



Native Plant to Know

Great Solomon's Seal

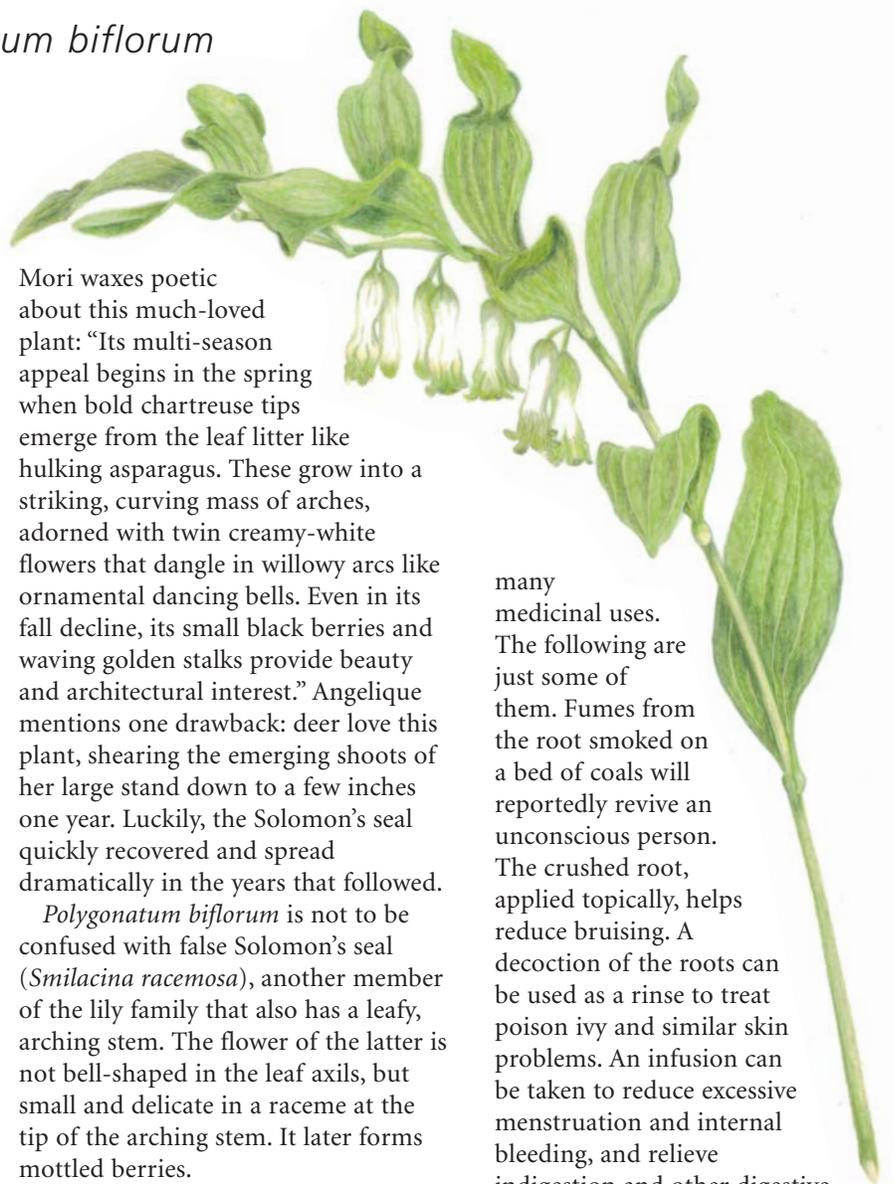
Polygonatum biflorum

by Judy Barnhart

Have you wondered where the name “Solomon’s seal” comes from? Look closely at the rootstock (which you have very gingerly pulled up from the decomposing leaf litter where it grows) and you will notice a series of circular rings or leaf scars half an inch (1.3 centimetres) apart. Each ring indicates where a leaf was attached to the root stock. Count the number of leaf scars to age the plant. If you use a hand lens to get a closer look at the leaf scar, it will reveal a triangular shape surrounded by circles: these are vessel scars where xylem carried water into the leaf stalk. This pattern was believed to resemble the seal of King Solomon, the third king of Israel (970-931 BCE). After your explorations, remember to return the rootstock to its original place!

Great or smooth Solomon’s seal (*Polygonatum biflorum*) is found in rich deciduous woods in the eastern United States and south-central Canada. The genus name *Polygonatum* means “with many knees,” referring to the knobby underground rootstock. The species name *biflorum* describes the pair of tubular, greenish-yellow flowers dangling underneath the axil of most leaves. After pollination, the flowers form dark blue berries.

Illustrator and writer Angelique



Mori waxes poetic about this much-loved plant: “Its multi-season appeal begins in the spring when bold chartreuse tips emerge from the leaf litter like hulking asparagus. These grow into a striking, curving mass of arches, adorned with twin creamy-white flowers that dangle in willowy arcs like ornamental dancing bells. Even in its fall decline, its small black berries and waving golden stalks provide beauty and architectural interest.” Angelique mentions one drawback: deer love this plant, shearing the emerging shoots of her large stand down to a few inches one year. Luckily, the Solomon’s seal quickly recovered and spread dramatically in the years that followed.

Polygonatum biflorum is not to be confused with false Solomon’s seal (*Smilacina racemosa*), another member of the lily family that also has a leafy, arching stem. The flower of the latter is not bell-shaped in the leaf axils, but small and delicate in a raceme at the tip of the arching stem. It later forms mottled berries.

