The Blazing Star

Winter 2022, Volume 23, Issue 1

A Publication of the North American Native Plant Society

Native Plant to Know

American Beech

Fagus grandifolia

by Don Scallen

At age 11 in the late 1960s I gingerly climbed a massive beech to reach a tree fort built by two of my friends. More risk-averse than they, I didn't take part in what I felt to be the rather perilous construction process. But I was excited to enjoy the fruits of their labour and get a bird's-eye view of the world.

The fort was firmly nailed to limbs thicker than I was. Healthy and stalwart, they stretched outward and upward to the sunlight, where they erupted with a flourish of smaller branches liberally dressed in deep green foliage.

Viewing the beauty of this tree from my lofty perch may have been when I fell in love with the American beech (*Fagus grandiflora*). The smooth grey bark, the strong limbs, the emerald hue of the leaves had me smitten.

Much later I learned that I inhabited a location in North America characterized by beech-maple forests. I remember James Hodgins, the late great editor of *Wildflower* magazine, using this term affectionately to describe the dominant forest type of southern Ontario, where he lived.

Woodlands dominated by beech and maple (*Acer* spp.) are considered "climax" forests, the last stage of plant succession in areas suited to those two species. A climax forest is considered stable and self-perpetuating, but can be altered by major impacts like cutting, climate change and disease.

