, preferring sheltered, shady, moss-laden hummocks and logs in rich forests and swamps. The clover-shaped leaves grow close to the surface, appearing to pop individually out of the mosses.*

Projects like the natural areas inventories (undertaken at several Ontario conservation authorities) and the general classification of conservation lands by various conservation agencies help to inform us about what makes up our landscape and – crucially – what we have left. We are quick to forget that most of that extra land is northern and boreal forest, whose size does not justify eliminating what remains of our fractured and vastly different Carolinian Forest Zone. Especially in a spacious province like Ontario, it is all too easy to expand human interests rapidly while vaguely assuming that "there's adequate land left." Surveys to map and classify our landscape are essential, helping us to focus on our remaining natural gems and to look ahead for future generations.

David d'Entremont is currently working as a terrestrial biologist with Azimuth Environmental Consulting Inc. He specializes in bird, plant and insect surveys, and has a particular fondness for the Odonata (dragonflies and damselflies).

Plant Defences

by Stephen Johnson

From spear tips to lethal chemical cocktails, the plants of the world possess an array of defence mechanisms and strategies as part of the dynamic co-evolutionary battle between ecological producer and consumer. Almost every plant employs a defensive strategy to prevent it from being eaten. Insects and mammals in the modern world are the chief perpetrators of this herbivory and some plants have mechanisms to deal with both. The defences fall into two broad categories: structural and chemical. Structural defences are often easy to observe while chemical defences are likely hidden.

In North America, plants using thorns have such evocative names as hawthorn (*Crataegus* sp.) and devil's walking stick (*Arelia spinosa*). The citrus family (Rutaceae) is also proficient with armaments. The North American prickly ash or cavalier (*Zanthoxylum americanum*) is protected by short sharp prickles. Its congener, the southern prickly ash, sea ash or Hercules' club (*Z. clava–herculis*), native to coastal dunes and barren sandhills, has equally sharp prickles mounted on larger pyramidal cork bases densely studding the tree's trunk. The cultivated oranges (*Citrus* spp.) increase their defences by incorporating stout and sometimes long spines. But the midwestern United States has a species with the most menacing thorns – the honey locust (*Gleditsia tricanthos*). This locust is studded with clusters of three to seven-inch thorns (7-18 centimetres) that can cause injuries ranging from topical infection to sepsis.

ILLUSTRATION BY STEPHEN JOHNSON

Whimsical view of how a flower fairy may cope with the mechanical defences of a cactus.

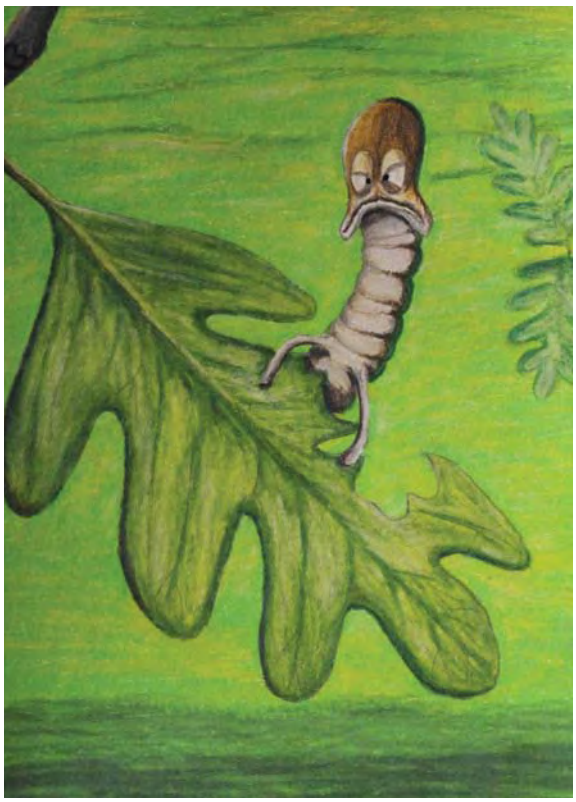

ILLUSTRATION BY STEPHEN JOHNSON

A cartoon view of how a caterpillar might react to digestion-blocking tannins.

