NYFA New York Flora Association

Quarterly Newsletter

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New York Flora Association Newsletter Summer 2020

Editor's Note: You will notice a dearth of field trip reports during this year of the coronavirus, nonetheless we did manage to come up with a number of interesting articles, including a fun report from David Werier on his fairground discoveries, an atypical but very interesting story with an important reminder that site conditions play an important role in morphology, a field trip report from 2019, and an article which will prime us for the fall season - a profile of Canada goldenrod from Knowlton Foote. Many thanks to Field Botanists of Ontario for letting us reprint the field trip article. Despite the cancellation of all field trips and workshops due to the coronavirus, it is evident that botanizing in the state didn't stop; see the photos and notes shared at the end of the newsletter.

Articles Inside:

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A Day at the Fair(grounds)

by David Werier

In 2002 Allison Cusick and colleagues published a paper on *Sclerochloa dura* (hard or fairway grass), a Eurasian native. They found that this species had been going undetected in parts of eastern United States and adjacent Canada, in part because it was found primarily at fairgrounds (a place that botanists apparently don't frequent) and disappeared by summer time (thereby leaving a short window to detect the species). This species was found as a waif in New York in 1895 and had not been recollected in the state until rediscovered it in 2000 at a fairground in western New York.

Left: Plant of *Sclerochloa dura* with inflorescences just starting to emerge, Otsego Co. Fairgrounds, NY, 16 May 2020; **Right**: Lawn of *Sclerochloa dura* gracing a race track, Trumansburg Fairgrounds, Tompkins Co., NY, 23 May 2013.

This prompted me (in 2013) to check my local fairgrounds in Tompkins Co. and lo and behold I found ample *S. dura* growing there. In 2020 I checked out a few more fairgrounds in New York to see what I could find. While I picked up more populations of *S. dura*, I also found a number of other rare or local non-native species. One of my favorite fairgrounds was the Altamont Fairgrounds in Albany Co., which I visited on June 1st. I found more *S. dura* at Altamont, but I was particularly excited (well, interested) to find a second New York State population of a plant in the buttercup family, *Myosurus minimus* (tiny mousetail).

Myosurus minimus is native to a large part of North America, primarily west and south of New York, and elsewhere around the world (Whittemore 1997), but is not native to New York. In 2014, Erik Kiviat of Hudsonia contacted me and a few colleagues about an odd plant he and Chris Graham found growing on the grounds of the Renaissance Faire in Orange Co., NY. The plant consisted of rosettes and was collected in November of that year. We puzzled over images of the plants but could not make a firm determination. In late spring of 2015, I visited the Renaissance Faire grounds and found a number of interesting plants, like *Plantago virginiana* and *P. pusilla* (pale-seeded and

slender plantain). I also found a very odd looking plant that consisted of completely shriveled leaves, a short stem, and a short infructescence. The whole plant was under 6 cm tall and had almost completely senesced. At first I thought it must be different than Erik and Chris's mystery plant. Another colleague, Richard Abbott, had joined in the fun. He thought Erik and Chris's rosettes might be *Myosurus minimus*. Once I had that guess in mind, my spring 2015 mystery came into sharp focus and it was clear that it was *M. minimus*. Two mysteries solved.

Small plant of *Myosurus minimus* at grounds of the Renaissance Faire, Orange Co., NY, 22 May 2016.

Robust plant of *M. minimus* at Altamont Fairgrounds, Albany Co., NY, 1 June 2020.

I revisited the site again in early spring 2016 and found plants still green although all were rather small. At least in this part of the world this species appears to act like a winter annual, germinating and growing into a rosette in the fall, blooming and fruiting in spring, and dying by summer. This find was the first for this species in New York State and I was able to get it into my 2017 Catalogue of the Vascular Plants of New York State. My more recent find of this species at the Altamont Fairgrounds turned up large and robust plants, some still in flower. Like the Renaissance Faire population they were growing in highly disturbed open areas that see seasonal foot and vehicle traffic and occasional mowing as well. The fairgrounds "habitat" appears to work well for this winter annual, perhaps because most of the disturbance occurs in the summer when it is dormant.

Another plant of interest at Altamont was *Alopecurus geniculatus* (water foxtail), a native of Eurasia and parts of North America, but not New York (Crins 2007). This species has not been documented too often in the state unlike its congeners, *A. aequalis*, a NY native, and *A. pratensis*, a native of Eurasia and North Africa. It differs from the former in having lemma awns much exserted from the spikelets versus not or barely exserted in *A. aequalis*, and from the latter in having widely acute to obtuse glumes, smaller anthers, no rhizomes, and generally being shorter versus narrowly acute glumes, larger anthers, rhizomes, and generally being taller in *A. pratensis*.

Inflorescence of *Alopecurus geniculatus*, Altamont Fairgrounds, Albany Co., NY, 1 June 2020.

Plant of *Alopecurus geniculatus*. Altamont Fairgrounds, Albany Co., NY, 1 June 2020.

Almost completely senesced *Sclerochloa dura*, Trumansburg Fairgrounds, Tompkins Co., NY on 2 July 2020.