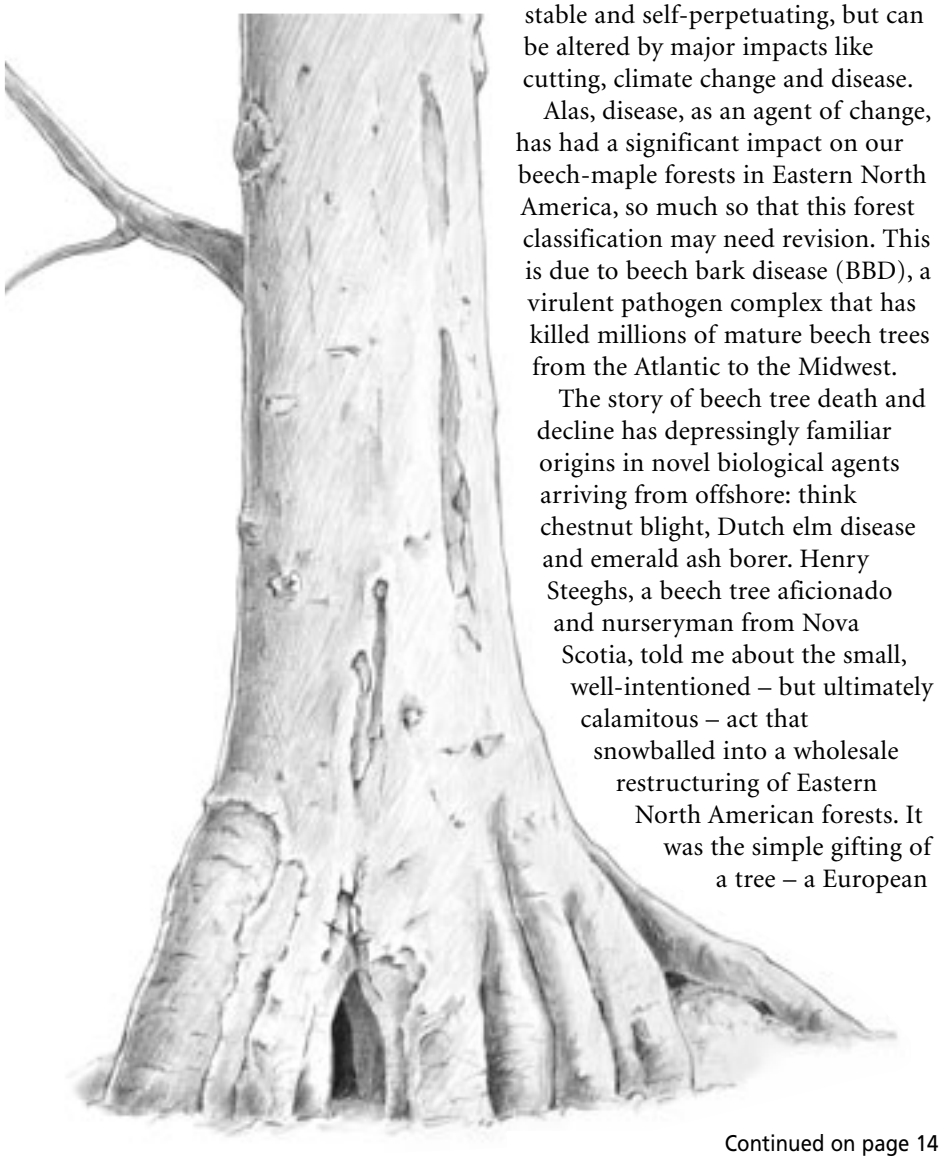

ILLUSTRATION BY ALAN LI

Alas, disease, as an agent of change, has had a significant impact on our beech-maple forests in Eastern North America, so much so that this forest classification may need revision. This is due to beech bark disease (BBD), a virulent pathogen complex that has killed millions of mature beech trees from the Atlantic to the Midwest.

The story of beech tree death and decline has depressingly familiar origins in novel biological agents arriving from offshore: think chestnut blight, Dutch elm disease and emerald ash borer. Henry Steeghs, a beech tree aficionado and nurseryman from Nova Scotia, told me about the small, well-intentioned – but ultimately calamitous – act that snowballed into a wholesale restructuring of Eastern North American forests. It was the simple gifting of a tree – a European

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***The Blazing Star* is . . .**

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NANPS News

The North American Native Plant Society spring plant sales will happen this year, never fear, with the usual array of gorgeous trees, shrubs, forbs, ferns, grasses and more. Advance ordering begins at the end of March. Please stay tuned to **nanps.org** for further information.

Collecting and Cultivating Native Plant Seeds
Wednesday, April 13, 2022, 7 p.m.

Paul Heydon, owner of Grow Wild Native Plant Nursery and Ecological Consulting, will cover best practices for collecting seeds, seed storage and how to provide optimum conditions for germinating seeds and growing them into healthy plants. To register: **https://tinyurl.com/nativeplantsfromseed**.

NANPS Toronto Native Plant Sale
Saturday, May 14, 2022,
9:30 a.m. - 2:30 a.m.
Toronto Botanical Garden
777 Lawrence Avenue East
Toronto, Ontario

NANPS Hamilton Online Plant Sale
Saturday, May 14, 2022,
9:00 a.m. - 3:00 p.m.
(pickup of pre-ordered plants only)
First Unitarian Church
170 Dundurn Street South
Hamilton, Ontario

NANPS Brantford Online Plant Sale
Saturday, May 28, 2022,
9:00 a.m. - 3:00 p.m.
(pickup of pre-ordered plants only)
Fairview United Church
49 Wayne Drive
Brantford, Ontario

The **NANPS Seedex** list of forbs, grasses, ferns, shrubs, vines and trees is available for viewing at **nanps.org/nanps-seed-exchange**. Order your seeds now to be ready to plant as soon as the ground warms in the spring!

Letters to the Editor on any subject we've covered in *The Blazing Star* are always welcome. Email them to **editor@nanps.org** with your name and home town or mail them to North American Native Plant Society, Box 69070, St Clair P.O., Toronto, Ontario, Canada M4T 3A1.

PHOTOGRAPH BY DON SCALLEN

The majesty of healthy mature beech trees – Boyne River, Ontario

A Quest for Early Buttercup

by Trish Murphy

Grand plans made in the winter of 2020 to spend less time in our nursery, pricking out asters and goldenrods nobody wanted to buy, and more time exploring the botanical diversity of the Ottawa Valley, crashed into the reality of lockdowns, interprovincial travel restrictions and a remarkable uptick in demand for nursery plants of all kinds.

Our first post-lockdown botany trip was to a very special botanical community. Spurred by reading "The Clay Banks Alvar: An important natural area in the Ottawa Valley" by Daniel F. Brunton, we headed across the Ottawa River to look for a new-to-us alvar. I have long been fascinated by the small tough plants that grow on the thin soils of alvars or limestone pavements. I encountered them first during childhood trips to the Bruce Peninsula. In the early 2000s, I rediscovered them on Field Botanist of Ontario trips to the Carden Alvar, just east of Lake Simcoe, when the Nature Conservancy of Canada (NCC) was assembling large tracts of land to preserve the area's unique biodiversity.

When I moved to the Ottawa area in 2013, I was delighted to visit the Burnt Lands Alvar, much of which is a provincial park or owned by NCC. I was even more delighted to discover a botanically rewarding strip of coastal pavement or riparian alvar, along the Ottawa River in Bristol Township, Quebec. This is close to where Beaux Arbres Native Plant Nursery, which I own with my partner, is located.