More familiar to naturalists and gardeners may be the prickles of blackberries (*Rubus* sp.) and roses (*Rosa* spp.). Easterners who hike nature trails and home landscapers may be familiar with the leaf margin spines of American holly (*Ilex opaca* var. *opaca*). The leaf margin spine is taken to splintered glass extremes by the thistle tribe of the Aster family. Thistle spines may be short, thin and irritating or stout, long and puncturing. The most notable in my experience has the deceptively innocent common name of yellow thistle. But this inhabitant of coastal sand dunes has a scientific name appropriate to its ostentatiously wicked spines: C*irsium horridulum* var. *horridulum*.

Eastern and western North Americans alike may be familiar with iconic cactuses such as eastern prickly pear (*Opuntia humifusa*) with its clusters of short, detachable, urticating bristles. The fragile prickly pear (*O. fragilis*) has more conventional spines. This cactus grows further north than any other in the U.S. northern midwest and Canada. In the western United States there is a plethora of spiny cacti. I have experienced the viciously armed Thornber or Colorado desert cholla (*Cylindropuntia acanthocarpa*). The southwestern U.S. and northern Mexico boast the flamboyantly armoured golden-spined jumping cholla (*Cylindropuntia bigelovii*) with spines that catch clothing. In fact, a pad detaches and grabs at you with such alacrity that it seems to jump from the plant onto your clothes.

These defences evolved to prick the

soft noses and tongues of browsing mammals and deter them from eating the soft fruit. These prickles and thorns, particularly the sharp and stout thorns of honey locust, may be ghosts of evolution; the animals for which these impressive armaments were adapted, such as giant ground sloths and mastodons, are no longer here.

Smaller structural defences in plants include myriad forms of plant hairs or trichomes. Dense formations of long, thin and stiff hairs can impede an insect's progress along a plant stem or even impair the insect's ability to get its mouth parts close enough to take a bite or a drink. There are curling hairs that can trap an insect's legs leaving the insect to die of starvation. There are many varieties of glandular hairs such as those on the unicorn plant (*Proboscidea* sp.) whose leaves trap insects in a slightly sticky leaf covering that is much like flypaper. Perhaps the worst type of hair from the human standpoint is the mechanically irritating or urticating hair. Some people have reported skin irritation after handling the leaves and stems of North American lady slipper orchids (*Cypripedium* spp.) but the most notorious of the urticating hair suite is the infamous stinging nettle (*Urtica dioica*). The sharply pointed hairs in Urtica are breakable-tip vials of irritating chemicals injected directly into the skin.

A variation on the structural defence is the employment of ants for defence. Gardeners may be familiar with the sight of ants gathered on the buds of garden peony (*Paeonia* spp.). The peony bud exudes sugary compounds that attract ants. Ants in turn protect the source of sugars and depart once the flower opens. The native North American prairie annual known as partridge pea (*Chamaecrista fasciculata*) has tiny nectar-filled cups at the base of its leaves. The cups, called extrafloral nectaries, attract ants. In southern Louisiana, I observed many native *Crematogaster* ants drinking from the urn-shaped nectaries of partridge pea.

Photograph by Stephen Johnson

Catesby's gentian is one of many gentian species containing iridoid glycosides and experiencing minimal insect damage.

Other plants produce external protein packets called beltian bodies which ants pluck from plant stems. One of the most interesting symbioses between ant and plant occurs in the South American tree *Cecropia* and the ant genus *Azteca*. *Cecropia* does not produce many secondary chemicals designed for defence and as such has a faster growth rate than surrounding chemically defended trees do. Instead *Cecropia* produces copious beltian bodies and has hollow stems where ants can nest. Any herbivorous assault is faced with a platoon of angry *Azteca* ants. The ants also chew off any epiphytic plants that attempt to colonize.