Solomon’s seal has, by all accounts,

many medicinal uses. The following are just some of them. Fumes from the root smoked on a bed of coals will reportedly revive an unconscious person. The crushed root, applied topically, helps reduce bruising. A decoction of the roots can be used as a rinse to treat poison ivy and similar skin problems. An infusion can be taken to reduce excessive menstruation and internal bleeding, and relieve indigestion and other digestive

Continued on page 15

The Blazing Star is . . .

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IN THIS ISSUE OF THE BLAZING STAR



PHOTOGRAPH BY VINCE FIORITO

Butterfly milkweed (*Asclepias tuberosa*), *Culver's root* (*Veronicastrum virginicum*), *spiderwort* (*Tradescantia ohiensis*) and other native plants in Vince Fiorito's ark garden. **Article on page 4.**



PHOTOGRAPH BY BILL MOSES

The highly invasive, non-native dog-strangling vine will grow in sun or shade. Pictured here at Fletcher Wildlife Garden in Ottawa growing in dense shade. Read more about this scary invader in an article by Bill Moses on page 8.



PHOTOGRAPH BY DAVID D'ENTREMONT

Marginal wood fern sori. Learn all about fern propagation from David d'Entremont on page 11.

NANPS SPRING CALENDAR

GROWING NATIVE PLANTS FROM SEED WORKSHOP

Saturday, March 2, 2019

9:30 a.m. – 12 p.m.

Toronto Botanical Garden, Garden Hall, 777 Lawrence Avenue East, Toronto, Ontario

Learn from an expert and owner of an established native plant nursery, Paul Heydon.

Paul will lead participants through seed harvest and germination techniques. These include moist-cold stratification, scarification, double dormancy, seeds that germinate without any pre-treatment, slow-growing woodland plants.

Space is limited. Tickets: \$36 for NANPS and Toronto Botanical Garden members and \$45 for the public. Contact Danielle at dtassie@nanps.org for information on how to register. Registration closes February 27, 2019.



PHOTOGRAPH BY VINCE FIORITO

WILD BEES IN TORONTO: IDENTITY, DIVERSITY AND HOW TO HELP

Wednesday, March 13, 2019

7 – 8:30 p.m.

Koffler House, University of Toronto, 569 Spadina Avenue, Toronto

Scott MacIvor, assistant professor in the Department of Biological Sciences at UofT will introduce Toronto's

common bee species and their habitats. He will discuss how human activities can have an impact on urban bees and how to create nesting opportunities for bees in urban areas.

Tickets are \$10 for NANPS members, \$15 for non-members and free for UofT students. Contact Danielle at dtassie@nanps.org for information on how to register.



UNSETTLING THE GARDEN: HOW NATIVE PLANTS CONNECT WITH RECONCILIATION AND HEALING THE LAND; A NON-INDIGENOUS PERSPECTIVE

Wednesday, April 17, 2019

7:30 – 9 p.m.

Koffler House, University of Toronto, 569 Spadina Avenue, Toronto

Celebrated author and NANPS past president Lorraine Johnson will share her thoughts on gardening, our relationship with the land and how native plant gardens can help advance reconciliation and healing.

Tickets are \$10 for NANPS members, \$15 for non-members and free for UofT students. Contact Danielle at dtassie@nanps.org for information on how to register.

NANPS ANNUAL SPRING NATIVE PLANT SALE

Saturday May 4, 2019

Toronto Botanical Garden, 777 Lawrence Ave East, Toronto

Once again NANPS will be hosting Canada's largest native plant sale! Come get your native shrubs, trees, ferns, grasses and wildflowers, and chat with other native plant enthusiasts. NANPS members have access to online pre-ordering for this event. Pick up your plants on May 4 at the Toronto Botanical Garden. Watch nanps.org for details available soon.

RIVERWOOD NATIVE PLANT SALE



Sunday, May 19, 2019

Riverwood, 4150 Riverwood Park Lane, Mississauga, Ontario

Join us for our first native plant sale in partnership with The Riverwood Conservancy.

CHRISTIE PITS PARK NATIVE PLANT SALE

Sunday, May 26, 2019

Christie Pits Park, 750 Bloor Street West, Toronto, across from the Christie subway station

NANPS will be at the annual Bike with Mike, a family-friendly event that celebrates cycling and environmental issues, at Christie Pits Park.

NANPS volunteers will be on hand to answer questions about gardening with native plants at all our plant sales.



PHOTOGRAPH BY PETER KELLY

Ark Gardening

by Vince Fiorito

And every living substance was destroyed which was upon the face of the ground, both man, and cattle, and the creeping things, and the fowl of the heaven; and they were destroyed from the earth: and Noah only remained alive, and they that were with him in the ark. (Genesis 7:23)

I live in Burlington, Ontario, where the Great Lakes and Carolinian deciduous forests merge. Sometimes I imagine what Burlington was like in 1789. That was the year that the British referenced a white oak (*Quercus alba*) tree on Lake Ontario's shoreline as a survey point to grant 1,400 hectares (3,450 acres) of land to Mohawk leader Joseph Brant for his services to the crown. This tree defined Burlington's east boundary until 1957.