PHOTOGRAPH BY TRISH MURPHY

Early buttercup blooming on the Clay Banks Alvar

Our 2020 trip to the Clay Banks Alvar was prompted by the desire to see one special little plant: early buttercup (*Ranunculus fascicularis*). Early buttercup is a pretty plant that deserves much wider use in rock gardens. It has deeply cut leaves and cheery yellow buttercup flowers. It blooms in early spring, as its common name suggests, and, after setting seed, it becomes dormant to escape the heat and drought of summers on the thin soils of the limestone pavements. Leaves re-emerge in the cooler, wetter weather of a typical September.

Although it grows, sometimes abundantly, on Central Ontario alvars, early buttercup occurs on one site only in the Ottawa Valley, the Clay Banks Alvar (according to Brunton). It was June when we finally made the trip to Clay Banks, but we hoped that the cool, late spring would have delayed the buttercup's flowering.

Heading east from the town of Arnprior toward White Lake (itself famous for its fens), we turned south, guided by a rather sketchy map in Brunton's article; the road climbed up onto a limestone plateau. There was active limestone quarrying going on behind tall,

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PHOTOGRAPH BY TRISH MURPHY

The Clay Banks Alvar

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chain-link fences. One more turn onto a side road and suddenly the tree cover retreated and we could see areas of bare limestone pavement, low grasses and, most excitingly, sweeps of the bright yellow blooms of balsam ragwort (*Packera paupercula*), a key alvar indicator species.

We knew the Clay Banks Alvar meadow was privately owned but, unlike the land held for limestone extraction, there were no fences or signs against trespassing. We decided we could venture in along a clearly demarcated UTV track, being careful where we put our feet and taking nothing but pictures. Although there was no fence, the constant road maintenance disturbance along the verge had created a formidable barrier of poison ivy (*Toxicodendron radicans*), after which the UTV track was clear. Closest to the road, invasive aliens, such as stunted lilacs (*Syringa vulgaris*) and Tatarian honeysuckle (*Lonicera tatarica*), were very common, but we were still in easy view of our car when most of these petered out and we found ourselves in a wonderland of low plants, lichens and bare limestone.

We had come to Clay Banks Alvar for the botany, yet it was fossils, not plants, that first got us crouched down, oohing and aahing, peering excitedly at the ground. Brunton had mentioned fossils but I hadn't paid much attention, figuring "It's limestone, of course there are fossils. I am sure we could find some if we spent a lot of time looking." But what astonishing fossils they proved to be: large, abundant, right on the surface, impossible to miss. The Ordovician cephalopods of the Clay Banks Alvar are the best, most detailed fossils I have ever seen outside a museum. The apex predators of their time, cephalopods are related to the present-day nautilus, but are straight-bodied, not coiled. They lived 440 million years ago. We were amazed as we ran our fingers gently along the hard, crisp edges of their segmented shells.

With our eyes focused on small details at ground level, we identified alvar specialty plants. Early saxifrage (*Micranthes virginiensis*), which had finished blooming, was abundant in the moss layer next to open pavement. Where there was enough soil to support some diminutive grasses, wispy little harebells (*Campanula* sp.) and hairy beardtongue (*Penstemon hirsutus*) had found a toehold. Both species can form handsome, many-flowered clumps when grown in a home rock garden, but each of the struggling plants on the alvar could produce only a blossom or two. We spotted a few scattered blooms of wild columbine (*Aquilegia canadensis*). The most abundant bloom was from the balsam ragwort, a biennial species that seems able to flourish in almost no soil. Doing very well in small pockets of soil were some lovely flowering specimens of Michaux's stitchwort (*Sabulina michauxii*, formerly *Minuartia michauxii*, formerly *Arenaria michauxii*). This tiny charmer occurs on most of the Ottawa-area alvars. I would love to collect seeds, to establish it in my garden, but this plant has mastered its disappearing act among the mosses after flowering. It is challenging to spot once it has gone to seed.

A pretty little thing with blue flowers called small skullcap (*Scutellaria parvula*) was abundantly sprinkled among the low grasses. I am interested to find out how this plant performs in a garden. There were few flowers per plant in the harsh conditions of the alvar, but it might become more lush and floriferous in a rock garden and then produce its handsome, red-purple seed capsules after flowering. Small skullcap is well represented on the alvars of the Ottawa Valley, so I will look out for a local source of its seeds.

