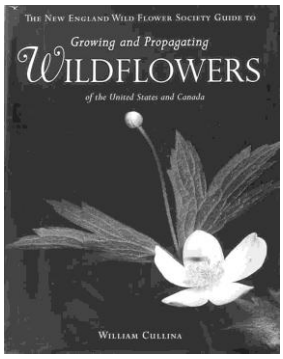
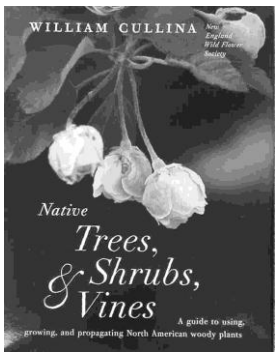
On The Fringe

Journal of the Native Plant Society of Northeastern Ohio

20th Anniversary Annual Dinner





2003 Dues Increase

It is with great reluctance that your Board must announce an increase in membership dues beginning with the 2003 Membership year to enable us to carry forward the work of the Society. The Board has reached the conclusion that an increase in the dues will be necessary to cover the cost not only of the Journal, but related operating costs.

During the last two years we have been fortunate to have Journal costs covered by generous grants from friends of NPS. However, it is important that in the future the Society be self-sustaining. As you know, the last few years have seen increases in the cost of just about everything. We are facing not only postage hikes but also rises in the cost of paper and printing.

It has been many years since we increased the dues, and at $15 for an active membership, we think it is still the best deal in town. We certainly hope you will agree. We feel that the Native Plant Society has a great deal to offer all of you. We want to have you stay with us this year and for many years to come.

All categories of membership are as shown below.

CATEGORY	FORMER RATE	NEW RATE
Individual	10.00	15.00
Family	15.00	20.00
Sustaining	25.00	30.00
Patron	50.00	50.00
Student	no charge	10.00

As always, the dues run from January 1 to December 31 and are not prorated during the year.

For those of you who wish to pay your 2003 dues at the same time you send in your annual dinner reservations, please so note on your check.

Native Plant Society of Northeastern Ohio
Cleveland Museum of Natural History Explorer Series Presentation

Date: Friday, October 25, 2002
Place: Cleveland Museum of Natural History
Time: Social hour 5:30pm Dinner 6:00pm Program 7:30pm
Speaker: William Cullina, Horticulturist, Author, and Nursery Manager of the New England Wild Flower Society's Garden in the Woods
Cost of Evening:
Dinner and Discount Explorer Series Program Ticket **$20**
Program Only (Contact Museum)
Send reservations to Ann Malmquist, 6 Louise Dr., Chagrin Falls OH 44022.

William Cullina is the nursery manager and propagator at the Garden in the Woods, the showplace headquarters of the prestigious New England Wild Flower Society. He travels extensively in the U.S. and Canada to study and photograph plants. He collects orchids, makes wheel-thrown stoneware, and builds furniture from wood he has cut himself. We are delighted that he has agreed to speak to our group and the Cleveland Museum of Natural History this Fall and are eagerly looking forward to his presentation.

Our dinner speaker this year is not just an author. He is an author who lives his words, shares photographs, both his and those of others, that are absolutely superb, and his anecdotal style is a joy to read. He includes sources of nursery-propagated native plants and seeds.

With Cullina's guidance, you will learn where plants are found in the wild and—even more helpful—where and how to succeed with them in your own garden wherever you live. It is his philosophy that a garden is not just an extension of our house but a habitat we share with plants and the animals that depend on it for food and shelter.

Join us for this exciting event. The annual dinner this year will include the election of the new Board of Directors at the business meeting immediately after dinner. A new caterer, "A Fabulous Affair", will provide the dinner.

The following quotes will give you an idea of Cullina's accomplishments.

Wayne Winterrowd, co-author of *A Year at North Hill*, echoes the sentiments of horticulturists, botanists, and gardeners alike. "William Cullina's book [*Growing and Propagating Wildflowers*] is the most complete study of its subject ever undertaken, and it is unique in being both a comprehensive field guide and a thorough manual of propagation. That would be reason enough to own the book.
(*continued on next page*)

The Journal of the Native Plant Society of Northeastern Ohio is published 4 times a year at Novelty, Ohio. Questions or comments are welcome and may be addressed to the Editor, Jane McCullam, 9880 Fairmount Road, Newbury, Ohio 44065, 440-338-3253; npsohio@hotmail.com, or to Ann Malmquist, 6 Louise Drive, Chagrin Falls, Ohio 44022; 440-338-6622, inky5@juno.com

Fall Program Schedule

Aug. 25, Sun.: Bog plant community at Jackson Bog. Led by Emliss Ricks. A boreal fen remnant with many rare plants. **9:30am**

Sep. 27, Sat.: Highland Heights Community Park, a superb natural area in suburban Cleveland. On Wilson Mills between Lander and Bishop Roads. Led by Suneeti Jog, (W) 216-687-2316 or (H)440-460-2301. **9am**

Oct. 12, Sat.: Late Fall Orchids and Gentians. Cuyahoga Valley National Park. Led by Tom Sampliner. Meet at Happy Days visitors' center on Rt. 303 east of Peninsula. **9am**

Oct. 25, Fri.: Annual Dinner and Meeting. Cleveland Museum of Natural History. See front page for details. **5:30pm**

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(Cullina - continued from front page)
But Cullina's work is no dry encyclopedia. He writes with a unique and charming voice, one that is humorous, meticulously observant, clever, and full of amiable good sense. This book will certainly be the standard reference on this subject for many years to come."

His "wildflower book had only one fault, which is that it excluded woody plants. Now this wonderful new book (*Native Trees, Shrubs, & Vines*), written with the same grace, clarity, erudition, and deep hands-on experience, will quickly join *Wildflowers* as the essential reference for anyone interested in or native flora."

Grant Announcement

The Native Plant Society of Northeastern Ohio hereby announces that it will consider applications and nominations for an Annual Grant to be awarded to an Ohio botanist that demonstrates excellence in research, conservation or education, to include land trusts, organizations and causes that clearly support the Mission of the Ohio Native Plant Society. The mission includes:

- Conservation of all native plants and natural plant communities through habitat protection and other means
- Public education and appreciation of native plants
- Proper ethics and methods of natural landscaping
- Surveys and research on native plants and publication of the information
- Cooperation with other programs and organizations concerned with the conservation of natural resources.

The amount of the grant will be $500.00. Deadline for submissions is September 15

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The Revenge of the Lawn

According to the National Wildlife Federation:

There are 25 million acres of lawn in the US, consuming

30-60% of all municipal water
70 million pounds of chemical pesticides, and
70 million pounds of fertilizer.

Lawnmowers are 10 times as polluting as automobiles. Lawns are of little habitat value to any living thing.

WOODLAND WILDFLOWERS: Easy Propagation of Fall-maturing Seeds

by Jane Rogers

First of a Series

Woodland wildflowers have a peaceful, tranquil beauty of their own. As more and more of our woodlands are being lost to development, our gardens can become important places to protect and preserve our native species. Many people, even active gardeners think growing native wildflowers is too difficult and thereby miss this very satisfying experience. Actually, many of our native woodland wildflowers are easy to propagate by seed. This article will discuss techniques for propagating five woodland plants with seeds that mature in the fall.

Whether you have a small shady corner, or a large wooded area, increasing your population of wildflowers can be rewarding. The propagation by seed discussed here is based on personal experience and results that have produced hundreds of native wildflowers in my small city garden and woods. You, too, can have the same results. The novice or experienced gardener alike can succeed. Many of us do not have the time or luck to deal with root cuttings, layering, refrigeration, potting and/or cold frames to multiply our native plants (even though such methods *can* yield good results). I prefer to take the complication out of propagation by using easier procedures. I find that seed harvesting and planting is a simpler way of dealing with native woodland seeds and can yield wonderful plants without much fuss. The keys to success are:

1) determining whether the species you are considering are suited to your area
2) recognizing the fruit or seedpod
3) learning when the seed is properly ripe
4) knowing how to treat the seed for optimum germination.

All the tools you will need to begin are a trowel and a sieve for rinsing.

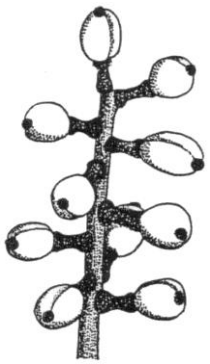
It is first important to consider where these valuable seeds can best flourish on your property. To have success with your seeds, it will help to study the soil and light condition needs of each plant. Observe and research plants that thrive in your area, that grow well together, and have similar needs. Then you can attempt to replicate those conditions. Over the years, I have mistakenly tried many plants that looked attractive in a book or catalog and have later realized that my climate or soil did not supply the right conditions for those plants to thrive or even survive. In your proposed planting area, supply plenty of organic matter, provide for good drainage, and plan ways to provide sufficient moisture until plants are established.

One of the joys of woodland gardening is to realize how easy it is to simply follow the patterns of Mother Nature. Avoid raking your native plant area – no one rakes the woods, so leave this ground relatively undisturbed. Skip the good housekeeping, too. Curb your desire to over-weed, remove yellowed stems, and clean up sticks and natural debris–leave them in place. A native plant area should look natural, not groomed like your other garden beds. Please, do not use your machines to blow or vacuum this area. Blowers could too easily pull out a tiny plant or remove a potentially ripe seed that could become a valuable wildflower in a year or two. Yes, remove invasive plants like garlic mustard and other undesirables, but allow a tiny seedling to grow until it is recognizable. Tell any overzealous weeders in your family or outside yard crews that this area is "off-limits".

One key to easily propagating many woodland natives is timing. Be aware that a number of these plants must have the ripe seeds planted at once, while they are fresh. Some of these seeds will not germinate if they are allowed to dry–-even for a few days. Also, many seeds of the woods are coated with a natural chemical inhibitor that prevents germination. For example, each trillium berry can produce up to 40+ seeds per year, yet they rarely yield 40 offspring. Most often, not even *one* seedling appears! Rinsing such seeds before planting helps encourage better germination. Many woodland seeds need only one year to emerge, some need two or three years. You might ask, why not let seeds fall naturally? If the seeds dry out, suffer from lack of moisture, or lack good contact with the soil, reproduction could be cancelled. When you actually plant the seeds, rinse when needed, cover them with a light dusting of soil, pat gently, and provide a little moisture, you have increased their chances by 20 to 100 times!

The following five woodland wildflowers seeds are ready in the late summer or fall–Baneberry, Jack-in-the-Pulpit, Solomon's Seal, False Solomon's Seal and Merrybells.

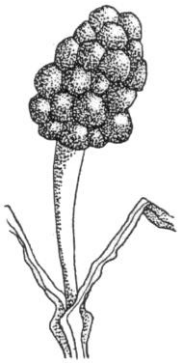
Baneberry *(Actaea rubra or pachypoda)* comes in two colors. After a white bloom fades a cluster of either red or white berries forms. By mid-summer the berries are a shiny green. As the summer progresses, the berry will develop its color. When most of the cluster has turned either red (*A. rubra)* or white (*A. pachypoda*), check one berry by removing its skin. This is one of the few plants that will germinate well even if the wedge-shaped seeds (not the berry) are greenish – though truly mature seeds should be medium brown. In the case of *Actaea* seeds, you have a wider window of opportunity for planting and germination, so you might choose to leave the clusters of berries on the plant longer to enjoy their decorative value. Once you have decided to plant, pick the berries and remove the skin. Rinse the seeds well, in a sieve under running water. Pat



Actea pachypoda fruit

the seeds dry and plant at once. Plant the seeds about ¼" to ½" deep, cover with soil, tamp gently, water, and cover with leaf mulch. Seeds should germinate the following spring and look like miniature versions of the mature plant. They will flower and fruit in about three years. *Actaeas* like neutral to moderately acid soil (pH5-7).

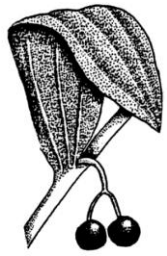
Jack-in-the-Pulpit *(Arisaema triphyllum)* forms a tight cluster of shiny berries on a stem. By mid-summer the green berries are beginning to enlarge. By fall the berries will turn orange and eventually a brilliant red. When a berry looks fat, fully red, and somewhat soft, see if it easily pulls away from the cluster. If it does, slip off the skin and check the seed color. The seed should look like a small, dull white pearl. If it does not, wait until the berry skin becomes softer and the skin slips off more easily and the color is correct. Some berries will not ripen until later and will still be green, and should not be picked until they too, turn red. CAUTION: some people are very sensitive to an irritating chemical on this red berry and will need to wear rubber gloves; others will be fine if they frequently wash or rinse when handling the red pulp. Once you determine which berries are ripe, remove them from the cluster and slip off all their red skins. Soak the seeds in water for several hours or overnight. Give the seeds an additional rubbing to remove the last of the clinging red pulp and rinse again under running water. Plant ½" deep, cover with soil, tamp gently, water and cover with leaf mulch. Use this same technique for additional *Arisaema* berries as they ripen. Only the large, fat berries will form mature seeds.