Back then, dense blazing star (*Liatrix spicata*), hoary mountain mint (*Pycnanthemum incanum*) and common hoptree (*Ptelea trifoliata*) grew along Lake Ontario's shoreline. First Nations peoples used fire to rejuvenate tallgrass prairie there and create farmland. Mature trees within the large acreage that came to be known as Brant's Block included American chestnut (*Castanea dentata*), butternut (*Juglans cinerea*), red mulberry (*Morus rubra*) and eastern flowering dogwood (*Cornus florida*). In the interior, American ginseng (*Panax quinquefolius*), American columbo (*Frasera caroliniensis*), broad beech fern (*Phegopteris hexagonoptera*) and hart's-tongue fern (*Asplenium scolopendrium*) emerged from a thick spongy layer of decomposing leaf litter on the forest floor. The ancient forest was home to woodland voles, Acadian flycatchers and cerulean warblers. Each fall, bald eagles returned to feed on Atlantic salmon spawning in the creeks.

If Joseph Brant were alive today, I doubt he would recognize his land grant. Brant's Tree survives, although hemmed in by asphalt. Human-made

structures dominate urban landscapes. Energy- and maintenance-intensive non-native grasses, flowers, shrubs and trees have replaced the ancient forest and prairie. Many species that made Burlington a North American biodiversity hotspot have disappeared or grown rare. The local Halton Region Conservation Authority has identified 48

species at risk on its conservation lands, including every species mentioned in the opening paragraph except the white oak.

Very likely your neighbourhood has suffered similar biodiversity loss. Ontario has 183 species listed as extirpated, endangered, threatened or of special concern. At least six species native to Ontario are known to have become extinct in modern times, including the passenger pigeon, which flew in numbers so great they would block out the sun. The problem is not unique to this province but part of a much larger global biodiversity problem.

Low-maintenance, alien ornamentals such as Japanese knotweed (*Fallopia japonica*) have overtaken entire ecosystems in Southern Ontario and many places as far afield as the United Kingdom, South Africa, New Zealand and Chile.

The plant is native somewhere (likely Japan) and probably behaves perfectly well there, but should never have been introduced on other continents. I volunteer to remove invasive species in local parks and natural areas and have seen mixed results. While a sufficient number of volunteers may be able to stop invasive species in a small area,



Brant's tree as it stands today.



Coreopsis tripteris (tall coreopsis)

we cannot save every park or natural area with a problem. I have come to accept that escaped McPlants from the world's McGardens will eventually conquer nearly every natural area, creating a globally dysfunctional McEcosystem.

How Bad Is the Global Biodiversity Crisis?

Recently scientists examined fossil records to estimate historical extinction rates and compare them with current rates. They concluded that we are in the middle of Earth's sixth great mass extinction. Species may be going extinct 1,000 times

faster than historical background rates and accelerating. Most species are in decline, degrading the biosphere's ability to provide the environmental services that clean the air, purify water and rejuvenate soil. If current trends continue, flora and fauna homogenization, invasive organisms, novel pathogens, overexploitation,

habitat loss, pollution/toxification and climate disruption may become so severe that within half a century nature may require three to five million years to recover lost biodiversity and ecosystem functionality.

Clearly, we face a crisis of biblical proportions.

We must seek coexistence with other species on land directly influenced by human activity. To save threatened species from extinction, we must deliberately create habitats for them in urban areas around our homes and businesses. We need to know about local species at risk, the conditions they need to thrive and deliberately re-create these conditions wherever we influence the landscape. To change common perceptions, we must communicate complex stewardship concepts with easily understood words and imagery.

We need to build ark gardens.

Ark Gardening

Gardening for endangered species, or ark gardening, is already happening, thanks to environmental organizations like Wild Ones and the North American Native Plant Society. Most people are aware that monarch butterflies are threatened with extinction. As a result, pollinator gardens have grown in popularity. However, these gardens planted intentionally for nature's benefit make up only a small portion of human-managed landscapes when compared to non-native turf grasses (*Poa pratensis*, *Festuca* spp.). Alien grasses consume some 200,000 square kilometres (over 77,000 square miles) in the United States (about the size of Texas), taking up three times more space than any other irrigated crop in the country. Imagine the impact on monarch butterflies if the default North American landscaping choice were milkweed (*Asclepias* spp.) instead!

I decided to start cultivating native plants, focusing on rare local species,



PHOTOGRAPH BY VINCE FIORITO

Vince added rocks to his garden to create summer and winter reptile habitat. He deliberately created crevices and open spaces underground, well below the frost line, to allow snakes to hibernate.



PHOTOGRAPH BY VINCE FIORITO

Riverbank grape (*Vitis riparia*) and other riparian vegetation filter out sediments and debris in the river on Vince's property, supporting fish and other organisms.

over 20 years ago when I lived in Cornwall, Ontario. I could not justify commonly made landscaping choices, given the context of a global mass extinction. I educated myself by joining the Canadian Wildflower Society (the precursor to the North American Native Plant Society) and reading books on growing Ontario native plants by Lorraine Johnson. I purchased plants and ordered prairie seed mixes from reputable local nurseries that specialized in native plants. I rototilled most of my lawn

and smothered the remnants with newsprint and leaf litter. Then I added two tandem truckloads of furniture-size granite rocks and another 7.6 cubic metres (10 cubic yards) of black earth. I rescued deciduous forest floor plants from a nearby quarry site.