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Photograph by Stephen Johnson

Echinocystis lobata *may release an aerosol "cry for help" that attracts predatory mites.*

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Many plant families invest in chemical rather than structural defences. I once saw a hairless and apparently defenceless meadow gentian (*Gentiana clausa*) growing next to a telephone pole in a utility line cut through a forest. It was perfect fodder for deer but it had not so much as an insect bite mark. Gentians of North America may sequester a cocktail of iridoid glycosides, which are toxic to insects, and pyrrolizidine alkaloids, which are toxic to mammals.

Perhaps the most famous of all plant chemicals are the alkaloids. These nitrogen-containing toxins can be lethal to insects and vertebrates alike. One particularly famous alkaloid is caffeine. While it stimulates mental acuity in humans, it is destructive to the nervous systems of insects. Another alkaloid popular at some social gatherings is cocaine (derived from *Erythroxylum coca* for anyone who's curious.)

Cardenolides, better known as cardiac glycosides, are collected by monarch butterfly caterpillars from milkweeds to make them unpalatable to birds. These chemicals may cause heart arrhythmias and cardiac arrest in vertebrates who attempt to eat the caterpillars.

Found throughout the higher plants are the chemicals called tannins. Tannins are dilute in young tree leaf tissue when many insect caterpillars come to defoliate but increase significantly as the leaf ages. The ubiquitous tannins cause lesions in caterpillars' digestive tracts and generally inhibit digestion, causing caterpillars to starve.

The Rutaceae – in addition to mounting a proficient defence against mammal browsing by the use of spines and prickles – also mount a chemical defence against insects. Their acrid aromatic volatile oils are familiar to us as the aromas of oranges, limes and lemons.

Plants may use secondary chemicals in other ways to thwart insects. Some studies have indicated that some aerosolized chemicals may cue predators of the herbivores to attack.

Asclepias viridiflora *(green comet milkweed) has cardiac glycosides. It is palatable to a bug, a beetle and a butterfly.*

Photograph by Stephen Johnson

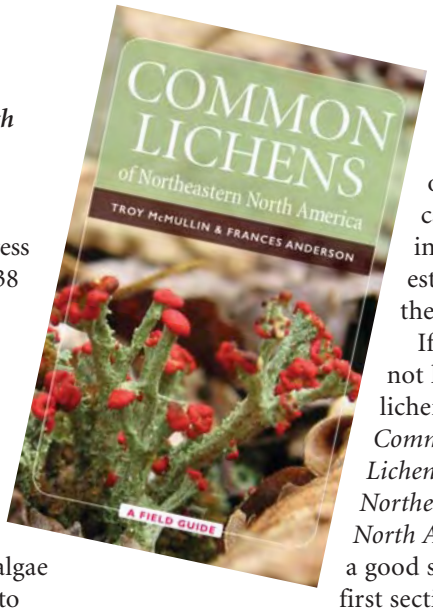
Attracted enemies are typically parasitoids that live their larval lives inside a host but are free living as adults. Such aerosolized chemicals have been isolated from cultivated members of the mustard family (Brassicaceae). This ability may also someday be found in native mustards such as toothwort (*Dentaria laciniata*). Other studies have shown that cultivated members of the gourd family (Cucurbitaceae) while under attack by spider mites release volatile chemicals that attract predatory mites in what has been termed "a cry for help." This may also be the case for native cucurbits such as the wild cucumber (*Echinocystis lobata*) and the bur cucumber (*Sicyos angulatus*).

Still other chemicals in plants mimic insect growth hormones and can delay the growth of an herbivorous caterpillar. Such a delay in development leaves the herbivore in a caterpillar stage longer leaving it more susceptible to attack by parasitoids or birds. It has been found in Gymnosperms and ferns.