Arisaema triphyllum fruit

A relative, **Green Dragon *(A. dracontium)***, can be propagated and planted in the same way. It fruits somewhat later than its cousin and its berries are orange-red when ripe. Both types of *Arisaema* seedlings should emerge the following spring and look like tiny versions of the mature plant. They should be full size in another year or two. Well-nourished plants will produce more berries. If you want more berries on *Arisaemas*, lightly fertilize with a 10-10-10 (or something similar) or spread compost over the bare ground – but do it only when they are dormant. They like moderately acid soil (pH5-6.5) and moisture.

Solomon's Seal *(Polygonatum),* forms round green berries that hang under its arching stem. The berries form after the white bell-like flowers have withered and dropped. These berries persist all summer and will turn darker blue as they ripen in the fall. Even when the berries are navy blue the seed inside might not be quite ripe, in which case it will be yellowish or greenish. The skin must turn almost a bluish black and begin to soften and the seed will be whitish in color when ripe. Watch the plant and only pick the soft, ripe berries as they mature. Do pick the berries before they dry out too much. You may find a few berries missing since animals love to eat them. Once you have decided some seeds are ripe, pull off their skins and rinse the seeds well. Plant the seeds ½" deep, cover with soil, tamp gently, and water. These seeds need darkness to germinate so they should be well covered with leaf mulch. It will take two years for small plants to emerge. At that time they will have one or two leaves and take another season or two to become fully mature. *Polygonatums* will flourish in a wider range of soil conditions than most woodlanders (pH4-7.5), but do best with moisture and moderate acidity (pH5-6.5).



Polygonatum biflorum fruit

False Solomon's Seal *(Smilacina racemosa)* forms a grape-like cluster of small berries at the end of its arching stem. During the summer, these berries change from green, to speckled, to white, to red. In the fall, the berry cluster could have several different hues but only the red berries with the softening skin are close to ripe. Pick one to check the seed color. It should be a dull, pearly white, somewhat like a smaller version of a ripe Solomon's Seal seed. Check the seeds daily as the berries ripen one by one.

Smilacina racemosa fruit

Another relative, **Star-flowered Solomon's Seal *(S. Stellata)*** has fewer and larger berries with attractive red stripes in the summer. The whole berry darkens to a deep red in the fall. These berries should be a blackish red and softening to be properly ripe. Both *Smilacenas* need to have their seeds rinsed, planted ½" deep, covered with soil, tamped gently, watered and covered with leaf mulch. Both types will probably take two years to emerge and will have one or two small leaves at first. They like moderately acid soil (pH5-6.5).

Merrybells or **Wild Oats (*Uvularia grandiflora* or *sessilifolia*)** forms a nutlet-like capsule hidden near a leaf along their arching, Y-shaped stems. This dark green capsule forms in early summer and is camouflaged by the plants' similarly colored leaf. By mid-summer, the capsule is a lighter, shiny green. It yellows slightly as the summer progresses. The capsule hangs on for months before it is fully ripe. The capsule is 3-cornered with a 3-part seam and is less than ½" long. In late summer or early fall,

Uvularia grandifolia fruit

squeeze the capsule gently to see if the seam splits. If it is still firm, wait a few days and recheck. Maturation of the seedpod varies greatly from year to year. One year it will be mature in late July, another year it will not be ready until nearly frost. If there has been a long hot spell during the summer these seeds seem to mature earlier. If the seed is whitish, it is not viable. When properly ripe, the capsule will yellow slightly and will split open with a gentle pressure to reveal light brown oval seeds. The capsule will not become soft like the other fruits listed here. Close observation is necessary because if the capsule begins to shrink somewhat or turn brown, the seeds could dry out and may not germinate. These seeds have a white, fleshy aril attached to one side of the seed. This aril (or elaiosome) must remain moist for germination to occur. Many other native woodland plants have such arils– Dutchman's Breeches, twinleaf, bloodroot, trillium and others. This fleshy appendage is attractive to ants and insects. When you have determined that the seeds are the right color, rinse, plant ½" deep, cover with soil, tamp gently, water and cover with leaf mulch. The seedlings will emerge after two years and have small leaves on a wiry stem. Both varieties of *Uvularia* can thrive in moderately neutral to moderately acid soil (pH 5-7).

If you have one or more of these types of plants in your shady area, it is fun to watch and learn the seed-ripening progression. In order to collect fully mature seeds, you have to be "in the right place at the right time". Some native plants are for sale through nurseries (check to be sure the nursery sells propagated plants and not wild-collected plants). Otherwise, you can use the roadside, a friend's yard or private property with the owner's permission to yield enough seeds to try these simple methods. Do not gather seeds from private property without the owner's permission or from native populations in public places.

Once you see how successful these easy methods can be, you can quickly have enough "extra" wildflowers seeds or plants to share with friends and neighbors. Native plants can increase faster than you might think if you are willing to "help" them along. I am thrilled to have provided many friends with enough seeds so that they, too, can line their woodland paths or shady corners with native plants. You might even get to the point where you accumulate so many extra native wildflowers that you are able to donate them to public sites. It is thoroughly rewarding to return the native plants you have nurtured to the woods where they truly belong. Conservation by propagation is a noble goal. Try to teach these easy methods to your neighbors, children, or grandchildren and just think how many thousands of wildflowers we can add to this earth each year! Good luck!

For those of you with further interest, you may want to read the following good references:

Cullina, William. *Growing and Propagating Wildflowers of the U.S. and Canada*. Boston: Houghton Mifflin Company, 2000.

Phillips, Harry R. *Growing and Propagating Wildflowers*. Chapel Hill: The University of North Carolina Press, 1985.

Jane Rogers, a wildflower enthusiast, speaks to garden clubs and conservation groups about wildflower propagation and conservation. She volunteers with a wildflower rescue and other related efforts.

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Gray's Sedge, *Carex grayi*

by Barry Glick

I love the pale green, mace like flower heads that shoot up from the coarse textured clumps of *Carex grayi* growing along my garden paths. These uniquely shaped, mid Summer blooms contrast nicely with the grassy foliage that provides texture and interest the gardening season long.

Carex grayi is at the top of my "Idiot Proof" plant list and you can grow this baby just about anywhere including the damp shade that it chooses as its native home.

I've used *Carex grayi* in colonies around ponds, where their reflections in the water make a dramatic appearance. The dark green color of the foliage is held well into Autumn. Even in Winter, the showy seed heads add an interesting look to an otherwise bleak landscape. They've often found their way into my floral arrangements while still green, and I've dried them to a creamy tan color for dried flower arrangements.

Propagation is simple by division and a two year old clump will yield dozens of ready-to-grow new plants that can be potted up or directly planted back into the garden. Seeds can be collected and easily germinated, as *Carex grayi* forms colonies left to the plant's own devices.

Hardiness Zone - zone 2, wow talk about hardy!!!
Light preference – Light shade to full sun, almost anywhere
Soil preference - Average to rich
Moisture preference - Moist to average
Bloom time - Late Spring, early Summer
Bloom color - Pale green
Foliage - Dark green, glossy, grass like
Spread - 8" - 18"
Height - 12" - 36"
Landscape uses - Naturalizing in a light shade or full sun border or woodland garden
Medicinal uses - None that I have found

That's Just Ducky!

Many people, when they encounter a green carpet covering a quiet pond, exclaim, "Look at all this algae!" or, "See this scum!" or, "Wow; get a load of this seaweed!"

Some waters do bear a load of an alga called *Cladophora*, an undesirable, smelly monofilamentous (single-strand) exotic species that is quite unwelcome in our still waters. Its growth can be explosive in warm, sunny areas, and when it dies its decomposition can seriously deplete oxygen in marshes and pools.

Scum, on the other hand, is a generic term that can be applied to 'most anything including fungi and other non-plants (some with blueprints and huge bank accounts).

And, of course, not being seas, our quiet pools and marshes can hardly support seaweed.

Almost always, when the viewer takes a closer look at this carpet or patchy green fabric, often collected on the leeward side of the water and forming necklaces around the stems of emergent vegetation, she or he will discover it is composed of tiny green ovals or cross-like laceworks, very loosely connected to itself and detaching very readily. And the little ovals usually have pale green threads hanging down below them into the water. Sometimes the undersides of these little ovals are green, sometimes purple. And on very rare occasions in very sunny areas, one may observe the tiniest of white dots attached to the central parts of these discs.

What is this stuff? It seems to be plants, but it has no .stem, no flowers, no leaves; are the little threads like roots?

Exactly. What you are beholding *is* a plant, and, believe it or not, a flowering one in fact, these are the smallest flowering plants in the world.

This is what is commonly and collectively referred to as "duckweed." These floating plants usually reproduce by a budding process, simply sprouting new leafy ovals (called *thalli*, singular *thallus)* from what is technically the node (the area of a stem that carries a leaf or bud) of a flattened stem.

Since duckweeds are flowering plants (angiosperms), they belong to the vascular plants (as do conifers as well as ferns and their relatives). The duckweeds belong to the class of flowering plants called the monocotyledons, which have only one seed leaf, or cotyledon In contrast, think of the two halves of a peanut or bean, or the two first oval "leaves" on watermelon or other cucumber family sprouts; these are dicotyledons, with their two seed leaves. Monocots have parallel veins in their leaves. Other familiar members of the monocotyledons include cattails, the grasses and sedges, the lilies, and the orchids.

The family of duckweeds is known as the Lemnaceae, and it belongs to the subclass of monocotyledons called the Aricidae. This subclass has plants with flowers that grow a fleshy club-like structure called a spadix, which has growing at its bottom an often hood-like bract called a spathe. Perhaps the most famous member of the Aricidae is the Jack-in-the-pulpit, with its classic spadix and spathe. Other members include skunk cabbage, calla lily, and sweet flag.

In the Lemnaceae the male flower has a single anther and several pollen sacs, and the female flower is a simple flask-shaped pistil with a single or a few ovules (egg cells) inside it. Both grow inside the cowl-shaped spathe, appearing to be a single flower. They seldom flower even in bright sunlight, and never in shady conditions. It is thought that drying conditions may stimulate flower development.

Some species produce overwintering forms called hibernacula. These are smaller and denser than the floating forms, with less air space between the cells; so they fall to the bottom of the pool. When the water warms in the spring, they begin to grow, the gases formed through metabolic processes make them more buoyant, and they float back to the surface.

There are about 30 species of duckweeds in the world, and they are grouped into 4 genera *(Spirodella, Lemna, Wolffia,* and *Wolfiella),* all of which have representatives in Ohio, which has about 10 species, all native, found in it. Michigan only has 6 species; these plants don't readily stand intense cold.

Fish, ducks, other waterbirds, snails, insects, and spiders eat duckweed and these species may form an important component of the ecology of our quieter wetlands. When sufficient predators are absent and growing conditions are optimal, the growth of these species can be spectacular, and may present a problem for submergent aquatic plant species, as the available sunlight is significantly reduced by the thick mat *of Lemna* species. I know of no way to control the growth of duckweed under these optimal conditions, although a number of people have enquired about this. At Dr. Pecora's marsh, it will be interesting over the years to see the effect of the heavy duckweed growth on the population of common bladderwort, *Utricularia vulgaris,* that grows there.

Spirodella polyrhiza differs from other duckweeds in that it has several (usually 4-9) roots (poly = multiple, rhiza = root) growing from the node; it has a tiny red "eyespot" and the oval thalli, 2-6 mm wide and 3-9 mm long, are purplish below. Sometimes the hibernacula, which are produced copiously, get washed up on the shores of ponds.

There are 8 species of *Lemna* in the world; 5 of them are found in Ohio, but 3 of these *(L. minina. L. perpusilla, and L. valdiviana)* are known in only one or two counties in Ohio.-The most common species, *Lemna minor*, has thalli 1.5-3 mm wide and 2-4 mm long, green both above and below, and is found throughout most of the state. It can tolerate a wide pH range. There is a single root, sometimes reaching 3 cm or more, growing from each thallus in this genus.