It took a few years to get rid of the turfgrass remnants and non-native volunteers, but with persistence and a bit of obsessiveness, I eventually had a front yard dominated by black-eyed Susans (*Rudbeckia* spp.), asters (*Aster* spp. and other genera), goldenrods (*Solidago* spp.) and little bluestem grasses (*Schizachyrium scoparium*). Taller native prairie grasses such as big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), bottlebrush grass (*Elymus hystrix*) and switchgrass (*Panicum virgatum*) filled the back. Trilliums (*Trillium* spp.), foamflower (*Tiarella cordifolia*), delicate, low-growing liverwort (*Hepatica nobilis*), blue cohosh (*Caulophyllum thalictroides*), stately Jack-in-the-pulpit (*Arisaema*

triphillum) and bloodroot (*Sanguinaria canadensis*) thrived on the shady side of my home. The year before I moved, my ark garden had over 100 native plant species and a few endangered ones, such as goldenseal (*Hydrastis canadensis*).

My efforts attracted the attention of the local Ontario Ministry of Natural Resources (OMNR) forestry department. The representative who visited understood what I was trying to do and encouraged my efforts. Later they sent a University of Ottawa student to me whose assignment was to find 40 local native plant species in the vicinity. The OMNR told him that it might take a couple of weeks to find all the plants on the list, but to speed up his search, they suggested he visit my garden first. I found 75 percent of the desired species in 15 minutes.

In 2000, I moved to the Greater Toronto Area for work and put my Cornwall home up for sale. I had trouble selling my native species-landscaped house. Many people were uncomfortable with my landscaping choices. A common complaint was that it looked “unkempt.” Potential buyers were concerned they wouldn’t know how to care for it, even though native species-based landscapes are usually less of a maintenance hassle than lawns. Selling my home took over a year and I had to drop the price \$20,000 below market value. The new owner brought in heavy equipment, bulldozed everything and replaced it with a lawn.

Since moving to Burlington, I have recreated my ark garden concept. I use rocks and organic material to create overwintering habit for reptiles and many other creatures. I grow endangered hoptrees, host plant for the giant swallowtail, which has appeared in my garden for the past three years. I have planted milkweeds, host plants for monarch butterflies, which I saw for the first time last summer, and New Jersey tea (*Ceanothus americanus*), host plant for the mottled duskywing butterfly.

PHOTOGRAPH BY VINCE FIORITO



Eight-spotted forester caterpillar on grape leaf

PHOTOGRAPH BY VINCE FIORITO



Hoptree in flower

Suggestions for anyone new to ark gardening

- Know your rights. In 1996, an Ontario court judge ruled that a municipal property standards bylaw cannot unreasonably violate our right to freedom of expression (*Bell v. Toronto*). Most city planners are now aware of the benefits of landscaping with native species.
- Consult a landscape architect knowledgeable about native plants.
- Talk to your neighbours before finalizing your plans. Try to understand their point of view and gauge their tolerance levels. Loan them a copy of *The Blazing Star*. Share native plants with them. Help make ark gardening trendy. Let neighbourhood children pick your flowers. Attempt to blend in with the neighbourhood in your front yard. Few people object to riotous backyards, provided they aren't perceived as dangerous.
- While no native species can handle trampling as well as non-native turf grass, many native plants can create the appearance of a mowed lawn in low-traffic areas. I recommend Pennsylvania sedge (*Carex pensylvanica*), which closely resembles turf grass, tolerates nutrient-deficient soils, has a fibrous root system, and is drought-tolerant, shade-loving and low-maintenance once established. Other native sedges that can create a turf grass look include cedar sedge (*Carex eburnea*) and oak sedge (*Carex albicans*). For pretty groundcovers, you might consider wild strawberries (*Fragaria virginiana* or *vesca*), bunchberry (*Cornus canadensis*), partridgeberry (*Mitchella repens*), wintergreen (*Gaultheria*



A sharp-shinned hawk and grey squirrel in a standoff

PHOTOGRAPH BY VINCE FIORITO

procumbens), mosses and liverworts (bryophytes) and violets (*Viola* spp.).

- Consult the Ontario Invasive Plant Council's "Grow Me Instead" guide for native plant substitutes for non-native ornamental species.
- Take into account that climate zones are migrating towards the polar regions. Avoid species at the extreme southern end of their historical range. Favour species near or beyond their northern historical range for your region. Use reputable nurseries that sell plants with local provenance. There are many listed under nanps.org/commercial-growers or cwf-fcf.org/en/resources/gardening/native-plant-suppliers-new/native-plant-suppliers. Take advantage of NANPS native plant sales and seed exchange.

Ark gardening helps us preserve local biodiversity. If everyone put as much time, money, labour and resources into creating habitat for nature instead of cultivating McLawn and McGardens of McPlants, we could preserve our local natural heritage and all the life forms that make our corner of the planet special. Ask yourself: "What would Noah do?"

Vince Fiorito grew up in Thunder Bay, Ontario, where he learned to collect wild foods. He is an amateur field naturalist, ecologist, botanist, arborist, gardener and photographer. He founded the award-winning Friends of Sheldon Creek stewardship. He welcomes more friends on Facebook <https://www.facebook.com/fiorito.vince>. He invites readers to take a tour of his backyard: <https://www.youtube.com/watch?v=KZEZyPluFUM>.



A profusion of perennial sunflowers (Helianthus doronicoides)

PHOTOGRAPH BY VINCE FIORITO

Dog-strangling Vine Strangles Native Habitats

by Bill Moses

I have family in Ottawa, Ontario and usually travel there once a year. I always make it a point of going to the Dominion Arboretum and the Fletcher Wildlife Garden next door. I discovered that dog-strangling vine (*Vincetoxin rossicum*) was a problem at Fletcher and started watching out for it in other parts of the province.