Plants also have some defence against attack from microorganisms. Often in nature, as in the garden, we may see a plant that has small brown spots on the leaves. These necrotic patches, usually observed as circular spots, are the localized cell death response of leaf cells to the introduction of a pathogen, most likely a virus. The virus needs living cells to proliferate. By killing the cells in the neighbourhood around the point of infection, the plant deprives the virus of living tissue and the isolated virus dies.

Since they are stationary, plants have had to evolve a variety of mechanisms to defend themselves against mobile herbivores. But the battle is never over. As insects develop ways to detoxify plant chemistry, plants evolutionarily respond by altering toxic chemistry. The plant vs. herbivore contest continues. As for the thorns, they await the return of a hungry mastodon.

Stephen Johnson is a botanist and plant ecologist always searching for and observing plant interactions.



Common Lichens of Eastern North America: A Field Guide
By Troy McMullin and Frances Anderson
2015, New York Botanic Garden Press
192 pp, 138 colour photographs, 138 black and white illustrations
ISBN 978-0-89327-511-2
$38.39 US

Lichens are ignored by most people, even botanists. Yet, they are an important part of the natural environment. The solid partnerships between fungi and algae result in organisms that are able to survive on substrates where even bryophytes have a hard time establishing themselves and rooted plants cannot exist at all. Being able to absorb moisture over their surface when it is available – and surviving for months when it is not – enables lichens to modify environments so that other organisms can move in and establish themselves.

If you do not know lichen species, *Common Lichens of Northeastern North America* is a good start. The first section describes species on trees, most of them found only in regions with deciduous trees. Lichens do not do well in farming and urban areas. The soil lichens of the second section are much more widespread, as are many of the rock lichens in the third section.

This is a very good book to take out into the field to see how many of these lichens you can find. The illustrations and concise descriptions are excellent. The book has a waterproof cover and a coil binding which makes it easy to keep open. You will need a hand lens of course, at least x5, since it is often necessary to check small characteristics in order to be sure of your identification.

When I became curator of the Lakehead University herbarium in Thunder Bay, Ontario and started teaching a course on bryophytes and lichens, I decided to make a checklist of lichens for the Thunder Bay District, which extends from the deciduous forest north of Lake Superior into the boreal forest. I thought that, like mosses, there would be about 200 species of lichens. I actually listed 450 and that did not cover the whole district since most collectors were not far from the few highways in the area. That said, the 138 species covered in *Common Lichens of Northeastern North America* are just a drop in the bucket, but a great way to start to familiarize yourself with lichens.

Review by Joan Crowe

Photograph by Catherine Pross

Xanthoria parietina

Midwestern Native Shrubs and Trees: Gardening Alternatives to Nonnative Species
By Charlotte Adelman and Bernard L. Schwartz
2016, Ohio University Press
396 pages, with colour photos and drawings
ISBN 9780821421666

Midwestern Native Shrubs and Trees points out that there is more to gardening than meets the eye. The authors observe that planting shrubs and trees to do double duty is the way of the future in North America. I concur with: "Recognition of the fundamental connection between native plant species and wildlife is essential. This insight leads to pitching in and planting native species in areas over which we have unique control (yards, gardens, condominium balconies). Choosing natives is a practical, direct, and enjoyable way to help wildlife and achieve immense good. To our readers we say, before planting a shrub or tree, think about the beauty and the environmental benefits provided by our true native midwestern woody species."

This book is replete with photos and drawings of butterflies, moths, bees, birds and other animals that rely on native plants for food and shelter, but it is not a field guide. It's more of a cross-reference companion to such. It presents shrubs and trees by season allowing the reader to focus on their primary landscaping interest. For example, if you're accustomed to planting exotic Siberian (red twig) dogwood (*Cornus alba 'elegantissima'*) because you like the red stems in winter, this book offers you a better choice in native red osier dogwood (*Cornus sericea*). Not only are red osiers less susceptible to disease and climatic variations, native dogwoods are host to 118 species of butterflies and moths, birds feed the caterpillars to their nestlings and the dogwoods are of "special value to native bees." Plus the berries have a high fat content which provides much-needed energy for migrating and overwintering birds and large and small mammals.