Lemna trisulca, called submerged or star duckweed, often forms dense tangles below the surface in shaded waters or under floating plants in sunnier places. These submergent plants have thalli with elongated stem-like basal ends, and appear feathery or cross-shaped. However, the flowering form grows on the surface of the water and is more compact than the submerged form, which is about 1.4-3 mm wide and 4-10 mm long. This species does not form real hibernacula, but overwinters as the submerged form. It is found in scattered locations throughout Ohio's northern and central regions.

Wolffia punctata, the smallest of our three *Wolffia spe*cies, is the smallest flowering plant in the world, with thalli 0.32-0.57 mm wide and 0.58-0.96 mm long; *W columbiana* runs a close second, at 0.3-0.9 mm wide and 0.32-1 mm long. One square meter of a pure culture of these plants can contain over 2,000,000 plants. In E. L. Braun's *Monocotyledonae* for Ohio, she writes, "During the drought year of 1933, Buckeye Lake in central Ohio had more than one square mile of water surface completely covered with *W. punctata.*" It is estimated that 'a single acre of this plant contains a thousand times as many individuals as there are human beings in the world.'" These rootless plants overwinter as hibernacula. The above two species occur in scattered sites throughout the state; the third, *W. papulifera,* has only been named from two locations in Ohio, in Jackson and Portage Counties.

The fourth genus of the Lemnaceae is represented from three sites in Ohio by one species, *Wolffiella floridana* (star Wolffiella). Its flowers and fruit are unknown; it grows only in completely still or boggy areas where there are no waves. Its thalli are strap-shaped, to about 14 mm long.

There is one other plant that is sometimes referred to as duckweed, but it is a very different kind of plant; not a flowering plant at all, it is actually a fern – one of the water ferns, or *Hydropteridales.* It is *Azolla caroliniana,* sometimes called mosquito fern because its growth can become so heavy that it is reputed to smother mosquito larvae. The tiny layered leaves have an iridescent quality, appearing red in bright sun to intense green in the shade. It is not too cold-hardy but readily colonizes new areas whither it is carried on the plumage and feet of birds. Its extremely fragile fronds are about 5 mm wide and 7 mm long, and are deeply lobed, producing spores that ripen in the spring.

As Bougton Cobb, in the Peterson *Ferns* field guide, explains, these spores, unlike the uniform spores of true ferns, are of two types: a female *megaspore* and a male *microspore.* In *Azolla* each spore type is borne separately in a special capsule called a *sporocarp.* The microspores are borne multiply within their sporocarps, the macrospores singly within theirs. When they ripen these sporocarps are carried to the water surface by vernal algae, where they break open, the microspores congregating in tiny floating groups called *massulae*, which have tiny barbs by means of which they each attach themselves to a macrospore. The microspore is guided through a canal in the macrospore to the egg within it by means of tiny floating directional hairs radiating from this area of the macrospore. There is jelly-like substance that now surrounds both the spores and facilitates fertilization, after which this protoplasmic material disintegrates, releasing the fertilized egg to the pond bottom, whence it will eventually sprout and float to the surface as a new mosquito fern.

Cobb also feels constrained to mention another fascinating character of *Azolla caroliniana.* He says, "The sporocarps are outgrowths of the fertile leaves. The leaves grow in the form of an encircling ring which eventually surrounds completely either the microspores or megaspores. Before the growth of the ring has completely encircled the spores, however, a colony of blue-green algae, *Anabaena,* moves into the cavity and establishes itself there until the sporocarp later bursts open. It is rare to find an *Azolla* plant without *Anabaena* as tenant. This is called shelter association, since the fern shelters the algae with no benefits derived for either, as far as is known today."

I have seen this elegant, mainly southern species only once in Ohio, in flourishing colonies in Killbuck Marsh.

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The Oak Openings of Northwest Ohio
Part 2 of 4: Savanna Spring

by Linda Munger, Naturalist, Metroparks of the Toledo area

No matter how many springs we see, the first signs are always special - we may know that spring always comes, yet we have a need to reassure ourselves each season. For many, spring is foretold in flowers. It may be the crocus, the daffodil or the hyacinth that lifts its head up in our yard. It may be of the wilder sort that asks nothing of humans except to be left in peace to thrive. When I am asked what my favorite flower is, I have to reply honestly that it is usually the flower that I am admiring at that particular moment. There are so many! Much has been written about the procession of ephemeral woodland flowers. Skunk cabbage, mayapple, bloodroot, hepatica, wild geranium, trillium and many others make a walk in the spring woods a time of special wonder. These seemingly delicate flowers rush to complete their yearly cycle before the tree leaves fill in their canopy and shade out new growth. There is a second kind of spring in the prairies and savannas of northwest Ohio, with a different, but equally lovely, procession of flowers. Spring flowers of harsher surroundings decorate the rare habitats of the Oak openings region. They too have their own special stories. Here are just two of them.

BIRDFOOT VIOLET (*Viola pedata*)

Few flowers come with more legend and lore attached than the violet. In one of those transformations so common in mythology, the hapless nymph, Io was changed into a white heifer by the great god Zeus. Understandably upset, she began to cry, whereupon Zeus took pity and changed her tears into sweet smelling flowers which were later called violets. Stories do not say whether or not she found comfort in this gesture. The Victorian language of flowers linked violets with thoughts of love, choosing them to represent faithfulness and modesty in romance.

In more modern times, violets are still well loved. For many of us, violets, along with dandelions, were in the first bouquet that we ever picked, presenting it proudly to mom who usually accepted graciously. If you've ever wondered why there are still so many violets, it is because most violet species have two kinds of flowers, the obvious showy flower so well loved by children, and a less obvious cleistogamous flower growing near the ground. This flower never opens, fertilizing itself and producing large numbers of seeds, all virtual clones of the parent plant. Self-fertilized plants are precisely adapted to their own habitat, but may suffer when transplanted. There are dozens of species but the basic violet with its heart-shaped leaves and spurred petal is readily recognized. Most of the botanical tomes I consulted agree that identification of specific species can be an exercise in frustration.

Not so with birdfoot violet which differs from its relatives in several ways. It does not have that easily recognizable heart-shaped foliage. Instead, its fan-shaped leaf is deeply cut and finely segmented, resembling a bird's foot, if you look with an imaginative eye. Divided leaves are a common adaptation in areas of bright sunlight, preventing overheating by the sun and providing protection from wind.

That brings us to another difference – habitat. We usually associate violets with damp, rich woods or shady nooks in our own back yards. Birdfoot violet blooms in the sandy, even rocky, soils of prairies and remnant oak savannas, a seemingly inhospitable environment that makes their delicate beauty a definite surprise. The luminous lavender flowers with their conspicuous orange anthers are, to my mind, the most beautifully colored of all violets. In monitoring these plants in oak openings Metropark, it has been found that they are negatively affected by too much shading. The harshness of the habitat seems to be necessary for survival.

Birdfoot violet is the only violet that I could find that does *not* produce cleistogamous flowers, that little adaptive trick that works for survival in specific microhabitats. Why is this? Scientists may have studied or formed opinions on this issue, but they were not in any of the sources that I consulted. Something to think about when contemplating the violets of spring.

As a naturalist, one of the things that I appreciate most about the violet is that it serves as the host plant for one of our most beautiful groups of butterflies - the fritillaries. With warm tones of orange and brown combined with silvery "spangles" on the outer wings, these insects are always a treat. The great spangled fritillary *(Speveria cybele Cybele)* is a common summer sight in the prairies and savannas of Oak Openings, but its relative, the regal fritillary *(Speveria idalia)* has all but disappeared from western Ohio. The larva of the great spangled has been found on a number of violet species, while the regal appears to be more closely linked to birdfoot violet. Whether this difference in distribution is habitat or plant host related, I cannot help believing that management to improve the lot of the birdfoot violet might just give me the opportunity to get my first glimpse of the regal fritillary. Hope springs eternal.

WILD LUPINE *(Lupinus perennis)*

In ancient times, scientific examination was not always as strict as it might be. When it was observed that lupine could thrive in dry, sandy, unpromising areas, the conclusion was that lupine somehow destroyed the soil. Thoreau mentions this belief in his Journals: "Gray says that the name is from lupus, wolf, because they 'were thought to devour the fertility of the soil.' This is scurrilous." Indeed it is! Lupine, like most members of the Pea family, enhances soil fertility by fixing atmospheric nitrogen into usable form. This has been well known by farmers who often plant fallow fields with cover crops of related vetch and clover.

There are more than 100 species of lupine in the world, 70 of them occur in North America. Texas bluebonnet *(Lupinus subcarnosus)* is just one of a host of western species ranging from tree-like and shrubby, to somewhat woody to the many groups of perennials. A European relative, blue lupine *(Lupinus hirsutus*) has been grown extensively as fodder. The seeds have been used as food in Mediterranean countries over the centuries, soaked to remove bitterness then boiled to a mushlike consistency. This doesn't sound especially appetizing, but Pliny said that eating lupine would brighten the mind and quicken the imagination, while giving a fresh color and cheerful countenance. Nonetheless, I'm glad that the edible varieties of beans and peas have been so improved over the centuries.

Excluding garden species and escapes of various sorts, the Oak openings region has only one native species of lupine, but it is an excellent one. The bright blue pea-like flowers are in an upright, elongated terminal cluster above palmately compound leaves which, according to Thoreau once again were "made to be covered with dewdrops." As an early blooming species, lupine is only 8 to 24 inches tall with subterranean root stocks reaching farther into the ground than growth on the surface. The height of many different prairie plants tends to increase over the growing season, culminating in the tall grasses of early fall. Practical descriptions aside, the search for lupine is its own reward. Aldo Leopold, author of *A Sand County Almanac*, says it best.

> Sometimes in June, when I see unearned dividends of dew hung on every lupine, I have doubts about the real poverty of sands. On solvent farmlands lupines do not even grow, much less collect a daily rainbow of jewels. If they did, the weed-control officer, who seldom sees a dewy dawn, would doubtless insist that they be cut. Do economists know about lupines?

Lupine would be important as one of our original native plants, not to mention the sheer pleasure of its beauty, but there are other reasons to promote its growth, small reasons but, so important. Three tiny, endangered butterflies feed exclusively on wild lupine: Persius duskywing *(Erynnis persius* persius), Frosted elfin *(Incisalia irus irus)* , and the locally extirpated Karner blue *(Lycaeides melissa samuelis).* A great deal of work has been done to restore habitat so that the Karner blue can be re-introduced into the area. We can only hope that all three of these butterflies will be common sights to future generations.

Is it so important to preserve plant and animal species that most people have never even heard about, let alone seen? Yes, it is. There has been a great deal written about the importance of biodiversity, but the short story is that, in managing for the rare species, we preserve endangered habitats of global significance. We may never know the importance of what we have lost and we can only guess at the importance of what we save. It is worth the challenge.

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A Good Steward

Ruth Ann Ingraham

In Indianapolis, the most prominent invasive in my garden was purple winter creeper *(Euonymus fortunei).* This is a popular, widely-used ground cover and one that I deliberately introduced to grow in the deep shade of twin beech trees. Initially, I was delighted when this hearty, evergreen plant grew in areas where other plants had failed. But shoots of winter creeper appeared where I had not intended for them to grow. And then I noticed in the wintertime that many forests in Marion County had vast, dark-green patches of winter creeper that had spread from neighboring gardens or started from seeds dropped by birds. Where spring wildflowers once bloomed, only dense, tangled mats of winter creeper grew. This is true in the old forest in Broad Ripple Park which volunteers hope to restore eventually to its original, natural condition.

With a garden fork, shovel, and my own hands, arms, and whole being I removed the two islands of purple winter creeper. When I was through I had giant mounds of wiry, unruly plant material that I had to stuff into trash bags for removal. In the first cleared space I planted a mass of hostas. This week in the second I combined native plants, namely cinnamon fern, wild ginger, and large-leaved waterleaf, with hostas.

I'm ever watchful in Indianapolis for seedlings of Amur bush honey-suckle. This spring I've pulled dozens.

Last fall in Brown County I cut down for the last time a graceful mass planting of *Miscanthus sinensis* and I'm treating fresh spring growth with herbicide. *Miscanthus sinensis* is a very popular ornamental grass and I can understand why. But this grass is an acknowledged menace to the south of us. Some Kentucky ravines are full of it. In Indiana the alarm has not yet sounded. However, last summer I found dozens of young Miscanthus plants growing in the woods across the road from my property. This area is on the fringe of a youth camp. Hours were spent searching for it and digging it up. I knew then that the end had come for my non-native tall grasses and that I had to eliminate them. And I know that I will have to be vigilant for years to come on the minimally managed properties that border mine and watch for escaped seedlings.