This year I went back to the Trumansburg Fairgrounds in Tompkins Co., NY a little later than I had been there in the past. And surprise, surprise, I found another NY rare nonnative grass, *Hordeum pusillum*. This species is native to a large part of North America mostly south and west of New York (Bothmer et al. 2007). This cute "little barley" was growing in the same area I had previously found *Sclerochloa dura*, although now the *S. dura* had almost completely senesced. In central New York *H. pusillum* had only been known as a newly seeded lawn waif (Tompkins Co., Cornell University Campus, 2 Jul 1932, *S.H. Burnham 17719*, BH!). In New York State the earliest collection I am aware of is from 1898 as a waif on wool mill waste (Westchester Co., about Yonkers Wool Mill, 26 Jun 1898, *E.P. Bicknell s.n.*, NY!). Unfortunately the herbarium specimen that documents that population was on a mixed sheet with *H. vulgare* and it was mostly removed from the sheet, with only one spikelet left. The specimen should have ended up on another sheet but I have yet to see that sheet. The one spikelet that was left behind does appear to be *H. pusillum*. The population at the Trumansburg Fairgrounds covered a large area and consisted of numerous individuals, mostly growing in the track where there was not a lot of competition from other plants.

Plant of *Hordeum pusillum*, Trumansburg Fairgrounds, Tompkins Co., NY on 2 July 2020.

Growing nearby at the Trumansburg Fairgrounds was a relative of *H. pusillum*, *H. vulgare*, a Eurasian native and the barley of agriculture. I saw a form with long awns and an almost awnless form. This species is not too uncommonly encountered in the state but it is not truly naturalized, with populations resulting from repeated introductions.

Awned form of *Hordeum vulgare*

Almost unawned form of *H. vulgare*. Both of the above photos taken at Trumansburg Fairgrounds, Tompkins Co., NY on 2 July 2020.

There is more to share about the fascinating plants of fairgrounds but it will have to wait till another day. Truth be told, I don't really care for fairs: you know, all those people and the crowds, but the plants that grow there seem to draw me in every time.

Acknowledgments: Thank you to Bailey Hortorium Herbarium, Cornell University – BH (Peter Fraissinet, Kevin Nixon, Anna Stalter) and New York Botanical Garden Herbarium – NY (Daniel Atha, Lisa Fruscella, Robert Naczi, Matthew Pace, Barbara Thiers) for housing and preserving the specimens discussed in this article as well as for welcoming me when I conducted research at those institutions.

References cited:

Bothmer, R. von, C. Baden, and N. H. Jacobsen. 2007. *Hordeum* L. Pages 241–253 *in* Flora of North America Editorial Committee, M. E. Barkworth, K. M. Capels, S. Long, L. K. Anderton, and M. B. Piep, editors. Flora of North America north of Mexico, volume 24, Magnoliophyta: Commelinidae (in part): Poaceae, part 1. Oxford University Press, New York, NY, USA.

Crins, W. J. 2007. *Alopecurus* L. Pages 780–788 *in* Flora of North America Editorial Committee, M. E. Barkworth, K. M. Capels, S. Long, L. K. Anderton, and M. B. Piep, editors. Flora of North America north of Mexico, volume 24, Magnoliophyta: Commelinidae (in part): Poaceae, part 1. Oxford University Press, New York, NY, USA.

Cusick, A. W., R. K. Rabeler, and M. J. Oldham. 2002. Hard or fairgrounds grass (*Sclerochloa dura*, Poaceae) in the Great Lakes region. The Michigan Botanist 41:125–135.

Werier, D. 2017. Catalogue of the vascular plants of New York State. Memoirs of the Torrey Botanical Society 27:1–543.

Whittemore, A. T. 1997. *Myosurus* Linnaeus. Pages 135–138 *in* Flora of North America Editorial Committee, editor. Flora of North America north of Mexico, volume 3, Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York, NY, USA.

Northern Forest Atlas Project

by Raymond Curran, on behalf of Northern Forest Atlas Foundation

BIG NEWS: All three digital atlases - Woody Plants, Sedges and Mosses - are now available to download for FREE. See: https://northernforestatlas.org/c…/products/digital-atlases/

These digital atlases - Woody Plants, Sedges, and Mosses - contain over 4,200 images. The images are mostly stacked photos, which can be zoomed to full screen or beyond; on a full-size monitor this gives magnifications from 3x to over 50x, and allow the atlases to function as digital microscopes, preloaded with 200 to 300 species each.

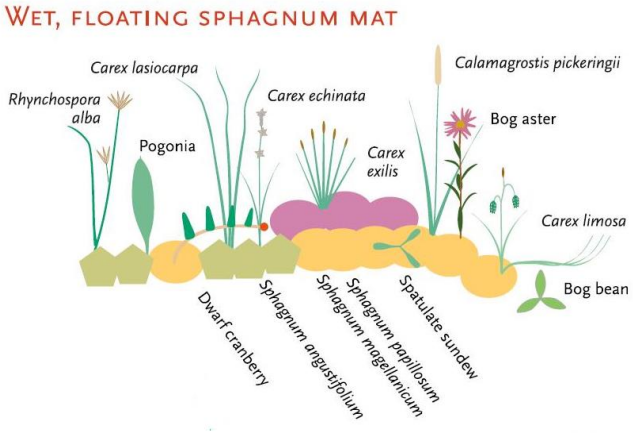
Also available from Cornell University are three printed photo guides (to Woody Plants, Sedges, and Mosses) at a low cost authored by Jerry Jenkins. And, available to carry in the field are pocket-sized folded posters on all three plant groups. See: https://www.cornellpress.cornell.edu/books/?q=jenkins