I was informed by the noteworthy information the book provides. For example, it discloses that some nurseries sell only male variants of some (exotic) woody plants so that fruits and berries do not litter manicured lawns – with a subsequent loss of food for wildlife. It's astonishing that this long-standing practice is still happening.

Also of interest is the discussion regarding native cultivars which the authors label "nativars". When writing about ninebarks (*Physocarpus* spp.), they observe that leaf chemistry of the dark (purple) foliage of nativar ninebarks has been altered to the extent that specialist ninebark calligraphy beetles cannot eat the leaves.

This book has a few shortcomings, however. Native fauna, according to the authors, is in decline partly because exotic woody plants are displacing natives, causing food and habitat loss for many insects and birds. They state, "On average, native plants support 13 times more caterpillars ... than nonnative plants." Although I agree that native plants are better, anyone could challenge this statement since the book provides little in the way of statistical comparisons. Nowhere are there side-by-side numbers of the attractiveness to pollinators of native plants versus exotics. On a recent walk in my rural community, I noted a handful of native plants along roadsides and trails. They were vastly outnumbered by exotics and yet I saw the same butterflies, bees and birds as we see on our property in Manitoba where my wife and I have altered the numbers game in favour of native flora. Obviously, most exotic (naturalized or invasive) plants are being pollinated.

Here are two of only eight occasions which spell out inadequacies of exotic plants:

- "[Poisonous] nectar produced by some [exotic rhododendron] species kills some species of bees."
- "Not one species of butterfly in North America can use buddleias [butterfly bush] as larval host plants."

Meanwhile, the book says that one native variant "hosts 32 species of butterflies and moths." The exotic might be better called *half* butterfly bush.

I also found the tiny font size difficult to read and the magazine style layout unappealing. Stringing information about each plant together in one, often lengthy, paragraph makes it difficult to find specific information. To me, it would be better if each topic had its own paragraph with butterfly or bird species presented in lists rather than long (sometimes 30 or 40 species long) sentences. Doing this might require more space. Graphic design is influenced by the number of pages in the budget. Still, there are ways to accomplish what I suggest. They could, for example, use a sans-serif font, which takes up less space. I hope the publisher rethinks the design of the book if they go for a third take on the subject.

All that said, I learned a lot and compliment the authors for their research and presentation of valuable information pertaining to a difficult subject.

Review by Robert G. Mears
Robert recently launched the Native Biota Forum (https://nativebiota.studiofive.ca/) which is devoted to discussing all native lifeforms.

Pollinator Plants for Hot, Sunny, Dry Areas

by Jane Zednik

Native plants were severely tested for their drought tolerance in the summer of 2016 – the driest summer in over 100 years in parts of southern Ontario. Even mature trees wilted.

The years 1998-2002 were also severe drought years for this region; 2007 and 2008 saw an extended drought period and the year 2012 was deemed the worst for drought in a decade.

The future promises unpredictable weather patterns, but I imagine we'll be seeing many more hot, dry summers, especially in the heavily populated Greater Toronto Area. I've chosen five showy native perennials that grow in my garden on the Oak Ridges Moraine north of Toronto to profile below. Not all are regionally native, but they are indigenous to North America. Their advantages: they ignored the horrible drought of 2016 and will brighten up dry, sunny landscapes in rural areas or even small urban backyards. Look for them at native plant nurseries (visit nanps.org for a list.) It's well worth the effort.

Prairie Smoke (*Geum triflorum*)

This spring wildflower is not restricted to the prairies as its common name suggests. It can be found growing on alvars in parts of Ontario. A charming low-growing ground cover, prairie smoke's fern-like, gray-green foliage turns red, orange or purple in late fall and persists throughout the winter. Its distinguishing feature is the reddish pink to purplish, nodding, globular flowers that attract many species of bees. The bloom period lasts from mid-spring to early summer. Long, plumed seed heads follow the long-blooming flowers, creating a gauzy effect that resembles smoke hovering close to the ground. This plant remained perky in my garden while surrounding plants languished or vanished during the summer drought. In Canadian hardiness zone 5a, they do well in my hilly, rocky, wind-swept landscape. (Zone 3 to 7 USDA; Zone 2 to 7 Canada NRC) Note: the hardiness zones given for prairie smoke vary on the internet. The plants might survive and even thrive in lower/higher zones.