Eradicating invasives is a never-ending process. On my few acres in Brown County I have Japanese honeysuckle and recently arrived Amur bush honeysuckle as well as multi-flora rose, crown vetch, burning bush (another Euonymus), vinca minor (periwinkle) and Asiatic bittersweet. There may be others. They all must go.

I'm sharing my experiences with you. It is hard to give up old favorites such as winter creeper, Miscanthus, vinca and burning bush. But I see how they behave and how they have changed environments. I am committed, like it or not.

Ruth Ann Ingraham is the former president of the Indiana Native Plant and Wildflower Society
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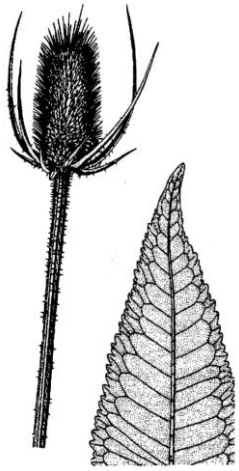
INVASIVE PLANTS OF OHIO

Common and Cut-leaved Teasel

Dipsacus fullonum (sylvestris), D. laciniatus

DESCRIPTION

Teasels are non-native, biennials or short-lived perennials that grow as a rosette for a minimum of one year, send up a tall flowering stalk, and then die after setting seed. During the rosette stage teasels develop a large taproot that may be over two feet in length and an inch in diameter. When flowering, teasels can reach a height of 7 feet. Both species have flowers packed in a dense oval shaped inflorescence on top of a spiny stem. Common teasel has pink or purple flowers, undivided leaves and bracts that are longer than the flowering head. Cut-leaved teasel has deeply lobed leaves and white flowers. A single teasel plant can produce approximately 3,000 seeds.



Dipsacus fullonum (sylvestris)

HABITAT

Teasels thrive in open sunny conditions in mesic to dry habitats. Cut-leaved teasel is often found in wetter soils than common teasel; both tolerate saline conditions. Teasels are commonly found in abandoned fields, along roadsides and in cemeteries. They can invade prairies, savannas, sedge meadows and moist forest openings.

DISTRIBUTION

Teasels are native to Eurasia and northern Africa. Introductions were probably made by early settlers deliberately as ornamentals or accidentally as toys made from the flowering heads. Teasels were also used commercially for combing wool. Common teasel is distributed throughout the United States (excluding the far north central states). Cut-leaved teasel currently has a more restricted range, primarily occurring in the northeastern and Midwestern states. Both species are found throughout Ohio, with the common teasel species being the more abundant of the two.

PROBLEM

Teasels produce massive amounts of seed that can remain viable in the soil for several years and have germination rates as high as 86%. In addition, the death of a mother plant leaves behind an excellent "nursery" for new seedling establishment leading to a continuous population of dense monocultures. The combination of these life history traits enable teasels to successfully out-compete native plants.

CONTROL

Mechanical: Individual rosettes can be removed using a dandelion digger; removal of the entire root is essential to eliminate re-sprouting. Flowering stalks may be cut down once the plant has initiated flowering, but if cut too soon plants may send up new flowering stalks. It has been shown that seeds will continue to develop and mature even after cutting. To prevent seed dispersal the cut stalks should be removed.

Chemical: Foliar application of herbicides is effective and useful when mechanical treatments are not feasible. A herbicide, such as Roundup® or Glypro®, should be applied to treat the plant in the rosette stage. In natural areas application during the late fall or early spring will result in less harm to non-targeted species.

Biological: No biological control methods are currently available.

ADDITIONAL INFORMATION SOURCES:

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Cut-leaved Teasel
Dipsacus laciniatus

For more information: Ohio Division of Natural Areas and Preserves 1889 Fountain Square Dr., Bldg. F-I Columbus, Ohio 43224, (614) 265-6453
www.dnr.state.oh.us/odnr/dnap/dnap.html

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Goldenrods – With Emphasis On Species Of Cuyahoga County, Ohio

Dr. George J. Wilder[1]

Definition of Goldenrods.--Goldenrods belong to the genus *Solidago* sensu lato. Of the four genera belonging to this genus, *Solidago* sensu stricto and *Euthamia* are the sole genera of goldenrods recognized here for Cuyahoga County. Worldwide, there occur approximately 100 species of goldenrods, including eight species of *Euthamia* (Gleason and Cronquist, 1991).

These two genera differ consistently according to a feature of plant anatomy, i.e., in *Euthamia* the leaves are more-or-less resinous-punctate (sticky and having dots or glands), whereas, in *Solidago* sensu stricto the leaves are not so (however, translucent-punctate leaves occur in *S. odora*). Additional, less consistent features of morphology serve in distinguishing between these two genera (Gleason and Cronquist, 1991).

Habitat.--Goldenrods, overall, may grow on dry, insolated, vacant urban land (*S. altissima*), in insolated lawns along highways (*S. nemoralis*), in woodlands (*S. caesia*), on rock crevices and sand dunes (*S. simplex*), on damp soil near waterways (*S. gigantea*), in swamps or wet meadows (*S. patula*), in bogs (*S. uliginosa*), and in saline places, either naturally saline or salted artificially (*S. sempervirens*).

Morphology.--Goldenrods, collectively, are fibrous-rooted perennial herbs with differentiated aerial stems and subterranean stems; the latter include simple or branched caudexes, long creeping rhizomes, or a combination of caudexes and rhizomes. "Caudex" means "a short, more or less vertical, often woody, persistent stem at or just beneath the surface of the ground, serving as the perennating (perennial) organ from which new aerial stems arise each year…" (Gleason and Cronquist, 1991).

Main aerial stems are mostly virgate (wand-shaped [slender, straight, and erect]) and bear foliage leaves. These leaves of aerial stems are cauline (borne distal to the stem base) and, at least sometimes, also compose a basal rosette. The foliage leaves are alternate, simple, mostly sessile or near-sessile, and entire or variously toothed**.**

As in other Compositae, the inflorescence is a head of epigynous, sympetalous flowers (situated above the ovary and having united petals). Heads are mostly small, pedunculate or sessile, bear phyllaries (peripheral bracts), but lack, or essentially lack, chaff (nonperipheral bracts). Phyllaries are imbricate (overlap) and compose several series. Heads are radiate, i.e., each head consists of peripheral ray flower(s) and central disc flowers. Individual heads vary from few-flowered to many-flowered, and the number of ray flowers per head varies from one to thirty-five. In most species flowers are all yellow, but all flowers are white or cream-colored in other species. Ray flowers are pistillate, disc flowers are perfect, and flowers of both kinds produce seeds. The pappus (calyx) is capillary, consisting of numerous, usually white bristles. The inferior ovary is bicarpellate and matures into a multinerved achene.

As interpreted here, the heads of an aerial shoot compose solely one cluster (capitulescence [or] synflorescence) typically confined to the distal (furthest from where the shoot attaches) end of the main aerial stem. Belonging to the capitulescence are the included portion of main aerial stem plus axillary branching systems of this stem, bearing the heads and bracts. Within the capitulescence, generally the main stem may bear typical foliage leaves (*S. caesia*) and/or more reduced leaves (*S. bicolor, S. altissima*). Robust individuals of various species may produce a capitulescence composed of subunits, each subunit resembling the entire capitulescence of typical or less robust individuals (*E. graminifolia*, *S. canadensis*, *S. bicolor*, *S. caesia*, *S. nemoralis*). Contrary to present practice, certain workers called the entire capitulescence an inflorescence (Fernald, 1950; Weishaupt, 1971; Gleason and Cronquist, 1991).

Selected Criteria for Distinguishing Between Species of Goldenrods.

1. Shape and organization of the capitulescence.—This feature is of primary importance in taxonomic keys to goldenrods. In certain species the main capitulescence axis may bear solely lateral branching systems much shorter than itself; then the capitulescence appears linear (*S. bicolor, S. caesia*). In other cases, developing lateral branching systems typically lengthen differentially, so that the capitulescence becomes flat topped and corymboid (*E. graminifolia, S. ohioensis*). In yet other species lateral branching systems also elongate differentially, but development yields an ovoid or paniculoid configuration (*S. altissima, S. canadensis, S. juncea*). Also, certain species produce secund lateral branching systems, some of these systems usually curved downward. "Secund" means "with the flowers or branches all on one side of the axis (often by twisting of the pedicels)" (Gleason and Cronquist, 1991).

2. Flower color (described above).

3. Length of involucre (all phyllaries enclosing one head).—*Solidago altissima* and *S. canadensis*, two very similar species, are distinguished by this criterion; the involucral lengths are more than 3mm and less than 3 mm, respectively (Swink and Wilhelm, 1994).

4. Miscellaneous aspects of phyllaries.--*Solidago squarrosa*, for example, differs from many species in having squarrose rather than tightly appressed phyllaries. "Squarrose" means "abruptly spreading or recurved at some point above the base" (Gleason and Cronquist, 1991).

5. Number of disc flowers and ray flowers per head.

6. Aspects of achenes (e.g., number of veins per achene).

7. Presence vs. absence of, distribution of, and nature of pubescence (hairiness).—In *S. patula* the foliage leaves are strongly scabrous (rough to the touch) above, whereas, in *S. sempervirens* foliage leaves are essentially glabrous (without hairs). Main stems are pubescent (*S. bicolor*, *S. altissima*) or glabrous (except sometimes within the capitulescence or a short distance below; *S. caesa*, *S. flexicaulis*, *S. gigantea*).

8. Size and shape of foliage leaves.—These may be typically linear (*S. riddellii*) or elliptic to ovate (*S. flexicaulis*). Leaves may vary characteristically along the aerial stem of one plant.

9. Venation of foliage leaves.—In certain species the leaves are strongly triple-nerved (i.e., with the midvein and two lateral veins especially prominent; *S. altissima*, *S. gigantea*), whereas, in other species leaves appear otherwise (*S. juncea*, *S. nemoralis*, *S. speciosa*). In *S. rugosa*, abaxial leaf surfaces may be rugose (with conspicuous veins of wrinkled appearance), contrary to those of the similar species *S. ulmifolia*.

10. Presence vs. absence of glands within foliage leaves (described above).

Hints for Identification of Goldenrods to Species.—I find it best to identify (or tentatively identify) goldenrods that are living and in nature, i.e., before they are dried and pressed; in the former case all portions of a plant are intact, arranged in three dimensions, and gross structure is obvious (e.g., major venation of foliage leaves).

Fernald (1950) commented as follows about identifying goldenrods to species (emphasis his). "SOLIDAGO, like ASTER, is one of our most difficult genera. Natural hybridization frequently occurs and the species are also highly plastic. For proper study FULL SPECIMENS, showing subterranean parts and basal leaves as well as the whole flowering stem, are essential." I support Fernald's assessment with regard to plasticity of species (see commentary below, especially for *S. nemoralis*). Goldenrods of Cuyahoga County (and Ohio overall) may be identified with one or a combination of the following works (with the caveat that certain of these works are incomplete): Fernald (1950), Gleason (1952), Weishaupt (1971), Fisher (1988), and Gleason and Cronquist (1991).

List of Species of Goldenrods of Cuyahoga County, with brief commentary.--

Seventeen species of goldenrods are listed below, based on the reports of Fisher (1988), Andreas (1989), and personal observations. I have observed all of these species in the County, except *E. tenuifolia*, *S. uliginosa*, and *S. ulmifolia*, and I consider these three species rare, if present, within the County. *Solidago puberula* and *S. sempervirens*, presently listed for the County, actually were first reported only recently for Ohio, and neither Weishaupt (1971) nor Fisher (1988) attributed them to the State. Within Ohio, *S. puberula* is presently known only from one locality in Cuyahoga County, and the nature of that locality (a relatively pristine meadow) suggests that the species has lived there for a long time, but has been overlooked. In contrast, *S. sempervirens* – in Ohio, a halophyte of disturbed land – perhaps entered the state more recently.

Cooperrider et al. (2001) listed 26 species of goldenrods for Ohio (24 of *Solidago* and two of *Euthamia*), but lumped together *S. altissima* and *S. canadensis* (in accordance with common [but not my] practice). Their list included both *S. puberula* and *S. sempervirens*. Thus, Cuyahoga County contains/has contained approximately 62% to 65% of Ohio's species of goldenrods.