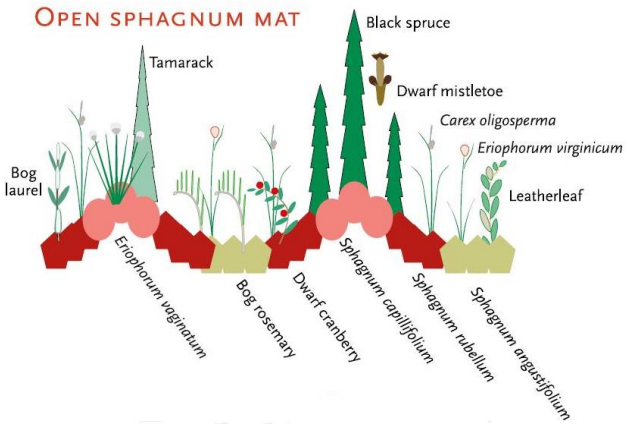
All three types of the new guides are specialized and have different content and organization, as well as format. One would do well to have all nine of the products to use. These products highlight the awesome beauty of nature and will inspire many people.

The Northern Forest Atlas was created to document the current biology of the northern forests and to provide tools for the next generation of naturalists and conservationists who will study and protect them. The Atlas was conceived by Ed McNeil and Jerry Jenkins in 2011, and began full-time operations in 2013. It has three main goals: to create a library of photos and videos showing the landscapes, plants, and animals of the northern forest; to create photographic and diagrammatic atlases, both paper and digital, for plants and landscapes; and to design and produce a series of modern field guides to plants and ecology.

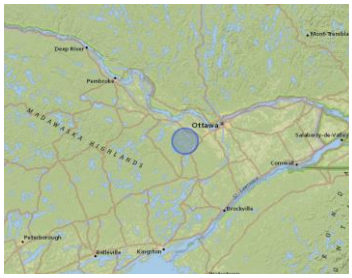
I find Jerry's innovative approach to presentation stimulating. He emphasizes graphical presentation and access to the subject matter for people of all skill levels and interests. The guides are truly beautiful.

For example, in the printed moss guide: there is a section on habitats, which is composed of ecological maps, called "Quick Guides to Habitats", showing different types of places in the Northern Forest where mosses can be found (like a dry boulder in a woodland) and then graphically locating mosses on an "iconic" image of that habitat, surrounded by detailed images of the species that could occur there. Throughout the guides he uses created images, or "caricatures" that capture key taxonomic features. I love the caricature of leatherleaf – it has progressively smaller leaves along a drooping stem. Jerry then places these images in appropriate places on his ecological maps. There could be a whole art form of these plant and ecological caricatures (see below)! On the Northern Forest Atlas website look for the free products for download – "Ecological Maps" and "Posters." There is quite a lot to see there!





Editor's Note: the images you see scattered throughout this newsletter were all taken from Jerry Jenkin's very artistic renderings.



In Burnt Lands Provincial Park, Ontario, Canada June 22, 2019

by Natasha Gonsalves*

A total of 14 people (including leaders) made the long trek out to Ottawa Valley on Saturday, June 22nd, 2019. The trip, with its focus on alvar species, was led by Dan Brunton and Holly Bickerton. It was made extra special as Field Botanists of Ontario members were joined by members of the New York Flora Association. It was the first, but hopefully not the last, joint excursion between the two groups.

We could not have asked for better weather: sunny, slightly overcast with a cool breeze, perfect for exploring the flat, open landscape of the Burnt Lands Provincial Park. Burnt Lands Alvar, located approximately 5 km east of the Town of Almonte, is a 516 ha property under both private and public ownership. The sections on Crown land are managed as a Nature Reserve Class Provincial Park.

The site has a long history of disturbance. Fires during European settlement helped inhibit and slow the establishment of trees and shrubs, a fact that many suggest gave the area its name. With its thin, exposed soils on limestone bedrock, the park contains one of the most expansive alvar ecosystems in the Ottawa Valley and southern Ontario as a whole. The Burnt Lands Alvar, as it is referred to, is a Provincially Significant Area of Natural and Scientific Interest (ANSI) and supports a diverse array of northern and western prairie and alvar species, many of which are provincially rare.

After introductions, Dan started off the day by displaying some herbarium samples that he had brought along with him (Figure 2). The samples showcased a wide selection of grass, sedge and herbaceous alvar species (many of which we would encounter later that morning). Examples included Parasol Sedge (*Carex umbellata*), Little Skullcap (*Scutellaria parvula*), and Pennyroyal Bluecurls (*Trichostema brachiatum*). He also brought along a potted specimen of Limestone Hedge-hyssop (*Gratiola quartermaniae*), a distinct alvar species.

Dan Brunton's Show and Tell.