PHOTOGRAPH BY JANE ZEDNIK

Prairie smoke in seed.

Spotted Horsemint (*Monarda punctata*)

A native of eastern Canada, this is a fantastic plant for hot, dry, sunny areas flowering in late June and July. It's also an amazing pollinator magnet, especially for beneficial wasps. When I first managed to germinate seeds of this plant I babied the seedlings, but they hated the rich soil they were planted in and quickly moved to a nearby parched limestone screening pathway where they continue to proliferate. Spotted horsemint grows half a metre tall (1.5 to 2 feet) and looks nothing like other Monarda species. It's not the small, purple-spotted, tubular yellow flowers, but the rosettes of large white or pink-tipped bracts extending up the square stem that create a long-lasting visual impact. The leaves of these tough eccentric beauties are highly fragrant. The bonus is that deer will not even consider munching. (Zone 3 to 8 USDA; Zone 4 to 8 Canada NRC)

PHOTOGRAPH BY JANE ZEDNIK

Spotted horsemint.

Continued on page 14

Continued from page 13

Rattlesnake Master (*Eryngium yuccifolium*)

A showy, highly drought-tolerant flowering native that makes a statement in a sunny, well-drained garden. It hails from the prairie landscapes of eastern and southern United States. Given its preferred habitat, this plant will sprawl and look awful if grown in overly fertile soils or less-than-full sun. Above the sharp-edged basal leaves that resemble those of a yucca, branched clusters produce 2.5-centimetre (one-inch) diameter globular heads of tightly packed, greenish-white flowers subtended by whitish, pointed bracts. The stems can extend one metre (three to four feet). The flowers have a mild sweet fragrance and are pollinated by many types of insects, especially wasps. Rattlesnake master, which blooms from June right through to September, will self-sow if happy. A real conversation piece. Note: thanks to its long taproot, it does not transplant well. (Zone 3 to 8 USDA; Zone 3 to 8 Canada NRC)

Photograph by Jane Zednik

Blazing star with monarch butterflies dining on it and blue sage in the background.

Rocky Mountain Blazing Star (*Liatris ligulistylis*)

Nobody should be without this spectacular flowering plant native to the prairies. In its native habitat, Liatris ligulistylis is found from Alberta south to New Mexico and east to Wisconsin and Missouri. Not only is it drought tolerant, growing happily in dry, gravelly soils, but it is also the quintessential monarch butterfly magnet. It is not unusual to see several species-at-risk monarchs dining at this favourite nectar source. The fluffy, thistle-like, deep rose-purple flower heads appear on terminal columnar inflorescences atop erect, leafy flower stems. This lovely plant, that can grow up to 1.8 metres (six feet) in cultivation, blooms in late summer to early fall. (Zone 3 to 8 USDA; Zone 4 to 8 Canada NRC)

Blue Sage (*Salvia azurea* and *Salvia azurea* var. *grandiflora*)

These two salvias are some of my favourite plants. They are perfect candidates for sunny areas. They tolerate drought and rocky dry soils. They're also deer-proof. *Salvia azurea* is native to southeastern United States, while *Salvia azurea* var. *grandiflora* is found further west from New Mexico north to Minnesota. *Salvia azurea* forms a low mound of grayish-green, lanceolate leaves and sends up tall stems in late summer that are topped with spikes of bright, two-lipped, sky blue flowers. *Salvia azurea* var.

grandiflora produces larger, darker blue flowers and narrower, dark green, lanceolate leaves. Both are stunners that bloom prolifically from August to late October and can grow to 1.5 metres (five feet), but in my northern garden they reach three-quarters of a metre at best (2.5 feet). Because they bloom so late in the season, they not only attract many varieties of late season butterflies, they are a wonderful farewell to summer. (Zone 4 to 9 USDA; Zone 5 to 8 Canada NRC)

Jane Zednik's enthusiasm for native plants sometimes causes her friends' eyes to glaze over. Undeterred, she continues her campaign to induce others to fall in love with these often-overlooked but important beauties.