The term “dog-strangling vine” or DSV refers to two invasives – black swallowwort and pale swallowwort – native to Eurasia. The perennial herbaceous vine spreads rapidly, causing damage to ecosystems in southern Ontario, the northeastern United States and beyond. It forms thick mats that choke out native vegetation and negatively impact woodlots. Spread by seed, it can grow

in a wide range of habitats. DSV has a woody rootstalk that can grow up to two metres (80 inches) or more. The downy stems twine or climb on trees or other structures. The red-brown to pinkish flowers emerge in clusters at the axils of the smooth, pointy leaves in late June and July. The fruit – which would be familiar to us because it looks like a milkweed pod – forms in late July and August. The feathery tufts are distributed by the wind, passing humans or animals, or machinery.

In July last year, I found dog-strangling vine and other non-native invasives such as European buckthorn (*Rhamnus cathartica*) along the trail at the McMichael Gallery in Kleinburg, Ontario. The self-guided McMichael Outdoor Interpretive Program invites hikers to observe native horsetail (*Equisetum* spp.) at viewpoint 4. You

may have guessed that there was no horsetail, only DSV!

Needless to say, on my next trip to Ottawa (end of September) I was bent on paying more attention to the DSV problem. I found that all you had to do was look and you’d see DSV everywhere! Volunteers at the Fletcher Wildlife Garden spend countless hours every year dealing with it, and admit that they are not making much headway.

I came back to my home in Owen Sound on a mission! I warned my fellow field naturalists to watch for dog-strangling vine, even though none had been reported in Grey and Bruce counties – that I knew of. I wanted to make sure we didn’t end up with the same problem we have with the alien phragmites (*Phragmites australis* subsp. *australis*).



PHOTOGRAPHS BY BILL MOSES

The horsetail that this sign along the McMichael Interpretive Nature Trail in Kleinburg points to has been obliterated by dog-strangling vine.

It turned out there had been a report in 2014 of 50 square metres (about 500 square feet) of DSV on trailside habitat in Owen Sound. I went to have a look and found that the vine had spread to a much larger area. I later calculated that it now covers more than 10,000 square metres (2½ acres), largely individual plants scattered over a wide area.

On eddmaps.org I saw DSV reports in Collingwood and went there to have a look. DSV has been there for at least 10 years and has spread from the highway back to and along Georgian Bay. As far as I could determine, nothing was being done about it.

Anyone who walks in woodlands and valleys in the Greater Toronto Area knows that it's a huge problem there.

Can anything be done?

Dog-strangling vine has invaded the Carden Alvar, a globally rare ecosystem in Kawartha Lakes, Ontario. The Nature Conservancy of Canada (NCC) and the Couchiching Conservancy actively monitor DSV invasions on the alvar and use a multi-pronged approach to control them. Small populations can be hand-pulled, dug out or covered with heavy black tarp to slow growth. Large populations need to be treated with a herbicide by a licensed exterminator. NCC staff visit the property in the fall to remove seedpods. To eradicate an invasive plant problem, controls must be repeated over many years. The NCC appears to be the only organization that tackles the invasives problem realistically, with a consistent, long-term plan, including the use of volunteers.

Grey and Bruce counties have pristine natural areas that need to be protected. The most important thing in this regard is early reporting of alien, invasive species. People need to know what these plants look like, to keep an eye out for them and report what they find.

Continued on page 10



Single plants of dog-strangling vine dot the affected area in Owen Sound



From single plants colonies start to form.

PHOTOGRAPHS BY BILL MOSES

PHOTOGRAPHS BY BILL MOSES

Continued from page 9

Facebook posts and news articles (newsprint and online) are great ways to get the message out there. An article in the *Owen Sound Sun Times* brought forward a report of another infestation south of the city on private property. I and other concerned naturalists plan to visit in the spring. The property owner said that they have been trying to deal with the problem, but with little success. Spreading the word through schoolchildren would also be a big help in the future.

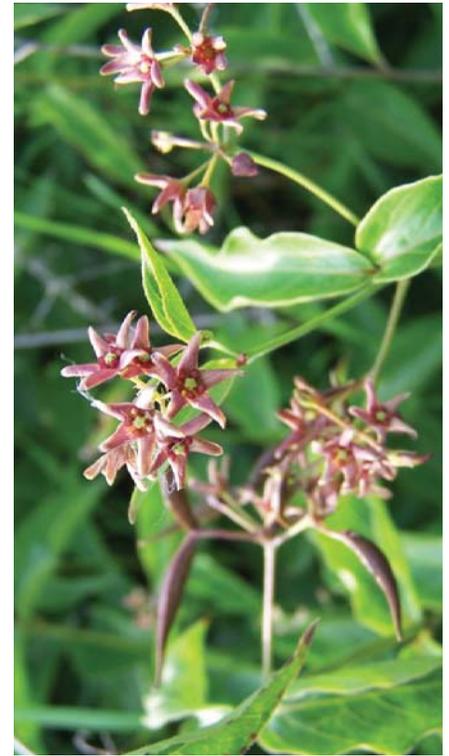
Where infestations occur, the most important thing is to put an NCC-style program in place to control them. In my neck of the woods, I and my fellow naturalists are meeting with the Owen Sound City Council to get permission to remove DSV on the vacant land where it is spreading. The rail trail land where it also occurs belongs to Grey County which has a contract with the Grey Sauble

Conservation Authority to apply pesticide to the swallowwort spreading there. We'll make a start in the spring by marking plants that need to be removed.