Seven species of goldenrods are included within the Rare Native Ohio Plants 2000-01 Status List (Ohio Department of Natural Resources), and three of the species are attributed to Cuyahoga County: *E. remota*, *S. puberula*, and *S. squarrosa*. For Ohio, these species are listed as threatened, endangered, and threatened, respectively.

In the following list of goldenrods, I rank individual species as abundant, common, uncommon, and rare within Cuyahoga County (but not in Ohio overall).

Euthamia graminifolia (L.) Nutt. = *Solidago graminifolia* (L.) Salisb.—Abundant. *Euthamia tenuifolia* (Pursh) Nutt. var. *tenuifolia* = *Euthamia remota* Greene = *Solidago remota* (Greene) Friesner).[2] —Rare (if present).

Solidago altissima L.—Various workers have lumped together this species and *S. canadensis* (Weishaupt, 1971; Fisher, 1988; Andreas, 1989; Gleason and Cronquist, 1991; Cooperrider et al., 2002). In the last two works the species is listed as *Solidago canadensis* L. var. *scabra* Torr. & A. Gray. In Cuyahoga County *S. altissima* occurs far more frequently than does *S. canadensis*. This finding parallels that of Swink and Wilhelm (1994) for the eastern (but not western) sector of the Chicago region (the eastern sector including parts of Indiana and Michigan). Abundant.

Solidago bicolor L.—Common in woodlands. This species exhibits various of the kinds of plasticity reported below for *S. nemoralis*. For example the capitulescence may include only a small terminal portion of the main aerial stem or all of this stem (G. J. Wilder and Martha R. McCombs, herbarium sheet no. 15329).[3] In this specimen, lateral branching systems of the capitulescence are subtended by typical foliage leaves and by reduced leaves of the basal and distal portion of the main aerial stem, respectively.

Solidago caesia L.—Common in woodlands.

Solidago canadensis L.—Uncommon.

Solidago flexicaulis L.—Common in woodlands.

Solidago gigantea Aiton—Common.

Solidago juncea Aiton—Abundant.

Solidago nemoralis Aiton—In Cuyahoga County, this is an extremely plastic species. The capitulescence is either not subdivided (the typical condition) or consists of subunits (as described above [from four to eleven subunits in specimens

prepared by Martha McCombs and myself]). Lateral branching systems of the capitulescence may be well separated or highly condensed together. The capitulescence may contain only a small terminal portion of the main aerial stem or may include most of, or essentially the entire length of this stem (George J. Wilder and Martha R. McCombs, herbarium sheet no. 14151).[2] In the latter case, plants may bear strong similarity to species with typically linear capitulescences, e.g., *S. bicolor* and *S. caesia*. Finally, the fertile aerial shoots vary considerably in length. Abundant.

S*olidago patula* Muhl.— I know of this species from only two localities in the County (Brecksville, Cuyahoga Heights). Rare.

Solidago puberula Nutt.—Ms. Ann Malmquist first collected this species in Ohio, in Pepper Pike (Cuyahoga Co.), in 1994, but that collection locality was subsequently developed and destroyed (Mr. James K. Bissel, personal communication of July, 2002). I subsequently found another population nearby, in Highland Heights. The latter population is the sole one known to be extant in Ohio. Within this population fertile shoots develop only during certain years. Rare.

Solidago rugosa Miller.—Common.

Solidago sempervirens L.—I have collected specimens along roads and on insolated wastelands in Cleveland (including "The Flats" and Whiskey Island) and in Brook Park. Uncommon.

Solidago squarrosa Muhl.—I know of the species from solely one locality (within Bedford Reservation), where it is not thriving. Rare.

*Solidago uliginos*a Nutt.—Rare (if present).

Solidago ulmifolia Muhl.—Rare (if present).

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[1] After Aug. 31, 2002, the author will reside at Apt. 2A, Cardinal Court, 990 Eighth St South, Naples, FL. 34102

[2] There is a problem of synonymies. In accordance with Kartesz (1994), I list *Euthamia tenuifolia* (Pursh) Nutt. var. *tenuifolia* as a synonym of *Euthamia remota* Green. Fisher (1988) listed *Solidago gymnospermoides* (Greene) Fernald for Cuyahoga County, and considered that species synonymous with *Solidago remota* (Greene) Friesner; however, Gleason and Cronquist (1991) recognized *Euthamia remota* Greene, *Euthamia gymnospermoides* Greene, and *Euthamia tenuifolia* (Pursh) Nutt. as discrete species, and listed *Solidago remota* (without author) as synonymous with *Euthamia remota* Greene and also listed *Solidago gymnospermoides* (without author) as a synonym of *Euthamia gymnopsermoides* Greene.

[3] After Aug. 31, 2002, herbarium sheets cited herein will first be stored at Florida Gulf Coast University (Fort Myers, FL), and will then be transferred to the Cleveland Museum of Natural History (CLM).

This article reflects my personal knowledge of goldenrods and reference to the following sources: Andreas, B. K. 1989. The vascular flora of the glaciated Allegheny Plateau Region of Ohio. Ohio Biol. Survey Bull. New Series. Vol. 8. i-viii; 1-191.; Cooperrider et al., eds. 2001. Seventh catalog of the vascular plants of Ohio. Ohio State Univ. Press, Columbus, OH. 195 p.; Fernald, M. L. 1950. Gray's manual of botany, 8th ed. American Book Co., New York. 1,632 p.; Fisher, T. R. 1988. The Dicotyledoneae of Ohio. Part 3. Asteraceae. Ohio State Univ. Press, Columbus, OH. 280 p.; Gleason, H. A. 1968. The new Britton and Brown illustrated flora of the northeastern United States and adjacent Canada. Vol. 3. Hafner Publ. Co., Inc., New York. 595 p.; Gleason, H. A., and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada, 2nd ed. New York Botanical Garden, Bronx, N. Y. 910 p.; Kartesz, J. T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland, 2nd ed. Vols. 1, 2. Timber Press, Portland, OR. 622 p., 816 p.; Mabberley, D. J. 1997. The plant-book, 2nd ed. Cambridge Univ. Press, Cambridge, U. K. 858 p.; Ohio Division of Natural Areas and Preserves. 2000. Rare native Ohio plants: 2000-01 status list. Ohio Dept. of Natural Resources, Columbus, OH. 28 p.; Swink, F., and G. Wilhelm. 1994. Plants of the Chicago region, 4th ed. Indiana Acad. Sci. 921 p.; Weishaupt, C. G. 1971. Vascular plants of Ohio, 3'd ed. Kendall/Hunt Publ. Co., Dubuque, IA. 293 p.

Web Sites of interest

Giving up your lawnmower
http://www.nwf.org/backyardwildlifehabitat

Emily Compost. A wide-ranging, chatty gardening site.
http://www.emilycompost.com

National plants database
http://plants.usda.gov/

The Missouri Botanical Garden Library's Rare Book Digitization Project.
The goal of the project is to digitize and preserve beautifully illustrated and botanically significant books in the private holdings in order to make them available to an international audience.
http://ridgwaydb.mobot.org/mobot/rarebooks/index.asp

Source for nursery-propagated native trees. Located in Loveland OH, near Cincinnati. Also has interesting information about potential problems with container-grown plant materials.
http://www.nativetrees.com

UMBEL PIE

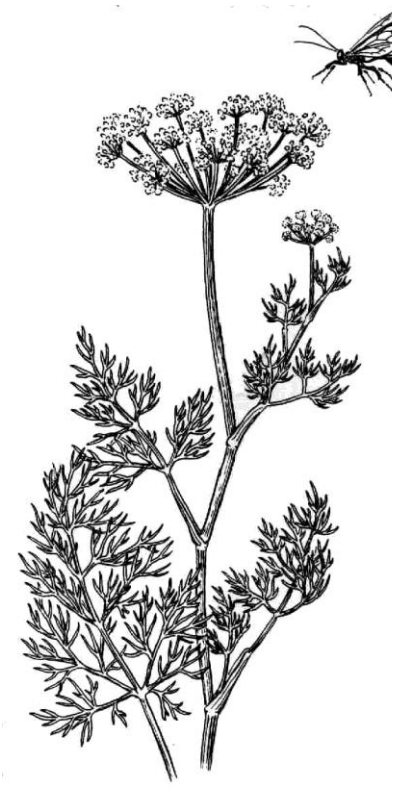
How One Family of Plants Excels at Luring Beneficial Insects to the Garden

By Niall Dunne

The Apiaceae or Carrot Family is a grand old clan with a new name. (Until very recently, botanists called it the Umbelliferae.) It includes such common culinary favorites as coriander, dill, fennel, parsnip, anise, cumin, carrot, and parsley. Yum yum! But it also includes a lot of other plants that wouldn't taste so good in your soup, such as hemlock (*Conium maculatum*), the poisonous species famously used to execute the ill-fated Socrates.

The Carrot Family is comprised of around 3,000 species-reflecting roughly 300 different genera of mainly herbaceous plants native to temperate regions around the globe. It has the distinction of being the first plant family ever to have been systematically studied. (A copy of Robert Morison's pioneering monograph of 1672, *Plantarum umbelliferarum distributio nova*, can be found in the Brooklyn Botanic Garden's rare book room.)

The family tie between these plants is clearly visible in their flower clusters, which generally look like miniature, flat-topped parasols. Botanically, these marvels. of. inflorescence are termed umbels (from the Latin word *umbellula*, meaning – hold on to your hats – "umbrella"). In a typical umbel, individual flower stalks arise from the same point on a primary stalk and stretch at different lengths so that the small flowers on top are all roughly on a level plane.



Dill (*Anethum graveolens)* & ichneumon wasp

Folks as far back as the ancient Chinese, Greeks, and Romans were aware of the shared floral characteristics of some of the plants in the Apiaceae. They were also aware of the plants' rich and varied chemistry, harvesting seeds and stalks and using them not only for food, but also perfume, medicine, and (as mentioned already) poisoning troublesome philosophers.

Historically, then, umbellifers have been of enormous biological importance as crop plants. In modern times, however, they have something else going for them as well: they're very attractive to beneficial insects – the so-called "good bugs" that act as pollinators, soil builders, or predators of pest insects in the landscape. Plants with umbels are magnets for predatory bugs in particular.

Lovage (*Levisticum officinale*), for instance, is beguiling to ichneumon wasps, which parasitize the larvae of herbivorous insects. Similarly, fennel (*Foeniculum vulgare*) attracts, among other beneficial bugs, lady beetles that prey on aphids, scale insects, thrips, mealybugs, and mites. Dill (*Anethum graveolens*) is very adept at luring such insects as lacewings, whose larvae are well-known aphid-devouring machines.

This kind of knowledge is very useful in an age when people are becoming increasingly concerned about pesticide use on their food, and about the health of the environment in general. The ability to attract and maintain a population of beneficial insects is very important to any large- or small-scale pest management scheme that seeks to cut down on the use of chemical sprays.

Bug Banquets

Although beneficial insects consume large numbers of pestiferous bugs, they often have to supplement their protein diets with plant pollen and nectar. Indeed, many of these insects have certain phases in their life cycles when they depend entirely on nutrients collected from plants.

In recent years, agricultural and habitat management scientists have been conducting field research to try and determine which plants offer the best nectar and pollen resources to natural enemies of insect pests. One plant family consistently comes out at, or near, the top: the Apiaceae. (Members of the Asteraceae or Aster Family and Brassicaceae or Mustard Family also have proven track records.)

In one study conducted by Oregon State University in 1997, eleven plant species were randomly arranged in small plots alongside a field of corn. Researchers then measured the feeding frequency of aphidophagous (aphid-feeding) hoverflies on each plant. It turned out that coriander (*Coriandrum sativum*) was the plant most visited by the hoverflies in the early growing season.

Fennel became the late-season plant of choice, after coriander had stopped blooming.

What makes umbelliferous plants so appealing to beneficial insects? Dr. May Berenbaum, head of Entomology at the University of Illinois, Urbana-Champaign, and author of *Bugs in the System* (Addison Wesley, 1995), summed it up nicely for me: "Small flowers with accessible nectar and a nice landing platform."

Although predatory insects often have custom-fitted mouthparts for eating other bugs, they are generalists when it comes to feeding on nectar and pollen. Most of them are also on the smaller side. So, invariably, they seek out diminutive, closely spaced, easy-to-land-on flowers that are shallow but brimming with exposed grub. Other factors like bloom time, flower color (usually white or yellow in the Carrot Family), shelter, and presence of prey play an important role, too.