* Printed originally in the Field Botanists of Ontario Newsletter Vol. 32(1). Thanks to Natasha Gonsalves and newsletter editor Chirstopher Zoladeski for permission to reprint.

After the "Show and Tell", we walked keenly and carefully into the Burnt Lands. No more than two steps in, our first species of interest, Balsam Groundsel (*Packera paupercula*), was encountered. This member of the aster family, with its bright golden yellow flowers, was a dominant throughout the alvar.

More species followed in quick succession: Hairy Beards-tongue (*Penstemon hirsutus*), Crawe's Sedge (*Carex crawei*), Richardson's Sedge (*Carex richardsonii*), Purslane Speedwell (*Veronica peregrina* ssp. *xalapensis*), Harebell (*Campanula rotundifolia*), Seneca Snakeroot (*Polygala senega*), Bastard Toadflax (*Comandra umbellata*) and Wood Lily (*Lilium philadelphicum*).

Wood Lily (*Lilium philadelphicum*). Photo by N. Gonsalves.

Moss and lichen-covered exposed rock interspersed across the landscape supported rare lithophiles (i.e., generally, plants showing preference or tolerance to living on rock surfaces) such as Early Saxifrage (*Micranthes virginiensis*), Rock Sandwort (*Sabulina michauxii*, syn. *Minuartia michauxii, Arenaria stricta*) and Northern Crane's-bill (*Geranium bicknellii*).

During our morning exploration, the group happened upon a small fen-like feature that supported unexpected delights, namely Northern Bog Aster (*Symphyotrichum boreale*, an obligate fen species), Swamp Fly Honeysuckle (*Lonicera oblongifolia*), and Autumn Willow (*Salix serissima*). Autumn Willow bears some resemblance to Shining Willow (*Salix lucida*) but differs in the stipules. By the end of the morning, an estimated three dozen alvar species were observed - most, but not all, were native.

Autumn Willow (*Salix serissima*). Photo by N. Gonsalves.

Initially, Dan and Holly intended to have the group move over to a nearby bog but recent flooding caused by beaver activity made the target area inaccessible and forced a change of plans. Reverting to Plan "B", the group navigated to a neighboring forested alvar community instead. This area largely consisted of White Cedar (*Thuja occidentalis*) and Jack Pine (*Pinus banksiana*).

It was here, not far from the road, that two patches of New Jersey Tea (*Ceanothus*) were found. The two seemingly innocent patches sparked a great and somewhat heated debate over their identification.

To bring the controversy to an end, a hardback copy of the botanical "bible", otherwise known as Michigan Flora, was examined. One patch was identified as *Ceanothus herbaceus* without argument. The other patch was more problematic as it exhibited a number of characteristics consistent with *Ceanothus americanus*, however the fact that it was in flower confounded the identification. Did we find a hybrid? Maybe. The question of which New Jersey

Tea plant we observed was not fully answered on this day.

New Jersey Tea: to be or not to be, that is the question. Photo by Rita Bauer.

Moving deeper into the forest, a surprisingly abundant population of Ram's-head Lady's-slipper (*Cypripedium arietinum*) was found. Most of the flowers had disappeared but the plant form within its preferred habitat was distinctive. Other finds in this part of the trip included Northern Panic Grass (*Dichanthelium boreale*) and Wild Lily-of-the-valley (*Maianthemum canadense* var. *interius*). This species differs from the more familiar Wild Lily-of-the-valley *(Maianthemum canadense* var. *canadense*) by the presence of hair on the underside of its leaves and along its stems (var. *canadense* is glabrous).

As the day was winding down, the group decided to make one last stop at an area known as Carp Hills. Situated on rich soils, Carp Hills is a 3-4 km wide forested ridge on the Canadian Shield. The upland forests sit atop Pre-Cambrian bedrock and are comprised of a mix of deciduous and coniferous tree species, particularly Red Maple (*Acer rubrum*), Sugar Maple (*Acer saccharum*), Trembling Aspen (*Populus tremuloides*), White Birch (*Betula papyrifera*), Bur Oak (*Quercus macrocarpa*), and Red Oak (*Quercus rubra*).

On route to the exposed rocky area of the Carp ridge we passed through lowland areas of alder swamp in which Northeastern Manna Grass (*Glyceria melicaria*) and Awl-fruited Sedge *(Carex stipata*) were found. Healthy populations of Cow-wheat (*Melampyrum lineare*) were also found along the way. The landscape (granite bedrock) transitioned into the rocky outcrops characteristic of the Canadian Shield. Here, expansive populations of Pale Corydalis (*Capnoides sempervirens*, syn. *Corydalis sempervirens*) were found. And this was my last observation on the wonderful outing!

FBO and NYFA members united, 2019. Photo by Rita Bauer.

A Tale of Two Trees

by Joe McMullen and Barb Root
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This is a story about two dawn redwood (*Metasequoia glyptostroboides*) trees, assumed to be from the same stock and the same age. One is now less than 3 inches in diameter and 25 feet tall, and the other 33 inches in diameter and about 90 feet tall. Details of the trees and their amazing size disparity are discussed below. But first, here is a short introduction to dawn redwood, abstracted partly from archives of the Arnold Arboretum of Harvard University (2015).