PHOTOGRAPH BY JANE ZEDNIK

Rattlesnake master

Continued from page 1 – **Indian Tobacco**

a stout stamen in the middle. Seed pods ripen a month to six weeks after flowers appear.

If you intend to harness her powers for herbal remedies or just want to grow specimens in your wild garden of useful plants, I would suggest a bit of study before making that important decision. While I love this plant and use her often, *Lobelia inflata* is listed as toxic. The entire plant contains active constituents that could be harmful if misused or accidentally ingested by animals or children. That said, I've never had any of our animals eat this plant and she's not interesting enough to attract children. Paul Bergner published an article at HerbMed.com that disputes the toxicity label.

Though this herb has many other actions, including emetic and nervine, it is the antispasmodic action I employ. I make a cold oil extraction or acidified tincture of the seeds, seedpods and roots. Heat will render the remedy impotent. *Lobelia inflata* is one of the ingredients of a tincture I like to keep on hand. It's my variation of the Anti-Spasmodic Formula from Dr. Christopher. This formula has been used in one variation or another by many herbalists through the years to prevent muscle cramps and it's hard to determine who to credit with the original recipe.

The time to harvest is after the seedpods have matured and begun to turn brown. Gather the plant by pulling the whole thing, roots and all. Put the tops down into a paper bag. Many of the tiny seeds will drop from the already ripened pods. When they're good and dry, you can shake the stems to collect the rest of the seeds at the bottom of the bag. I'll cut the roots off while still fresh, wash them quickly, then chop and put them to tincture. I don't use the stems or leaves, but do include all the seedpod dry matter in my extractions.

Since Indian tobacco is a short-lived plant, how you handle the seeds is key to sustainable populations. I take a handful and scatter them in areas that should support their growth. Another practice I follow is what I call proportional harvest. If a plant is plentiful, as *Lobelia* is around here, I'll take one for every three I find. For plants in limited supply, I take fewer and leave more overall, but I also pay more attention to the ones I don't touch. I leave behind the best, most robust plants so they can pass on genetics that will improve the generations to come.

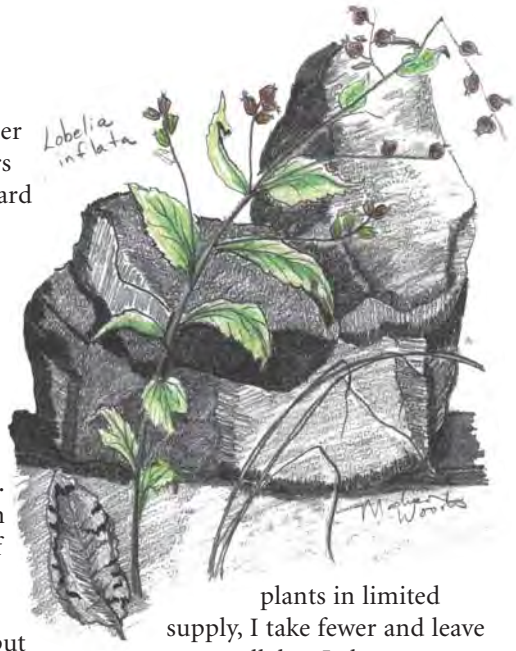


ILLUSTRATION BY MADISON WOODS

Madison Woods wanders the remote and tick-infested hills of the Ozarks in northwest Arkansas with a notebook in one hand and her camera in the other. You can find her online at WildOzark.com.

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