Botanists have recorded very little specialization in umbel-pollinator interactions. Umbelliferous flowers are morphologically so uniform and their insect visitors so varied that some scientists refer to the plants as being "promiscuous." One might normally associate promiscuity" with waywardness or a lack of discipline, but in the case of pest management, an orgy of umbellifers can contribute, ironically, to an increase in biological control.

Triple-duty Beauties

Most of the research done on the beneficial-bug magnetism of the Apiaceae has so far focused on the culinary herbs. Gardeners looking to increase the number of predatory bugs in their vegetable patches need look no further than these plants. But what about gardeners who want to fight pest insects in the rest of the garden, too?

Well, we know that some of the culinary herbs can also make dramatic statements in purely ornamental settings. Korean angelica (*Angelica gigas),* for example, with its dark purple flowers and tall red stem, is a great centerpiece plant for the perennial border. (It's also good at attracting lacewings, lady beetles, and parasitic wasps.) Dill, with its thread-like, blue-green foliage and lacy, aromatic, deep - yellow umbels, can look good planted almost anywhere in the yard.

In her book, *Great Garden Companions* (Rodale, 1998), Cornell Cooperative Extension specialist Sally Jean Cunningham recommends the summer-blooming, umbelliferous sea hollies (*Erygium* species) as striking plants for the front of a perennial cluster. Not only do they have, according to Sally, attractive “leathery, blue-gray, spiny foliage" and "silvery blue flower heads with dome-shaped centers and silvery leaf-like bracts," but they also are good at attracting parasitic wasps.

As yet there just isn't much information on how well the more decorous members of the Carrot Family perform as insectary plants. "The science of which plants attract or, maintain which insects, at which time of year, in which climate zones is at an elementary stage," says Sally.

So this is a good opportunity for gardeners to get in on the action and study such traditionally planted ornamental genera as *Astrantia* (masterwort), *Myrrhis* (sweet Cicely), *Aciphylla* (speargrass), and *Bupleurum* (thorow-wax) for signs of beneficial insect activity. But you don't need to stop there. The ornamental palette of the Carrot Family is broadening steadily.

In the April 2001 issue of *Horticulture* magazine, plantsman Daniel J. Hinkley wrote about some of his favorite lesser-known umbellifers. He recommended the spring-blooming *Chaerophyllum hirsutum* 'Roseum' for its "low spreading mounds of handsome, deeply dissected foliage" and its “lacy heads of rose-colored flowers." He also gave special mention to *Pimpinella major* 'Rosea' (greater burnet), whose sturdy, 3-foot stems produce "lovely discs of light pink" from July to August.

I asked Dan if he had noticed any high insect activity on the specialty umbellifers that he grows at Heronswood Nursery. He couldn't say for sure, but his interest was definitely piqued. "You know, come to think of it, there's always a swarm of wasps flying around our angelicas."

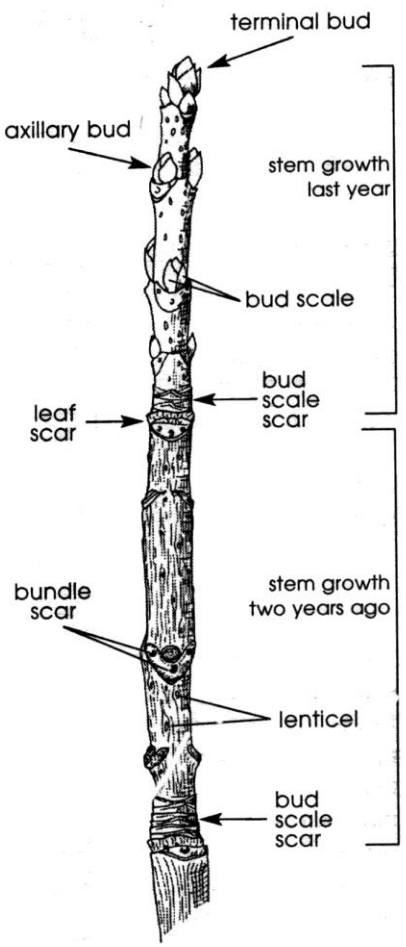
Illustration by Bobbi Angell
Reprinted from *Plants & Garden News*, the Brooklyn Botanic Garden, Summer 2001

Botany 101 eighth in a series

Twig Characteristics

By Rebecca Dolan

Looking out my window reminds me that this is a good time of year to think about identifying trees using twig, or young branch, characteristics. It will be a long time before the leaves return. All twigs are all built on the same basic scheme, but different species have distinct characteristics. Study the diagram and match up the terms below, then scout out some common trees you have identified in summer and look for the specific traits that are displayed best in winter.



Twigs end in **terminal buds.** These contain the **meristem** that will provide more branch growth in the coming year. Buds are protected by **bud scales.** Terminal bud scales leave **bud scale scars** around the circumference of a twig when they fall off as new growth is initiated. These scars often remain visible on twigs, indicating where growth started the previous season. Three to four years' growth can often been seen on a twig.

Axillary buds are found appressed along the sides of twigs just above where the petiole of last year's leaves attached to the twig. These will develop into side branches. The spot where the leaf attached is referred to as the **leaf sear.** Some trees have obvious **bundle scars** within the leaf scars. These are the traces of the vascular system, the xylem and phloem that supported the leaf.

Other features of twigs are often used in winter botany identification. **Lenticels** are corky cracks in the bark that took like elongated dots scattered along the branch. The soft, central part of a twig, visible when you cut a small branch, is called the **pith.** The pith may be chambered, having tissue that divides it into sections along the twig, and may be circular, or have another distinctive shape in cross section. **Thorns,** if present, are also easily seen in winter. The color of twigs is sometimes also diagnostic.

Distinctive twig features of some common trees:

Members of the **rose family,** including many fruit trees, often have **large lenticels.** Out common Black Cherry displays numerous long lenticels.

Oaks have distinctive star-shaped pith, clearly visible if the twig is **cut** cleanly, and buds clustered at the ends of the twigs.

Sycamores have leaf scars that completely surround the axillary buds, so next year's growth comes right out of the spot where last year's leaf attached, not below the point of attachment as in most trees.

Ohio buckeye has heart-shaped leaf scars that are very large, along with large terminal buds.

Maple twigs usually have three bundle scars and tend to be slender.

Black locust has buds that are hard to see; they remain underneath the leaf scars. It often, but not always, has thorns.

Ash twigs are stout and have many leaf scars.

American beech twigs have one inch long, tan buds with many bud scales.

Mulberry twigs have many bundle scars and no terminal bud.

Redbuds have uneven fringing on the upper edge of their leaf scars with the axillary bud centered directly above the leaf scar.

Tulip poplar has flattened terminal buds.

That nasty, **invasive, non-native, Tree-of-Heaven** has brown pith with up to nine bundle scars along the lower side of each leaf scar.

Black walnut has chambered pith that is tan or light brown.

Becky Dolan is Director of the Friesner Herbarium at Butler University. Illustration of Silver Maple *(Acer saccharinum)* by Jan Glimn-Lacy, botanical illustrator.

Reprinted from the Indiana Native Plant and Wildflower News, Spring 2001

Encounters With *Origin*

By David B. Williams

In the winter of 1997, I held a first edition of *Origin of Species* in my hands. The green cover was cracked and frayed. Cardboard backing protruded through the torn corners. Wanting to be careful, I put the book down and simply stared at it. The owner of this book had been Asa Gray, one of America's greatest botanists, and a friend of the author, Charles Darwin.

Gray was a professor of natural history at Harvard University in 1859, when *Origin* was published. More importantly, he was a member of Darwin's inner circle and a provider of key botanical information to the English naturalist while he wrote his great book. After publication, Gray became the most important American supporter of natural selection, writing and lecturing on behalf of Darwin's radical idea.

Until I touched that historical edition, I had never had a desire to own the basics of the theory of evolution, so why read a Victorian-age book bound to be impenetrable and filled with unwieldy sentences? Consider the rarely used title: *On the Origin of Species By Means of Natural Selection, or the Preservation of the Favoured Races in the Struggle for Life.* How could this book be interesting?

I first heard about this unique copy of *Origin* while researching unusual materials owned by Harvard's natural history libraries. A librarian had told me that the university owned Asa Gray's personal copy of *Origin of Species*. I wondered if Gray had made notes of any kind in his book, so I asked if I could see it. The librarian said yes, and I returned to the red brick building two days later.

Inside the library, I handed over my book bag and filled out the required white form to request the book. Judy Warnement, the head librarian, walked over to a gray cabinet, unlocked it, and pulled out a gray box. On the spine in simple black lettering it read *Origin of Species Darwin*, each word stacked on top of the other. She unwound the two white strings that held the acid-free box closed and pulled out the book. Before handing it over she cautioned me to be careful as the book was not in good shape.

I carried Gray's book over to one of the two reading tables, pulled out a chair, sat down, and dried my hands on my pants legs. I was already somewhat nervous getting ready to hold and read through this book. Now, I had to be extra careful to not damage it further. Beyond the cracks and dog-eared corners, the binding and cover had separated to the point that only the brownish endsheets held the book together. Asa Gray either was careless with his books or had read and reread this one.

I pulled up my sleeves and opened one of only 1,250 copies of the first edition of *Origin of Species.* Surprisingly, neither the publisher, John Murray of London, nor Darwin expected the book to sell well. (Not that sales mattered to Darwin financially; he was independently wealthy. Nevertheless, he would receive two-thirds of the net profit!) Just one month before publication Darwin wrote to Murray: "I heartily hope that my Book may be sufficiently successful that you may not repent of having undertaken it." To spread the word about *Origin*, Darwin had asked his publisher to send presentation copies to potential reviewers.

The book I held was one of these review copies. Turning past the dark brown endpaper of Gray's book, I found where the publisher had written “From the Author” in ink now faded to golden brown. Asa Gray had penciled his name above it. Skipping over the wordy Victorian title page, I discovered that writing his name was only the first of numerous additions made by Gray. He peppered the margins with "Yes", "Well put", and numerous exclamation points. But he also read it like an editor, writing “too much personification” and “overdone, too fanciful”, adding commas, and rearranging sentences. In summing up Gray's marks his biographer Hunter Dupree wrote "the[y] point to the conclusion that he approved much of Darwin's reasoning and most of his individual examples."

Gray's copy of *Origin* also contained two pages of Darwin's handwritten notes pasted into the back, comments that addressed several errors from the first edition and clarified information on domesticated dogs and slave-ants. Darwin sent these notes in January 1860, so that Gray could facilitate the publication of an American edition of *Origin.* Gray was instrumental in this endeavor because America did not recognize foreign copyrights until 1891; therefore, anyone could publish *Origin* in the U.S., with or without the author's consent. Gray helped arrange for a single American edition to be published in New York by Appelton. By May 1860, Appelton had sold 1,750 copies.

One week after looking through Asa Gray's copy, I had the opportunity to examine another first edition, presentation copy of *Origin.* Louis Agassiz, who in the 1860s was America's foremost opponent of the theory of evolution and Gray's colleague at Harvard, owned this copy. “From the Author” adorned the frontispiece of his book, too. The similarity with Gray's ended there, for no cracks marred the green cover and the corners lacked dog ears. Agassiz also wrote in the margins but his comments ranged from 'This is monstrous” to “The mistake of Darwin...” to “A sentence likely to mislead!”

Despite his opposition to evolution, Agassiz was a world renowned naturalist, respected by scientists and liked by the general public. He lectured brilliantly on subjects as diverse as the Ice Age, fossil fishes, and embryology. Agassiz,

however, supported the theory of special creationism, which held that God had created each and every species in its current location. Species did not change through time, but great catastrophes like glaciers or floods periodically destroyed life on earth, and then God began the process all over.

After reading through these two books, I felt obligated to purchase my own copy of *Origin of Species*. I wanted to understand the context of their notes. I had many editions to choose from at the local bookstore. Publishing *Origin* has come full circle; anyone can publish the book because the copyright ran out years ago. I purchased the Penguin Books edition because it was a reprint of the first edition.

Darwin's writing pleasantly surprised me. He occasionally baffled me with long, ponderous ramblings, but for the most part I found *Origin* to be compelling and thought-provoking. I enjoyed his almost overwhelming number of examples. Despite the fact that Darwin wrote the book from his country home in England, he referred to rhododendrons from the Himalayas, South American tyrant flycatchers, slave-making ants in Sussex, and glaciers in North America. He also discussed plants and animals as diverse as legumes and lemurs, parasites and pigeons, and beetles and bats.