Dawn redwood is an interesting tree species. It is a narrow-leaved, deciduous, monoecious gymnosperm, attaining a height of 75 to 100 feet or more at maturity. According to the Arbor Day Foundation, "The dawn redwood is very versatile—growing in acidic, loamy, moist, sandy, well-drained, wet and clay soils. While it prefers moist conditions, the tree can withstand some flooding and has some drought tolerance". Save the Redwood League describes its native range as the Sichuan-Hubei region of south-central China in narrow valleys, on hills and wetlands in low lying areas near rivers and streams.

Until the early 1940s dawn redwood was thought to be extinct. Fossils from 100 million years ago suggest that different *Metasequoia* ('like' or 'after' *Sequoia*) species may have inhabited a broad region spanning from Russia to Japan and North America. Climate change is thought to have altered its distribution, leading to the believed extinction. A living specimen of what we now know as dawn redwood was first observed in central China in 1941, however samples were not collected until 1943; in 1946 the living tree specimens were recognized to correspond to the tree specimens long known from the fossil record. With its discovery in the 1940s, dawn redwood became known as the "living fossil". Harvard University's Arnold Arboretum was an early

participant in collection and seed stock distribution, and a fascinating chronology of their involvement can be found at the following link: *Metasequoia glyptostroboides*, 1940-2010.

Now, let's get back to our story of the two sister trees. In the early 1980s Barb worked for a short time at the State University of New York College of Environmental Science and Forestry (SUNY ESF) Syracuse, NY greenhouses on top of Illick Hall. The greenhouses were run by Larry Whelpton. As Barb remembers, he set up and managed several different biota themes on the rooftop: desert (he had a nice cactus and succulent garden); tropical (she recalls orchids, bananas, palms, vines); one may have been Pacific NW (bay laurel, some western cedars and other trees); and a sale house. There were also houses used for experiments by others.

Larry grew many plants from offshoots and cuttings, both herbaceous and woody. Students also worked with him. Woody cuttings were dipped in rooting hormone and initially grown in rooting medium (vermiculite and pearlite), kept moist and humid, then later transplanted to soil if they rooted. In the sale house there would be typical garden flowers and house plants, interesting oddities (vanilla!), and sometimes small woody plants. Barb got two dawn redwood trees from the sale house. The trees would have been from cuttings, which probably came from a large dawn redwood behind another campus building. Since they were similar in size, it seems very likely they were made at the same time from the same source, but we do not know for sure.

Joe lives in a residential area in Liverpool, Town of Clay, Onondaga County, NY and Barb gave him one of the dawn redwood trees for his yard. He planted it in an open part of his lawn where runoff during rain events is common. The soil is silt loam, with more clay content as you dig deeper. The nutrient level is probably high. Two years ago, Joe had the large spreading limbs cut from the lower 50 feet or so of the tree, because they were shading his vegetable garden.

Two sister dawn redwood trees, Barb's on the left and Joe's on the right.

Barb lives in a rural area in the Town of Onondaga, Onondaga County and planted her tree behind her house along the top of a creek bank in the Cedarvale ravine. The site is very shady, with stony, high pH soils that are likely low in nutrients. She added compost to the hole and may have top-dressed it with compost a time or two.

The dates and timing of purchase and planting of these two trees are no longer clear, but we estimate that they are now about 40 years old. We measured them recently (see photos). Barb's tree is 2.8 inches in diameter at breast height (dbh) and is about 25 feet tall, with a sparse crown diameter of 14 feet. While Barb was unintentionally torturing her tree, Joe's tree grew to 33 inches dbh, about 90 feet tall, and although the lower limbs were cut, has a crown diameter of 44 feet. The trunk of Joe's tree has the fluted appearance and hollow "armpits" characteristic of larger dawn redwoods. The size difference of these two trees is amazing.

This incredible size disparity illustrates the significant role that soil/site conditions play in the growth of plants. Being planted in the same county, these two trees of presumed similar genetic makeup obviously grew under the same climatic conditions. What was different was their soil/site conditions; differences that included: amount of shade, pH, soil texture and coarse fragments content, soil fertility, and soil organic matter and moisture content.

In comparing these two trees, one last thought comes to mind. It seems that in recent years there has been an emphasis in plant study on assessing genetic composition and genetic disparity to sort out plant systematics and taxonomic relationships. What we appear to have lost sight of is the incredible variation within plant species resulting from environmental conditions. Intra-species morphological variation from differing soil/site conditions is rampant. The phenotypic plasticity exhibited by species should not be ignored in plant identification, descriptions, and keys.

Literature Cited

Arbor Day Foundation website: https://www.arborday.org/trees/treeGuide/TreeDetail.cfm?ItemID=914

Arnold Arboretum of Harvard University. 2015. President and Fellows of Harvard College. Archives IV B-3 Metas; *Metasequoia glyptostroboides* Records, 1940-2010: Guide.

Dirr, M. A. 1998. Manual of Woody Landscape Plants, Their Identification, Ornamental Characteristics, Culture, Propagation and Uses, Fifth Edition. Stipes Publishing, LLC, Champaign, IL.