It wasn't long before we spotted an early buttercup in bloom, then a second, and then several. Once we recognized the leaves, we saw *Ranunculus fascicularis* all over the place, although many had finished blooming and were busy ripening their seeds, which looked like small green burs.

The UTV track now entered a shrubby area and we were pleased to see some eastern Saskatoons (*Amelanchier alnifolia*), long finished flowering but easily recognizable by their ripening but still green Saskatoon fruits.

Brunton reported the presence of other interesting alvar species, such as prairie dropseed grass (*Sporobolus heterolepis*) and Seneca snakeroot (*Polygala senega*). It would have been wonderful to confirm that these species were still present at Clay Banks, but, reluctantly, we decided we'd seen as much as we were likely to see from the UTV track and we turned back towards our car. Almost there, with my

Photograph by Trish Murphy

*Balsam ragwort (*Packera paupercula*)*

PHOTOGRAPH BY TRISH MURPHY

*Small skullcap (*Scutelaria parvula*)*

PHOTOGRAPH BY TRISH MURPHY

An early buttercup seedling blooming in a hypertufa trough at the Beaux Arbres gardens

attention on the ground to avoid stepping on the poison ivy, and with my early buttercup leaf pattern recognition still on high alert, I saw something I hadn't noticed on the way in: a few plants of *Ranunculus fascicularis*, no flowers but with quite a few seed clusters, right there on the road allowance. I plucked two of the little burs and folded them gently into a scrap of paper.

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Prairie smoke (*Geum triflorum*) and field chickweed (*Cerastium arvense*), strikingly beautiful components of the spring flower mix on the alvars of Central Ontario, do not occur at all on the Ottawa Valley alvars. It is also a puzzle why early buttercup, so abundant on Clay Banks Alvar, is not present on any of the other alvars in the Ottawa Valley. When I watch the seeds of prairie smoke, with the long, wispy, smoke-like styles that give the plant its common name, disperse in the wind I am tempted to think that this species, with its more westerly range, just hasn't reached as far east as the Ottawa Valley. Yet. But, someday, it might arrive on the wind. It's much more likely that the patchy presence of alvar species in eastern Ontario reflects the fragmentation of a once much larger expanse of post-glacial open grasslands. As the islands of open alvar became smaller, surrounded by an encroaching sea of forest, species winked out, not to be replaced, as the work of the late biologist E.O. Wilson warned us. In the Ottawa area, only the Burnt Lands Alvar has any legal protection. (There are areas of treed alvar and shrub alvar in Stoney Swamp reserves but, as far as I know, the National Capital Commission reserves do not include alvar meadows of any extent.) As limestone extraction and suburban development nibble away at the edges of the alvar islands, we may soon lose more species.

As for those early buttercup seeds – they produced more than two dozen little plants. Reports that this species is finicky to germinate must come from attempts using dry-stored seed; fresh seed germinates just fine. At Beaux Arbres, we have slightly acidic sand and granitic rocks, so my little buttercups are planted in hypertufa troughs, to give them the limey soil they need. They bloomed in the spring of 2021 and from their seeds I am now growing early buttercups for sale. Perhaps the suburban sprawl around Ottawa is inevitable, but if we can get enough home-owners valuing and growing native plants, we may be able to stem biodiversity loss.

***Trish Murphy** has been interested in native plants since childhood. She served as a NANPS director in the 2000s, ran the plant sale for several years and then the seed exchange. At her nursery, she propagates little-known or under-appreciated species to expand the palette of native plants available to home gardeners.*

Preparing for Global Warming in the Garden

by Peter Loewer

I've been a garden worker, weeder, dreamer and writer, all roles that involved me as an integral part of countless gardens. My toils began in our family Victory Garden, which fed our neighbourhood during World War II. Its success was due in part to the grunt work I did as a teenager. I learned about seeds, seedlings, watering, weeding and all that's involved in being a tiller of the soil and gardener of the mind.

One critical truth I've learned: by tying yourself down to the responsibility of tending gardens and paying attention to the increasingly unpredictable weather, you will become deeply involved with the passing seasons, what nature may have in store for you, and how to deal with things beyond your control. The COVID-19 pandemic has brought innumerable societal changes and completely jumbled our sense of time and connection with others. But no matter where you live, as long as you have a place for a pot, throughout your life you'll be awed by the wonder and beauty of plants, and you'll be able to look ahead to what awaits you.