As a naturalist I was most impressed with Darwin's discussions of the relationships between organisms. In one case he showed how domestic cats affected the abundance of wildflowers in a field. He began by describing how bees are essential to the fertilization of flowers. From them Darwin examined how field mice destroy the insects' nests and honeycombs, thus affecting the number of bees in a region. "The number of mice," he said, "is largely dependent, as everyone knows, on the number of cats." By the end he created a splendid domino effect: Cats killing mice prevents the rodents from destroying nests, which allows bees to multiply and pollinate, thus producing a field full of flowers.

Darwin understood the importance of this interdependence of organisms. In the conclusion of his chapter devoted specifically to natural selection he wrote: "I can see no limit to the amount of change, to the beauty and infinite complexity of the coadaptations between all organic beings, one with another and with their physical conditions of life, which may be effected in the long course of time by nature's power of selection."

He clearly appreciated nature and did not write merely as a detached observer. He raised pigeons to show how domesticated animals could serve as an example of "natural selection"; examined the means of dispersal by testing the effects of salt water on seeds; and studied pollination in his garden plants. And of course, Darwin also spent the early part of his career traveling around South America on the HMS Beagle.

Darwin even discussed the deleterious effects of cattle grazing. He described exploring a "large and extremely barren heath" where cattle grazed. In the midst of the heath was an enclosure of Scottish fir. Within this fenced-in area he found 12 species of plants and six birds not found in the heath. In describing the heath he wrote: "I found a multitude of seedlings and little trees, which had been perpetually browsed down by the cattle."

My greatest surprise in reading this book was that Charles Darwin did not use the phrase "survival of the fittest." He came close, using phrases like "individuals having any advantage ... would have the best chance of surviving..." or "the selected form having some advantage in the struggle for life over other forms." The precise four word aphorism, however, did not appear until the fifth edition, printed in 1869, ten years after the original publication. Furthermore, Darwin did not even coin the maxim – English philosopher Herbert Spencer first used "survival of the fittest" in 1862 in his *Principles of Biology Volume I.*

After reading *Origin* I decided to find out if I was alone in my prior prejudice against the book. Over a several-month period I asked scientists, friends, writers, and science journalists if they had read it. The responses ranged from "I once read a book with *Origin* in the title. Does that count?" to "Of course, I even celebrate Darwin's birthday." This same friend said that he had self-consciously kept a copy of *Origin of Species* in his hip pocket during junior high school. He read it then and continues to reread it "for its constantly new insights and graceful language, and especially for the way in which the right questions kept coming to him (and, often, the right answers)."

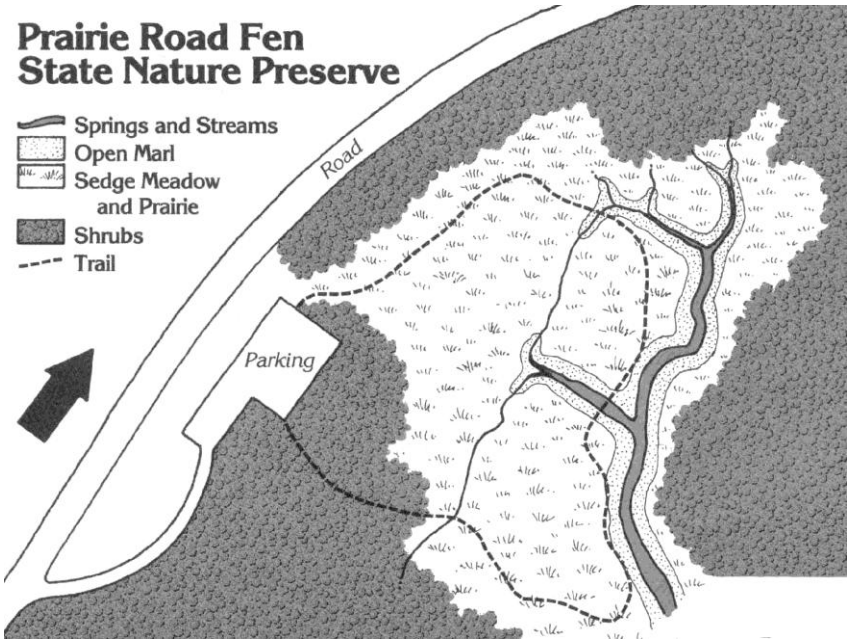
Most of the people I asked, could not claim such familiarity with *Origin*. They knew of the book, but they had only read passages or at most a chapter or two. Of the few who had finished the entire book, most had been required to read it for a class. I only found one or two people who had read it on their own accord.

I was not surprised. Most of the people with whom I spoke are readers and are familiar with natural history writing, but they, like me, take Darwin for granted; his theory has been explained, updated, and proven, so why read *Origin of Species?*

The reason is simple; we should read *Origin* to honor Darwin. The theory of evolution changed the way humanity thinks about itself and the world around us. Few natural scientists have had such an impact. We owe it to Darwin to read *On the Origin of Species By Means of Natural Selection, or the Preservation of the Favoured Races in the Struggle for Life* because it presents clearly one of the most important ideas ever proposed. Plus, it is a good read.

Reprinted from the Winter 2000 issue of *Douglasia*, the newsletter of the Washington Native Plant Society

Prairie Road Fen
by Tim Snyder



Prairie Road Fen State Nature Preserve is administered by the Division of Natural Areas and Preserves in cooperation with the U.S. Army Corps of Engineers. It is open by permit only. Directions to the site will be given when a permit is issued. For more information, contact the division at 1989 Fountain Square Court, Building F, Columbus, Ohio 43224. 614-265-6453.

Prairie Road Fen is the largest and finest prairie fen left in Ohio. As home to spotted turtles and the eastern massasauga rattlesnake-both on the state's list of rare animals-this area provides an important refuge for some of Ohio's vanishing natural heritage

The Fen Environment

Fens are alkaline wetlands found in the glaciated region of North America. They occur where ground water moving through calcareous gravel reaches a lower area and forms springs. During its subterranean journey, the water becomes cold, oxygen deficient and hard, picking up dissolved bicarbonates of calcium and magnesium from the gravel. Some of these dissolved compounds precipitate out around the springs, mixing with mud to form grey, lime-rich marl. The combination of cold water and alkaline marl creates a harsh habitat in which only specialized plants can thrive.

The ground water emerging as springs at Prairie Road Fen fell as precipitation on a segment of Urbana outwash to the west. This gravel plain was formed by a meltwater stream coming from the retreating continental glacier. A later meltwater river flowing at a lower level cut through the Urbana outwash. The gravel bed of this latter stream is called Mad River outwash and forms the floor of the valley where Buck Creek runs. The springs feeding the fen emerge from the 20-foot high bank of the Urbana outwash along the west side of the preserve.

Flora of the Fen

The most characteristic fen plants are found where the water is coldest and most alkaline. These include Kalm's lobelia, false asphodel, grass-of-Parnassus and seaside arrow-grass. Look for them near the open marl flats.

Farther from the springs where water temperatures have moderated and fallen organic matter offers some protection from the marl, a sedge-meadow forms. Here are found shrubby cinquefoil, Canadian burnet, smaller fringed gentian and Ohio goldenrod.

Intermingled with these fen plants are a number of species more commonly found in prairies. These plants extended their range eastward during a period of warmer, drier climate that occurred several thousand years ago. With the return of conditions more favorable to trees, the prairie was shaded out except in favored spots where trees could not grow. The presence of big bluestem, spiked blazing-star, whorled rosinweed, prairie dock and queen-of-the-prairie makes this a prairie fen.

Although its wetness has helped protect it, Prairie Road Fen is not totally undisturbed. Ditches in neighboring fields, construction of roads and houses on its edges, and farming in drier years have all affected it. With its purchase by the U.S. Army Corps of Engineers as part of the C.J. Brown Reservoir project and its subsequent lease by the Ohio Department of Natural Resources, Prairie Road Fen now has a better chance of surviving.

Reprinted from an Ohio Department of Natural Resources publication, 1990. Map by Jim Glover

Composites Of The Prairies

There probably isn't a tallgrass prairie found anywhere in North America where the greatest numbers of prairie forb species located within that prairie are not members of the Composite Family *(Asteraceae* or *Compositae).* The Composite Family (also called the Aster Family, the Daisy Family, or the Sunflower Family) is not only the most advanced and most complex of the plant families on Earth, but is also the most recent plant family to appear on Earth. The Composite Family has the greatest number of plant species of all of the plant families in North America. Worldwide, The Composite Family is second only to the Orchid Family *(Orchidaceae)* in numbers of plant species. The bright colors (mostly yellows, but with some reds, purples, blues, or of various shades in-between) of the composite flowers attract insects, such as the bees or the butterflies, which drink the nectar and facilitate cross-pollination, which increases genetic diversity. (Although most composite species do have attractive flowers, which are also insect-pollinated, one genus, the Ragweed *(Ambrosia* spp.), does not have attractive flowers and is also wind-pollinated.) The rainbows of bright flower colors also attract many human visitors to these prairies. Because of their bright colors, many people raise composites in their flower gardens.

There are a few composite species, such as the lettuce and the artichoke, which are cultivated for food. A few other species, such as the sunflower or the safflower, are cultivated for food products, such as cooking oils.

Composite forbs can vary in height from under one foot to over ten feet. Their leaves can vary greatly in size and shape. These leaves can be simple or compound and can be alternately, oppositely or whorledly arranged upon the stem. Some plants even have basal rosettes of leaves. However, none of the composite leaves have stipules (Latin: *stipula,* stalk, straw, or stubble) at the base of their leaf stalks or petioles (Latin: *petiolus,* little foot or little leg). What really make the Composite Family different from other plant families are its flowers.

All composite flowers are placed upon a flower head or capitulum (Latin: *capitulum,* little head). The capitulum is composed of numerous small flowers or florets (Latin: *flos,* flower) that are placed upon a disk (Latin: *discus)* or a receptacle (Latin: *receptaculum,* reservoir), which is a large, expanded tip of a single stalk or pedicel (Latin: *pediculus,* little foot). The whole flower head is then encircled or subtended by a ring or an involucre (Latin: *involucrum,* case, envelope, or wrapper) of leafy green bracts (Latin: *bractea,* thin plate of metal) or phyllaries (Greek: leaves). The phyllaries may be arranged in a series of one to many or may be arranged in an overlapping imbricate *(Latin: imbricatus,* covered with gutter tiles) pattern. A second set of bracts, scales, or chaffs (Old English: *ceaf,* Middle English: *chaf, German: kaf* , husk) may also be present. This second set may subtend (Latin: *subtendere or sublendo),* or enclose at an angle, each individual floret that grows upon the receptacle. Depending upon the species, the receptacle may also be bristly, hairy, pitted (Latin: *puteus,* a well) or punctate (Latin: *punctatus or punctum,* a point). Each individual floret upon the flower head should be a perfect flower. The gynoecium (Greek: female house) consists of a single lower or inferior pistil (Latin: *pistillum,* pestle) with a bicarpellate ovary (Latin: *ovum,* egg), one style (Greek: *stylos,* column or pillar), and a two-lobed stigma (Greek: point). The androecium (Greek: male house) consists of five (rarely four) stamens (Latin: *stamen,* filament). The stamens all have free filaments (Latin: *filamentum,* thread) but with the anthers (Greek: flowering) are all fused into a single tube that encircles the style. The corolla (Latin: *corolla,* little crown) is composed of five united petals. The calyx (Greek: *kalyx,* cup), referred to in the Composite Family as the pappus (Latin: *pappus,* plant down; Greek: *pappos,* old man), may or may not be present. If the pappus is present it is in the form of stout awns (Latin: *agua;* Middle English: *aune or awne,* sharp), capillary (Latin: *capillaris or capillius,* hair) or plumose (Latin: *pluma, plume, or plumosus,* feather down) bristles, hairs, palea (Latin: *pales,* chaff) scales, or anything else that may resemble gray hairs. On some species, the pappus may stay attached to the seed to help its distribution.

Unlike other plant families, the Composite Family is the only family that has two different types of flowers borne upon the same capitulum: the smaller disk flowers that are located at the center of the capitulum and the larger ray (Latin: *radius,* spoke of a wheel) flowers that encircle the outer margin of the capitulum. The central disk flowers are radially symmetrical tubular flowers with a five-lobed or two-lipped corolla. The outer ray flowers are bilaterally symmetrical and are ligulate (Latin: *ligulatus,* having a small tongue), with a short basal tube and a flat strap-shaped band or blade that are commonly mistaken for the petals. Think about that the next time you pluck off the plant's ray flowers while saying "He/she loves me, he/she loves me not." However, not all flowers in the Composite Family will have both the disk and the ray flowers.