Save the Redwoods League website: https://www.savetheredwoods.org/redwoods/dawn-redwoods/

Hollow depressions or "armpits" in the trunk beneath the branch connection characterize dawn redwood, and according to Dirr (1998) are a good trait to distinguish it from bald cypress (*Taxodium distichum*).

Soft green foliage and fibrous bark of dawn redwood.

Wildflowers of New York State: Canada Goldenrod

by Knowlton Foote, PhD

I'm sure we can all call to mind a Fall field covered with a blanket of goldenrods in the northeastern United States. The yellow of the goldenrod mixed with the purple of New England Aster set against the anthocyanic colors of the surrounding senescing hardwood forests can create a beautiful picture postcard of "New England Fall".

A study of a field of goldenrods often reveals the surprising observation that it is not made up of a single species of goldenrod, but indeed contains numerous coexisting goldenrod species. It is not unusual to find five or six different species. In one field in central New York, Stuart Hurlbert (1970) observed eleven different coexisting goldenrod species, though not all flowered at the same time. One of the most widespread species in the northeastern U.S. is Canada goldenrod (*Solidago canadensis* L.*)*, which received its botanical name in 1753 from Carolus Linnaeus. It is a well-studied species with a bank of considerable literature and, as Werner et al. (1980) point out, many varieties.

Its name and classification

The goldenrod genus is *Solidago*, a word that comes from the Latin "solidus" and "ago" meaning to make solid or whole in reference to its reputed healing properties (Gleason 1963). It is a large genus with over 100 species, most of which are native to North America (Beaudry and Chabot 1959). Gleason (1963) listed 62 species and numerous varieties in the northeast. The Revised Checklist of New York State Plants (Mitchell and Tucker 1997) listed 28 species and many varieties of goldenrods in NYS.

Solidago, along with the genus *Aster*, are among the most difficult of the composite species to identify (Fernald 1950). Many of the species are quite variable and the sexual barriers between large numbers of them are weak (Beaudry and Chabot 1959). Naturalist Anna Comstock (1939) advised that "unless one is a botanist, it is wasted energy to try to distinguish any but the well-marked species of goldenrod." However, with this warning, interested individuals can learn to identify several species relatively easily, such as early goldenrod (*Solidago juncea*), lance-leaved goldenrod (*Solidago graminifolia*), tall goldenrod (*Solidago altissima)* (quite prevalent in central New York), wrinkled-leaved goldenrod (*Solidago rugosa*), silverrod (*Solidago bicolor*), and Canada goldenrod (*Solidago canadensis*), the subject of this article.

Habitat and range

Canada goldenrod is a heliophyte, a sun worshipper, loving open sunny habitats. It tolerates a fairly wide range of soil fertility, texture, and moisture, suggesting again the presence of numerous ecotypes within the species (Werner et al. 1980). One sees its golden flowers in old fields, pastures, and along roadsides, shores, and stream beds. Its range is from Virginia to Colorado and northward into the lower Canadian provinces from Ontario to British Columbia (Werner et al. 1980). It is not found in the far west or in the deep south regions of the U.S. (USDA 1971).

Description

Canada goldenrod (Fig. 1) is a perennial herb that reproduces sexually by seed and vegetatively by rhizome extension. Because of its ability to spread by rhizomes, a single plant may develop 200 of more individual plants, all genetically alike. Its erect stem grows three to five feet tall with numerous leaves except on the bottom half of the stem where they drop off as the season progresses. The lance-shaped leaves have a serrated edge, are three-veined, two to five inches long and up to 3/4 of an inch wide (Fig 1). The yellow inflorescence is broadly pyramid-like, and 2 to 16 inches in height. Not seen as a general characteristic of this species is the plant gall, but which is seen in five other goldenrod species, particularly tall goldenrod

(Abrahamson and McCrea l986).

The inflorescence consists of many flowers. Each flower in turn contains 10 to 17 fertile ray florets and a fewer number of fertile disk florets. The rays are 2/10 of an inch long and the corolla of a disk floret is 1/10 of an inch deep (Fernald 1950). Each floret produces a one-seeded fruit called an achene. At the top of an achene are found numerous pappus hairs. These hairs, slightly longer than the achene itself, spread out at maturity and aid significantly in wind facilitated seed dispersal.

Figure 1. Canada Goldenrod, *Solidago canadensis* L. (Gleason 1963).

The root system consists of both fibrous and adventive roots. In addition, from the base of the stem radiate two to six rhizomes (short modified stems). These additional rhizomes play a vital role in the vegetative expansion of the clone as they in turn have vertical roots that can penetrate to depths of three feet (Potvin and Werner 1983.).

Characteristics distinguishing Canada goldenrod from coexisting species include: a) stem hairs, b) three-nerved leaves, c) pyramid shaped inflorescence, and d) pubescence on the leaf underside. In addition, the involucre of each flower is 1/16 to 2/16 inch long, an important measurement for distinguishing this species from tall goldenrod (Fernald 1950). Canada goldenrod flowers from late July to September (Gleason 1963). In central New York it usually flowers from early August to mid-September. The basic chromosome number for Solidago species is n = 9 and the diploid number is 2n = 18 (Beaudry and Chabot 1959).