After years of advance notice and warnings from scientists, warnings that most gardeners understood back when increasing temperatures began sneaking in the back door, society has acknowledged that climate change is a threat to our lives and our planet. Only the intrepid plant lovers who yearly took accurate notes on seasonal temperature fluctuations or had a rain gauge that told them just how much rain was falling in the back 40 knew that a new millennium was at hand. As a nation, we are realizing that an old Cole Porter song – "The temperature's rising, it sure is surprising, we certainly can-can!" – is calling it as it is.

Be reminded that winters will whistle by, bringing mixed levels of snow, and cheat the expected weather schedule every way possible, with January thaws much warmer or icier than a few years ago. Incredible storms will rampage through the Midwest, great buckets of rain fall from east to west, forest fires rage and hailstones assume the size of baseballs.

Illustration by Peter Loewer

*The yucca moth is the sole pollinator of yucca blossoms (*Yucca *spp.).*

Photograph by Peter Loewer

*Swallowtail butterflies enjoying the flowers on 10-foot (three-metre) high branches of Joe-Pye weed (*Eutrochium purpureum*) grown in the same spot (with shade from the noonday sun) for over 25 years.*

So get a cup of tea or coffee, sit down and think about taking your garden to new heights. Grow as many native plants as you can, not just currently native, but those indigenous species that will move north as the climate in your area warms. Create a garden that salutes where you live. Begin by planting an area of native trees and shrubs to provide food and shelter for birds and pollinating insects. Create small pools of water and find a place to hang squirrel-proof seed containers. At the edge of your small grove, plant several native ferns, including evergreens like Christmas fern (*Polystichum acrostichoides*).

Why not take whatever land you have control over and, instead of doting on island beds full of blockbuster flowers, view your garden as an environmentally savvy ecosystem, a system constructed of native trees, shrubs and wildflowers?

Include flowers from all seasons, including early winter where possible. Get to know rocks, not 10-ton boulders, but smaller rocks that can be used to make rocky outcrops. Join a rock garden or native plant society and feast your eyes on plants that have survived high-altitude global warming for years, yet still flower and seed with a beauty that astounds the senses. Because of global warming, I now have something blooming in my garden in North Carolina every month of the year. If we do get snow, it acts as a blanket, protecting the plants until everything warms up again.

Tired of your perennial border but not willing to take the time to redesign or replant? Move in containers, setting them on ground-level concrete squares or circles, then plant with mixes of perennials and annuals that bloom all summer and well into fall. It allows you to experiment with native plants that you're afraid will not survive the extremes of the climate to come. Try growing these beauties in pots. You'll have ample control of their environment, using portability to best advantage, moving them from place to place and providing weather protection where needed. Clusters of potted native plants are just as likely to attract beneficial insects as plants in the ground.

Thinking of new colour combos that trendy magazines might reject as too much? Arrangements that look great on the page are open to judgement when using pots – if a scheme proves too garish, you can dig it up easily. Containers also offer short-term solutions to aesthetic problems, such as growing glorious bulbs that bloom and leave behind clumps of uninteresting foliage that must ripen before the bulbs go into storage. When plants become unsightly, move them out of sight.

A variety of pots provide many choices for gardeners. Remember that cheap pots usually don't survive a hard frost, but a well-designed terra-cotta pot imported from Italy or thrown by a local potter, perhaps painted with heavy, decorative, enamel glazes, will last a lifetime. Just remember to soak any areas not covered with enamel in a water-seal product from the hardware store. Finally, if you're not as young as you once were and your mobility is limited, pots are welcome. They can be placed at any level and moved about with ease. Larger pots can go on wheels or be lugged about on a dolly.

PHOTOGRAPH BY PETER LOEWER

*Lichen (*Usnea comosa*) brings colour to Peter Loewer's garden when it grows beside a spider rock made for him by a friend.*

As for the future, I have some suggestions. Ask questions. Read books. Visit garden shows and look where the native plants are. Drop a letter to the editor of your native plant journal and suggest they encourage the publication's readers to send in the names of books that have helped them grow as gardeners. By nurturing a native plant garden, you are at least partially armed and ready for the adventure of gardening and the unpredictability of life that lies ahead.