Just in case you're still not convinced that removing DSV is worth your efforts, note that it may be contributing to the demise of monarch butterflies. Monarchs lay their eggs on native milkweeds (*Asclepias* spp.) because the hatching caterpillars have evolved to eat only their plants. Dog-strangling vine is in the same family (Asclepiadaceae) and has been known to trick monarchs into laying their eggs on it. It does not provide the necessary nutrients for the caterpillars and they soon die.

Best of luck!

Bill Moses: phrag fighter, DSV recruit, seed collector and propagator of native woody plants.



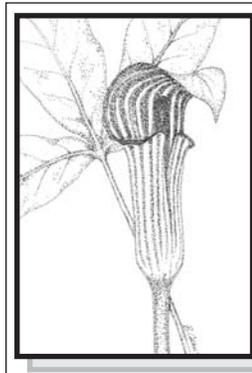
DSV in flower

PHOTOGRAPH COURTESY CREDIT VALLEY CONSERVATION



DSV gone to seed.

PHOTOGRAPH BY BILL MOSES



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Fern Propagation

by David d'Entremont

Ferns are fascinating. Their curling crosiers and delicate, feathery fronds are a familiar sight, but the life cycle of a fern remains a mystery to most. Even the greenest thumbs may be unnerved by the idea of growing ferns from spores. Fear not! The propagation of ferns is as simple as it is rewarding, although understanding what's going on in the background helps to demystify the process.

The vast majority of plants use seeds to grow their next generation. A seed is the self-contained embryo of a new plant – complete with nourishment – that will spring to life under the right conditions, with leaf and root primordia and everything it needs to start growing. Seeds are incredibly useful, which explains why seed-bearing plants took over the planet. Ferns have no such advantage.

Hundreds of millions of years ago, ancient plants had no such vehicle as a seed to propagate themselves.

Plants like ancient horsetails, mosses, clubmosses and ferns utilized spores – single, self-contained plant cells that could be manufactured in the millions and blown far and wide by the wind or dispersed by water to begin growth if they found favourable conditions.

Spores are not prone to animal predation because, unlike seeds, they have little food value. They also have very little energy available to start up growth and are so small as to be easily overtaken by bacterial or fungal infection. Spores play the numbers game: even with the low odds of survival per spore, some of the millions of spores will be successful. During ancient times, spores were the best strategy plants had evolved for sexual reproduction. Modern ferns never stopped using spores.

So how does a spore become a full-fledged fern? How can understanding this process allow you to grow your own ferns from nothing but spore-laden dust? The first thing to know is that the growth process of a fern spore is unlike that of a seed. Seeds are little ready-to-grow, post-reproduction packages that germinate into sprouts that

grow directly into adult plants. A bean, for example, simply opens a couple of seed leaves, then matures directly into a vine. Fern spores, on the other hand, are in the pre-embryo stage and have not even completed sexual reproduction. They're actually in the pre-sperm and pre-egg stage at the very start of the process. Fern spores are haploid, meaning they possess half the chromosomes they need to become adults and must combine with the chromosomes of another to become complete.



Fern propagation chamber

PHOTOGRAPH BY DAVID D'ENTREMONT

The structures that produce spores, called sporangia, are found underneath fern fronds. They are organized into visible clusters called sori – brownish, sometimes fuzzy, round or semicircular spots underneath fertile fern fronds. Their appearance varies from species to species. For example, intermediate wood ferns (*Dryopteris intermedia*) and Goldie's wood ferns (*Dryopteris goldieana*) have the classic circular spots, but silvery glade ferns (*Diplazium pycnocarpon*) have crescent moon-shaped sori while hart's tongue ferns (*Asplenium scolopendrium*) have linear, fishbone-style sori. With some species, the plant is actually divided into vegetative fronds and spore-bearing fronds. The spore-bearing fronds are partially or wholly given over to sori and look completely different. Cinnamon fern (*Osmunda cinnamomea*), ostrich fern (*Matteuccia struthiopteris*) and sensitive fern (*Onoclea sensibilis*) have obvious fronds dedicated to sori and spore production. Interrupted ferns (*Osmunda claytoniana*) have a portion of fully dedicated fertile fronds inserted into the middle of an

Continued on page 12

Continued from page 11

otherwise vegetative frond. Similarly, the weird and wonderful family of grape ferns all contain oddly shaped, bizarre-looking fronds dedicated to spore production. The look of sori, as well as their location, depends strongly on the species.

Whatever the look of sori, their function is to produce haploid, single-celled spores by the millions. If the spores arrive in a place with suitable growth conditions, each successful individual spore grows slowly into its own small proto-plant called a gametophyte. Gametophytes sound highly technical, but they are the most basic of simple plants. They are tiny, often heart- or kidney-shaped single leaves that rarely exceed two to three millimetres (.079 to .118 of an inch) at full size for most fern species. Each spore produces a single gametophyte with a single heart-shaped leaf and some root-like rhizoids underneath.

The first month after spores have been planted, it appears to the untrained eye as though an even carpet of very fine moss has begun to grow where the fern spores fell. Remember, each spore had to grow this from scratch, so it takes a while to gain size! Over the next few months, the carpet of fuzz grows and develops into a bed of green, overlapping leafy “scales.” These are the hundreds and hundreds of competing gametophytes – each appearing as a single, green, leafy scale as it expands to full size – overlapping each other as they vie for precious sunlight.

At this stage, the gametophytes undergo the invisible next step in the process, which is aided by occasional misting with a spray bottle. Gametophytes are subdivided into males and females. During the fern’s version of pollination, male gametophytes release gametes, which find their way through the film of water on the soil’s surface to female gametophytes. With this stage complete, the egg within the female gametophyte, typically nestled within the crook of the heart-shaped leaf, becomes fertilized and diploid. With a full set of chromosomes and completed sexual reproduction, the egg begins to grow into a sporophyte, what we would recognize as the adult body of the fern plant.