Life cycle

Each spring new plants develop either from seed or from rhizome extensions. Rhizome extensions are usually produced in late autumn and lie dormant over winter. In spring an aerial stem rises from the tip of each existing rhizome. Last year's plant may give rise to more than one shoot depending on the number of rhizomes it produced. After a brief period as a rosette of scaly leaves, shoot extension with numerous leaves is rapid followed by flowering in July - August. Seed production in central New York is from September to October while rhizomes are forming from its bases of flowering shoots. The existing shoots then die back in late fall, leaving fields full of stems now brown in color and loaded with seeds.

Seed germination does not normally begin until spring because of the late flowering season the previous year. In the field, seeds germinate in June to early July (as observed in southern Ontario and southern Michigan by Bradbury and Hofstra 1976, Werner et al. 1980). These seedlings normally do not produce flowers the first year, but establish their root system (including rhizomes). In the fall, additional rhizome growth occurs, followed by a stem with flowers the next season.

Floral biology

Canada goldenrod has a typical "radiate composite" flower (as also seen in New England aster), composed of both disk florets in the center and ray florets at the margin. Both types of florets are quite small. The ray florets are female (pistillate) and fertile, while the disk florets are bisexual (perfect) and also fertile. The ray florets mature first and are receptive for several days prior to the maturation of the disk florets. Under normal conditions, ray florets have a much higher rate of seed production relative to disk florets (Gross and Werner 1983).

The disk florets are protandrous (anthers maturing before pistils). Before the stigmatic surface of the pistil becomes receptive, the styler brush pushes up through the yellow anther tube created by the lateral margins of the five anthers carrying with them a load of pollen. The inflorescence of a plant has 50% of its flowers receptive to pollinators at one time and for up to 10 days (Gross and Werner 1983.). The disk florets provide both pollen and nectar. The pollen is sticky and insect carried (not wind carried, hence one must look to another species as the cause of Fall hay fever - the wind dispersed ragweed (*Ambrosia*).

The florets are largely self-incompatible (Mulligan and Findley 1970). In Michigan, Gross and Werner (1983) tested Canada goldenrod for self-compatibility by placing nylon mosquito netting over plants to exclude insects as well as wind-borne pollen. Hand pollinations were then carried out between plants of the same clone and between different clones. The results showed only 4.5% of potential seed production occurred when the flowers were pollinated with pollen from a plant of the same clone, and 65.7% seed production when outcrossed with pollen from another clone. Thus, this rhizomatous species is predominantly an outcrosser between clones which insures genetic diversity from one generation to the next, though at the same time it does maintain some self-fertilization capabilities.

Seed production

The number of potential seeds produced by a flowering plant is enormous! It is estimated that a single large plant can have as many as 20,000 florets and thus the potential for the same number of seeds (Gross and Werner 1983). A large clone may have over a million florets. Seed production, needless to say, is most often considerably less due to predation, site conditions, weather, lack of pollination and fertilization, and the abortion of achenes. The actual seed number per plant in the northeast falls in the range of 10,000 - 15,000 (Werner et al. 1980). Seed weight is amazingly small, being reported as 0.3 to 0.4 mg/ seed or 12,900 seeds/lb. Canada Goldenrod seeds are among the smallest seeds of our field wildflowers.

Seeds are dispersed over 5 to 6 months. The seed bearing portion of these tall plants is usually above the snow pack in the northeast. Seeds show a 50% germination rate when collected before the first frost. Experiments indicate little or no dormancy in the seeds (Bradbury 1973). Seeds in central New York that overwinter germinate the following spring with as much as 100% germination success (Morris et al. 1986).

Pollinators and other visitors

Charles Robertson (1929) observed 218 different species visiting Canada goldenrod in Illinois. Farr (cited by Werner et al. 1980) observed 241 species in a single year in Michigan, making this species perhaps the most visited species of our field wildflowers. However, not all of these species are nectar and pollen eaters; many are "phytophagous" eaters that eat various plant parts such as bracts, leaves, petals, stamens, pistils and developing ovules of the florets. The phloem tissue that is carrying the sugary products

of photosynthesis is a food source for aphids, which use their stylets to pierce a sieve tube of the phloem. Nine species of aphids have been identified on Canada Goldenrod (Richards 1972).

Pollinators include six species of bumblebees (including the honeybee, *Apis mellifera*). From the point of view of an individual floret, this species is not energy rich. The amount of sugar per floret has been determined to be only 0.000l mg or .0024 mg per flower (Heinrich l976). In one minute a particular bumblebee (*Bombus vegans*) can visit an estimated 110 florets of Canada goldenrod for a potential reward of 0.l mg sugar. The same period of time will furnish the bee 2.3 mg from red clover *Trifolium pratense* (Werner et al. 1980). However, from the point of view of insect species, goldenrod species, because of their large inflorescence and large number of plants, represent a rich, economic source of nectar for fall insects.

Goldenrod ecology

Ecological succession may be defined as an orderly process of ecosystem changes involving both environmental changes and species composition changes. Canada goldenrod is an important part of old field succession in the northeast. Succession begins in open fields with pioneer plants. As observed by Dayton (1975) in central New York fields, these species may first include grasses such as foxtail *(Setaria glauca*) and wintercress *(Barbarea vulgaris*)**.** In the second year white sweetclover (*Melilotus alba),* a biennial legume, became the dominant species. Also important were Canada goldenrod and lance-leaved goldenrod along with six other non-goldenrod species.