The inflorescence (Latin: *infloresco,* start to bloom) of the composites may be clustered upon the plant as corymbs (Latin: *corymbus; Greek: korymbos,* cluster of flowers), as racemes (Latin: *racemus,* bunch of grapes), or as panicles (Latin: *panicula,* tuft on plants). Corymbous flowers may be broad and be rounded or flat-topped. Each of the flower head's stalks, which originate from a central stem or rachis (Greek: *rachis,* backbone), are of varying lengths with the flower heads in the center having the shortest stalks and the outer flowers having the longest stalks. Racemous flowers are an elongated and an unbranched cluster of stalked flower heads that are borne from a central rachis. Panicled flowers are compound racemes with multiple, loose and irregular branching and with the flower heads borne upon their final branchlets. The blooming order of the flower heads of these inflorescences is from the bottom up or from the outside inward.

There are two subfamilies within the Composite Family, but only one of them, the *Tubuliflorae* Subfamily, has prairie plants.

Tubuliflorae Subfamily

All of the disk flowers, if perfect, would be tubular and would usually have five even lobes. Any ray flowers, if present, would be located around the margin of the flower head and would either be female or neutral. The plant's sap would be clear and

watery. Of the twelve plant tribes within the *Tubuliflorae* Subfamily, only four of them have local prairie plants.

***Heliantheae* Tribe (Sunflower)**

Has the largest number of prairie genera of any of the prairie tribe. Leaves, especially lower leaves are usually oppositely arranged. Flower heads usually have disk only or both disk and ray flowers. The disk flowers are cylindrical, domed, or flat. The ray flowers are yellow. Receptacle may be chaffy. Involucred bracts are usually herbaceous and are arranged in a one-to-many series. Style is simple or branched and has a crown of hairs below stigma. Anthers are not tailed but are rounded at their base. Pappus is not hairy or bristly, but is scaly or toothed.

Genus *Coreopsis* (Coreopsis or Tickseed)

Most leaves are opposite and with entire or dissected margins. Flower heads are about one to 2.5 inches wide, are stalked and are either single or panicled. Involucred bracts are arranged in two rows of eight each. Disk flowers are convex or are flat. Ray flowers are usually eight, are yellow, white, or pink, and have entire, lobed, or three- or four-toothed tips. Pappus is two awns or two teeth.
Local Prairie Species: Tall Coreopsis *(Coreopsis tripteris)*

Genus *Echinacea* (Purple-Coneflower)

The stems are stout and erect. Leaves are simple, alternate, and have entire or toothed margins. Lower leaves may have long petioles. Flower heads are large. Involucred bracts are arranged in a three-to-four series. Disk flowers are purple or yellow and are cone- shaped. Its chaff is spine-tipped and is longer than the disk's tubular flowers. Ray flowers are purple, rose, white, or yellow, are two- or three-lobed and are reflexed or droopy. Pappus is a small-toothed rim.
Local Prairie Species: Purple Coneflower *(Echinacea purpurea)*

Genus *Helianthus* (Sunflower)

The stems are simple or branched. Leaves are simple, lobed or toothed, are opposite near the bottom and are alternate near the top. The lower sides of the leaves have a pair of conspicuous midveins that are parallel to its midrib. Leafstalks can be very short or very long. Larger leaves are unlobed. Flower heads are terminal, and are solitary or in corymbs. Involucred bracts green and leafy and are arranged in two to four rows. Disk flowers are brown, purple, red, or yellow, are flat or in a low cone shape, and are chaffy. Ray flowers are neutral, yellow and are three-toothed at the tip.
Local Prairie Species: Giant or Tall Sunflower *(Helianthus giganteus),* Saw-Toothed Sunflower *(Helianthus grosseseratus),* Showy Sunflower *(Helianthus laetiflorus),* Pale-Leaved Wood Sunflower *(Helianthus strumosus)* .

Genus *Heliopsis* (Ox-Eye)

Not a true sunflower. Leaves are simple, opposite, coarsely-toothed, three-veined, and petioled. Flower heads are about 1.5 to 2.5 inches wide and are terminal. Involucred bracts are arranged in two or three rows and are overlapping. Disk flowers are brown, purple, or yellow, are cone-shaped and are partly enclosed by narrow chaff. Ray flowers are yellow, fertile with a forked pistil at their base, and are notched at the tip. There is no pappus.
Local Prairie Species: Oxeye or False Sunflower *(Heliopsis helianthoides)*

Genus *Rafibida* (Prairie-Coneflower)

Leaves are simple, alternate, and have pinnately lobed margins. Flower heads are single and borne are at the ends of branches. Involucred bracts are arranged in two rows. Disk flowers are brown or gray, chaffy, and columnar. Ray flowers are yellow, drooping or reflexed, and have slightly three-toothed tips. Pappus is two teeth or non-existent.
Local Prairie Species: Prairie Coneflower, Yellow Coneflower, or Ray-Headed Coneflower *(Ratibida pinnata)*

Genus *Rudbeckia* (Coneflower)

Leaves are simple, have lobed or pinnately lobed margins (but are not compound), and are alternate. Flower heads are terminal. Involucred bracts are leafy. Disk flowers are brown or purple, columnar or conical, about 1/2to3/4inches wide, and are chaffy. Ray flowers are yellow or orange (but may be darker toward the base), are narrow at the tip, and have slightly toothed tips. There is no pappus.
Local Prairie Species: Black-Eyed Susan *(Rudbeckia hirta),* Brown-Eyed Susan or Thin- Leaved Coneflower *(Rudbeckia triloba)*

Genus *Silphium* (Rosinweed)

Leaves are simple, alternate, opposite, or whorled, and have entire or pinnately lobed margins. Some species have very large leaves. Upper leaves are sessile. Sap is resinous. Flower heads are multi-flowered. Involucred bracts are arranged in a small series with the outer bracts being broad and leafy. Disk flowers are flat with narrow chaff. Ray flowers are yellow and are arranged in two or three rows. Pappus is two-teeth or non-existent.
Local Prairie Species: Whorled Rosinweed *(Silphium trifoliatum),* Cup Plant or Indian Cup *(Silphium perfoliatum),* Prairie Dock *(Silphium terebinthinaceum),* Pinnatified Prairie Dock *(Silphium terebinthinaceum* var. *pinnatified),* and Compass Plant *(Silphium laciniatum).* Note: Compass Plant is not native to the Darby Plains.

Genus *Verbesina* (Crown-Beard)

Leaves are alternate or opposite, toothed, and with the base running down the stem. Flower heads are solitary or are clustered. Involucred bracts are arranged in a two to several series. Disk flowers are conical to globular and are chaffy. Ray flowers, if present, are white, or yellow and with three-lobed or three-toothed tips. Pappus is two awns or non-existent.
Local Prairie Species: Yellow Crown Beard *(Verbesina helianthoides)*

***Helenieae* Tribe (Sneezeweed)**

Closely related to the *Heliantheae* Tribe (Sunflower). Leaves are alternate or opposite and are usually resinous-dotted or are glandular-dotted. Flower heads usually have both disk and ray flowers. Disk flowers are conical or domed. Ray flowers are directed downward and are yellow. Receptacle may be chaffy, but not the disk flowers. Involucred bracts are arranged in one to three rows. Outer bracts are green. Style may have a crown of

hairs below stigma. Anthers are acute, blunt, or rounded but are not tailed. Pappus is not hairy.

Genus *Helenium* (Sneezeweed)
Leaves are simple, alternate, sessile, have entire or pinnately lobed margins, and with their bases running down the stem. Flower heads are solitary or are arranged in corymbous clusters. Involucred bracts are spreading and are arranged in two or three rows. Disk flowers are globular or oblong. Ray flowers are yellow, drooping, and have three- to five-lobed tips. Pappus is five awn-tipped scales.
Local Prairie Species: Sneezeweed *(Helenium autumnale),* Purple-Headed Sneezeweed *(Helenium nudijlorum)*

***Astereae* Tribe (Aster)**
Leaves are usually simple and alternate. Flower heads are either of disk flowers only or of both disk and ray flowers. Receptacle is not chaffy. Involucred bracts are of unequal lengths and are arranged in a series of a few to many. Disk flowers are flat or nearly flat and are usually yellow. Ray flowers are usually three-lobed or are three-toothed. Stigmas are flattened and have marginal rows of terminal hairy segments. Anthers are blunt and are not tailed. Pappus is awns or bristles.

Genus *Aster (Aster)*
Leaves are simple, alternate, usually sessile, and not pinnately lobed. Upper leaves are usually smaller than the lower leaves. Flower heads are usually arranged in clusters and are usually borne at the ends of the branches. Involucred bracts are of unequal length, are overlapping, and are arranged in several series. The outer bracts are green. Disk flowers are blue, rose, violet, or yellow. Ray flowers are arranged in a one or two series and are blue, rose, violet, white, but never yellow. Pappus is one or two rows of hairy bristles. Local Prairie Species: Smooth Aster *(Aster laevis),* New England Aster (Aster *novae-angliae)*

Genus *Solidago* (Goldenrod)
Leaves are simple, alternate, narrow or lance-shaped but never heart-shaped, and have entire or toothed but never lobed margins. Basal leaves may have petioles but upper leaves are usually sessile. Leaf venation is either feather-veined or parallel-veined.
Flower heads are small and may be arranged in clusters or racemes ranging from a few to many. Both disk and ray flowers are yellow or cream-colored. Pappus is non-existent. Species may hybridize.
Local Prairie Species: Rigid or Stiff Goldenrod *(Solidago rigida)*

***Eupatorieae* Tribe (Boneset or Thoroughwort)**
Leaves are simple, alternate, opposite, or whorled. All flower heads are alike. Receptacle is not chaffy. Involucred bracts are overlapping. Disk flowers are perfect and, instead of being pure yellow, may be blue, pink, or white. Ray flowers are non-existent. Styles are long and have blunt or flattened and thick stigmas. Anthers are blunt not tailed. Pappus is bristly or scaly.

Genus *Eupatorium* (Boneset or Thoroughwort)
Leaves are simple, opposite or whorled, have toothed margins, and have resinous dots. Numerous flower heads are arranged in broad terminal flat-topped or rounded clusters. Involuered bracts are bell-shaped or cylindrical and are arranged in a two to four series. Disk flowers are blue, purple, rose, or white. Ray flowers are non-existent. Local Prairie Species: Tall Boneset *(Eupatorium altissimum)*

Genus *Liatris* (Blazing-Star or Button-Snakeroot)
Leaves are simple, alternate, narrow or lance-shaped, have entire margins, and have resinous dots. Flower heads are arranged in dense spikes or racemes, or even solitary. Heads supported by scaly bracts. Disk flowers are purple, rose, or white. Ray flowers non-existent. Pappus is plumed or barbed haired. Species may sometimes hybridize.
Local Prairie Species: Rough Blazing Star *(Liatris aspera),* Blazing Star *(Liatris scariosa),* Scaly Blazing Star *(Liatris squarrosa)*

Most tallgrass prairies also have other composite species that are not considered to be true native prairie plants. Some these other species are even from the other tribes within the Composite Family. Some of the non-prairie species, such as from the genera *Ambrosia* spp. (Ragweed), *Solidago* spp. (Goldenrod) and *Vernonia* spp. (Ironweed), are native to this area. Other composite species, like Chickory *(Chichorium intybus),* Yellow Goatsbeard *(Tragpogon pratensis),* Oxeye Daisy or Common White Daisy *(Chrysanthemum leucanthemum),* Yarrow or Mifoil *(Achillea millefolium),* Common Burdock *(Arctium minus),* Great Burdock *(Arctium lappa),* Bull Thistle *(Cirsium vulgare)* and Canada Thistle *(Cirsium arvense),* are not native to this area. The last species is now classified as an invasive species and is a major weed eradication problem in most tallgrass prairies.

When you visit a tallgrass prairie during its peak blooming season, take time to admire its colors and its beauty.

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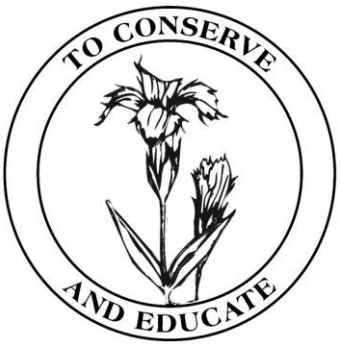

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