The first sign that this process is complete is when the gametophyte begins to grow a new, raised, different-looking

leaf from its crook. Although the first leaves may seem atypical for the species, they are the first to look like a fern rather than a strange moss. Some ferns, such as walking fern, look vaguely recognizable as triangles. Ostrich fern and lady fern (*Athyrium filix-femina*) raise tiny fronds that look



Lady fern: 21-day-old gametophytes



Lady fern: young sporophytes 170 days old

PHOTOGRAPH BY DAVID D'ENTREMONT

PHOTOGRAPH BY DAVID D'ENTREMONT

fern-like, if abstract. Sensitive fern's first few leaves look completely off; they could almost be confused for garlic mustard (*Alliaria petiolata*)!

The tiny fronds are followed by ever larger fronds, all gradually becoming more characteristic-looking of the species. Gametophyte roots are supplanted by larger, formalized roots of the true fern body. From this point on, you can consider the fern to be a seedling and treat it as such. These young ferns are well on their way to becoming adult plants!

From a propagation perspective, many young ferns are hardy and easily survive being separated from the mat of gametophytes they are embedded in, although it may take a few years of growth before they grow large and robust enough to be considered adult plants. The advantage is that, with so many gametophytes, one round of fern propagation produces a great many baby plants, which can all be separated and grown into individual plants. The one-time



PHOTOGRAPH BY DAVID D'ENTREMONT

Lady fern: one year, 11 months old

propagation success can result in dozens and dozens of plants of your favourite species.

Fern propagation is slightly more biologically complex than growing plants by seed, but don't let this deter you. It's actually simpler and more rewarding in practice than appears at first glance. The hardest part is going out and finding the wild ferns; the rest is mostly waiting.

Once you understand what's going on, the world of native ferns opens up in a whole new way. Like responsible seed

collection, spore collection is easy and doesn't harm the host plant. All you need to do to get enough spores to inoculate your chosen potting media is to scrape several sporangia into a collection packet with a knife. This will generate dozens of new plants. Many of our fern species are surprisingly willing to oblige an adventurous propagator. I have successfully reared more than half a dozen native species with no trouble.

Collection and Planting

Collect spores by scraping the sori off a fertile frond or by taking a frond with sori and placing it sori-downward onto some white paper in a sheltered location. (The latter method – removing a segment of sori-covered frond – is acceptable in situations where it will not significantly damage the adult plant.) This allows the spores to fall off gradually and collect as “dust.” The location and appearance of sori may vary greatly between species; use guide books or the internet before going out, to save a lot of effort. Not every frond will have sori on it. Some fronds that could have sori simply don't while others are loaded. Strong-looking robust fronds are often a good place to look. Some ferns don't have sori on normal fronds and instead pack them all onto a specialized fertile frond. There's nothing quite like scouring a leafy sensitive fern frond for sori, only to realize that the weird, knobbly, brown thing beside it holds all the spores!

Some people recommend getting spores from at least two individuals of the same species. I have read that some species are less likely to successfully complete the gametophyte reproductive process if all the spores come from the same parent plant.

Planting spores is simple. Pour or sprinkle the spores unceremoniously onto moistened soil substrate. Cover with a clear humidity chamber (or seal them inside a ziploc bag) and place in a window in indirect sunlight. As long as light and moisture persist, the next stage (which can take months) will take care of itself.

Humidity

Gametophytes seem to propagate best if sealed inside a humid environment, as their natural environments (like the forest floor) are typically humid. However, when you plant young ferns outside of that environment, it's a good idea to acclimatize them to drier conditions gradually. Sudden transfer to dry air may shock young plants. Some species, such as marsh fern (*Thelypteris palustris*) and royal fern (*Osmunda regalis*), do not do well in completely dry conditions.

Winter

From what I can tell, spores of many native fern species will begin their growth cycle immediately after you plant

Continued on page 14

Continued from page 13

them, even if you collect them just before winter. Gametophytes can be grown over the winter months indoors (I'm doing that now with maidenhair spleenwort) and will make great progress the next summer.

However, temperate plant species sometimes become unhealthy without exposure to winter dormancy. I would recommend that native species be dug into the ground outdoors to complete winter dormancy naturally. As a somewhat inconvenient alternative, you can attempt what I did with my walking ferns and put them in a dark container in the fridge for three months. They are now sprouting up a storm! I do not recommend using a freezer or leaving them on an exposed apartment balcony – in my experience, this is more likely to kill them.

Sudden Gametophyte Loss

In a healthy fern reproductive process, at no stage should the gametophytes suddenly disappear or go dark before producing fronds. During a couple of my trials, a species of fly larvae invaded the substrate and began to kill off the gametophytes. During another trial, mould appeared to kill off sections of plants. In both cases, the sudden disappearance of gametophytes was abnormal. If this happens to you, separate some of the gametophytes from the batch to save them from whatever is killing them off.

Soil

None of the species I propagated were picky about soil type; ordinary peat-based soils (standard peat pellets) were used in all cases. Although it would seem counterintuitive, I've had great success with growing rock ferns such as walking fern (*Asplenium rhizophyllum*), maidenhair spleenwort (*Asplenium trichomanes*) and rock polypody (*Polypodium virginianum*) on simple, peat-based potting substrates. This seems a bit strange since rock ferns typically live on thin soil and these three were sourced from populations on the Niagara Escarpment, characterized by more alkaline soils rather than the acidity of peat.