Once established, goldenrod plants begin to spread by rhizomes and form large clones. The goldenrods typically become dominant in abandoned fields by about age six years and studies suggest a good deal of stability in field composition (Mellinger and McNaughton 1975). Fields 100 years and older have been observed with goldenrods still the dominant species suggesting a good deal of stability of this successional stage even to the point of suppressing the next stage (woody species) by inhibitions of seed germination and seedling growth.

Conclusion

Canada goldenrod is a gregarious species that adds a great deal to the soil and the ecosystem of a field, along with a flash of yellow to our fall landscape. Quite a wildflower!

Bibliography

Abrahamson, Warren G., and Kenneth D.McCrea. l986. Nutrient and biomass allocation in *Solidago altissima*: effects of two stem gall makers, fertilization and ramen isolation. Oecologia 68: 174 - 180.

Beaudry, Jean R. and Denise L. Chabot. 1959. Studies on Solidago L. IV. The chromosome numbers of certain taxa of the genus *Solidago.* Can. J. Bot. 37: 209 - 228.

Bradbury, Ian K. l973. The strategy and tactics of *Solidago canadensis* in abandoned pastures. PhD Thesis. Univ. of Guelph, Guelph, Ont.

Bradbury, Ian K. and G. Hofstra. 1976. The partitioning of net energy resources in two populations of *Solidago canadensis* during a single development cycle in southern Ontario. Can. J. Bot. 54: 2449 - 2456.

Comstock, Anna B. 1939. Handbook on the nature- study. Comstock Publishing Associates. Ithaca, New York. 24 ed.

Dayton, Bruce R. 1975. Early stages of vascular plant succession in a century old NY field. Amer. Mid'l. Natur. 94: 62 - 71.

Fernald, Merritt L. 1950. Gray's Manual of Botany. 8th ed. D. Van Nostrand Co., NY. 1632 p.

Gleason, Henry A. 1963. The new Britton and Brown illustrated flora of the United States and adjacent Canada. Vol. 3. Hafner Publishing Co. Inc. New York. 910 p.

Gross, Ronald S. and Patricia A. Werner. 1983. Relationships among flowering phenology, insect visitors, and seed-set of individuals: experimental studies on four co-occurring species of goldenrod. (Solidago: Compositae) Ecol. Mono 53: 95 - 117.

Hurlbert, Stuart H. 1970. Flower number, flowering time, and reproductive isolation among species of *Solidago* (Compositae). Bull. Torr. Bot. Club: 97. 189 - 195.

Linnaeus, Carolus. 1753. Species planetarium. Stockholm.

Mellinger, Michael V. and S. J. McNaughton. 1975. Structure and function of successional vascular plant communities in central New York. Ecol. Mono. 45: 161 - 182.

Morris, W. F. , P.L. Marks, C. L. Mohler, N. R. Rappaport, F. W. Wesley l986 and M.A. Moran. Seed dispersal and seedling emergence in an old community in central New York. Oecologia 70: 92 - 99.

Potvin, M.A. and P.A. Werner. 1983. Water use physiologies of co-occurring goldenrods (*Solidago junco and S. canadensis)*. implications for natural distributions. Oecologia 56: 148 - 152.

Richards, W. R. l972. Review of the Solidago - inhibiting aphids in Canada with descriptions of three new species (Homoptera: *Aphididae*. Can. Entomol. 104: 1 - 34.

United States Dept. Agric. l971. Common weeds of the United States. Dover publications, New York. 463 p

Werner. P. A. , I. K. Bradbury and R. S. Gross. 1980. The biology of Canadian weeds. 45. *Solidago canadensis* L. Can. J. Plant Sci. 60: 1393 - 1409.

Botanical Notes and Photos:

A portion of the Altona Flat Rock in Clinton County burned two years ago, evidenced by the standing burnt and dead jack pine. A number of interesting sedges responded favorably to the fire, as did plants such as *Aralia hispida* and the blueberries. The following photos all come from a trip there on 25 June 2020.

The landscape in the burnt area of the Flat Rock. Photo by Anne Johnson.

Carex foenea. Photos by Steven Daniel.

Carex adusta, inflorescence and perigynia. Photos by Steven Daniel.

The most abundant of all the sedges at the Flat Rock was *Carex cumulata*. Photos by Steven Daniel.

Pinus banksiana regeneration at the Altona Flat Rock. Photo by Steven Daniel.

Editor's Note: Fixweed (*Descurainia sophia*), a non-native plant that had not been seen in a number of years was the subject of an article in the last issue of this newsletter. Up until then I had never heard of the plant, so imagine my surprise when I bumped into one almost in my own backyard, all the way up here in northern NY. It was growing in an abandoned corn field with *Rorippa sylvestris*, *Capsella bursa-pastoris*, *Veronica peregrina*, and *Panicum dichotomiflorum*.

Left: voucher specimen of *Descurainia sophia* from St. Lawrence County, NY. Right: its habitat.

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