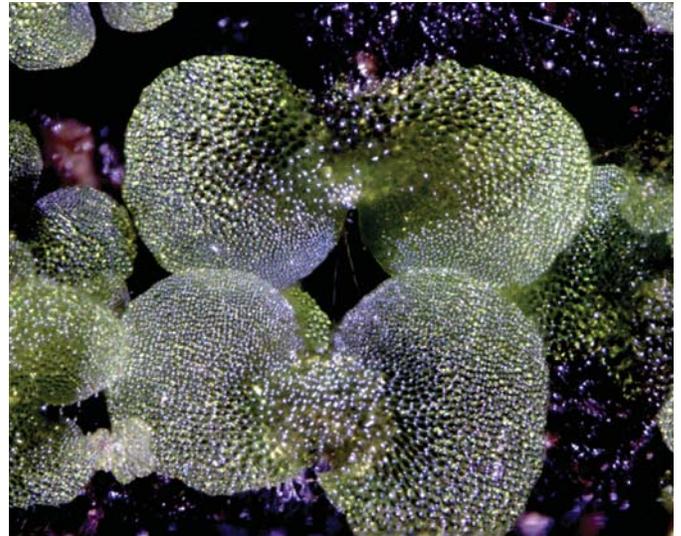
Some ferns that prefer a particular soil chemistry may not do well if propagated on the wrong substrate.

Species Notes

Many native fern species are amenable to propagation. Lady fern is one of the easiest species to attempt. It is a robust spore producer – I've even had it invade other planters. It grows well in a variety of conditions and is easy to divide when it gets larger. Other forest species such as spinulose wood fern (*Dryopteris carthusiana*), intermediate wood fern and Christmas fern (*Polystichum acrostichoides*) also do well without too much hassle.

Ostrich, cinnamon and sensitive ferns have the advantage of producing fertile fronds dedicated to spores. These brownish clusters are loaded with abundant spores; spore-laden pieces can be collected in a similar way to seed

collection in plants with seed clusters. The clusters, when mature and dry, release clouds of spores when tapped. The spores can simply be shaken over soil or broken apart by hand and sprinkled on the soil substrate. Ostrich and sensitive ferns are straightforward to propagate. Some species do not work easily. I have not had any success so far with green spleenwort (*Asplenium viride*), bulblet fern (*Cystopteris bulbifera*) or anything in the grape fern family,



Spinulose and intermediate wood fern gametophyte photomicrograph taken at 35 days old



Spinulose and intermediate wood fern sporophytes at 87 days old

including rattlesnake fern (*Botrypus virginianus*) and cut-leaf grape fern (*Sceptridium dissectum*). Regarding the grape ferns, I later learned that this family is known for growing underground gametophytes that rely on soil fungi to live; they are, therefore, unlikely to take in a normal propagation setting. Keep in mind that not every species will be willing and you may have to take some losses.

Last Words

For the botanically adventurous, the key things to remember about fern propagation are:

- keep the substrate damp (a humidity chamber or ziploc bag is best, involving little to no follow-up watering)
- don't place the humidity chamber in full or direct sun that will fry the little plants, but keep it near a window that gets indirect sun
- spritz the mature gametophytes a couple of times at the third or fourth month
- above all, be patient. Do not throw out the gametophytes!

Propagating ferns brings you closer to an ancient lineage of plants, making you an active participant in a process hundreds of millions of years old.

David d'Entremont, a terrestrial ecologist with Azimuth Environmental Consulting, Inc., has a fondness for ferns, dragonflies and damselflies.



PHOTOGRAPH BY DAVID D'ENTREMONT

Maidenhair spleenwort in its natural habitat

Continued from page 1 – **Great Solomon's Seal**

complaints such as ulcers, bowel problems and haemorrhoids. A tea made from the roots is a good tonic for the heart and sexual organs. The Chippewas called the plant *makodjibik*, or bear root, and used it to relieve kidney or back pains. To be effective, they believed, the medicine had to be stored in a bag made of bear paws. Although all parts of the adult plant are poisonous, young shoots harvested in early spring can be prepared like asparagus. The roots may be eaten, but only after boiling in three changes of water and roasting; native North Americans reportedly made flour from the powdered roots.

Of the three species of *Polygonatum* that grow naturally in North America, I have great Solomon's seal (*P. biflorum* var. *commutatum*) in my garden. It originally filled in a dark corner next to our east-facing back porch, softening the harsh cement-block foundation below my kitchen window and arching toward the front of the garden. When we decided to install an air conditioner, that dark corner was chosen as the ideal spot. This was in November and the plants were going dormant. I dug up the root

stocks, which fell apart easily into many sections. I bagged up a few to give as Christmas presents to family members. The rest I moved to a new garden on the north side of my house next to our hot tub. The Solomon's seal now serves as a backdrop for my woodland garden, which also features bloodroot (*Sanguinaria canadensis*), eastern columbine (*Aquilegia canadensis*) and other natives.

Since I suffered a stroke in 2011, I find gardening and experimenting with plant locations for easygoing plants like Solomon's seal peaceful and therapeutic. I recommend this activity and this plant to anyone looking to bring more peace and healing into their life.

Judy Barnhart is the vice-president of the Native Plant Society of Northeastern Ohio.



PHOTOGRAPH BY SUSAN KELSH

Solomon's seal in Susan Kelsh's garden.



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