Our climate is changing and nobody on Earth has ever prepared for or lived such an adventure. It will radically change the world we remember. But we are here, today, and the challenge has been dropped at our feet. We must accept that challenge and try to bring about a bright new world for all of us, including the gardeners yet to be born.

***Peter Loewer** is a botanical artist, author and gardener who has written over 30 books about gardening and natural history. His 1991 book,* The Wild Gardener*, was named one of the best 75 garden books of the twentieth century by the American Horticultural Society and his botanical illustrations are part of the permanent collection of the Hunt Institute for Botanical Documentation in Pittsburgh, Pennsylvania.*

NDAL is an educational series dedicated to the art, culture, & science of ecology-based landscape design. Winter Series featured speakers include **Wambui Ippolito, W. Gary Smith, Claudia Thompson, Larry Weaner,** & **Thomas Woltz**.

February - March, 2022

"Sharing this actionable knowledge is crucial for us now and into the future." - Kate K., 2021 Winter Series Attendee

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Tufa-Plant Relationships

by Andy Fyon

"Do I wade into this spring-fed, warm-water, calcareous pool to get a closer look at the bubbles breaking the water's surface?" I think to myself. "Or do I listen to the voice inside my head yelling, 'Are you crazy? Those bubbles are warning you that the bottom of the pool will open up and swallow you into the boiling bowels of the Earth!'"

A geologist with a strong interest in the influences of geology on plant diversity and boundaries between species, I was visiting Atlin in northern British Columbia. Here groundwater springs and unusual rock types come together in spectacular landscapes, showcasing uncommon geological habitats and their flowering plant communities. It occurs within the homeland of the Taku River Tlingit First Nation. And it was well worth the 12-day drive for me and my wife.

The Atlin area boasts serpentinite barrens, limestone barrens, dry lake basins (known as playa, they are filled with the mineral hydromagnesite, which formed when lake evaporation exceeded recharge), calcareous fens and tufa.

Tufa is a terrestrial deposit of calcium carbonate that precipitated from calcium-enriched spring waters, flowing through limestone bedrock. Tufa is similar in composition to limestone rock; however, there is a big difference between the way tufa and limestone form. Limestone is a layered rock, which formed millions of years ago from lime-rich muds and shells of dead marine animals that accumulated on the bottom of a subtropical to tropical ocean. Conversely, tufa forms when calcium carbonate, generally in the form of the mineral calcite, precipitates from cold to warm, calcium-rich groundwater springs. Tufa is generally not well layered. It may contain ghostly casts of plants that grew where the spring discharged. Tufa is usually porous because many cast voids form when trapped plants decay. Globally, tufa forms in a variety of habitats, including pools, creeks or rivers, lake bottoms or edges, terraces and gentle slopes near spring discharge sites. The Atlin tufa is actively forming in an area where cool and warm calcium-rich springs discharge onto, and flow over, the land surface.

PHOTOGRAPH BY ELIZABETH FYON

Andy Fyon getting a closer view of the calcareous warm pool located south of Atlin, British Columbia. Herbaceous vegetation related to pool-creek tufa deposits is best seen at this bubbling, warm pool, which became established at a discharge site or its related drainage creeks.

Several chemical processes cause calcium carbonate to precipitate from a groundwater spring. Carbon dioxide gas from the groundwater degasses, much like a carbonated beverage effervesces violently when you snap off the bottle top. Spring water evaporates on the land surface. The final process is photosynthesis of aquatic plant and algae in pools, creeks and on the wet land surface. All of these processes remove CO_2 gas from the spring water, which causes calcite to precipitate. Evidence of active CO_2 gas degassing is illustrated by bubbles breaking the surface of the main Atlin warm-spring pool.

The Atlin tufa substrate has important physical and chemical properties that influence the types of plant species present. The tufa substrate is mesic to water-saturated; it contains a lot of calcium in the form of calcium carbonate ($CaCO_3$), making it lime-rich; and the pore water is likely alkaline. The pH of typical tufa pore water ranges from 6

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to 8. Specialized plant species called calcicoles, like marsh grass-of-Parnassus (*Parnassia palustris*), thrive in calcareous, alkaline conditions. Since the Atlin tufa is alkaline and wet in places, moisture- and lime-loving calcicolous plants are present.

*Scientists use the pH scale of 0 to 14 to describe how acidic or alkaline a substance is. By definition, a substance is alkaline if it has a pH greater than 7. For comparison, bog water is acidic, with a pH of 3.3 to 5.5; rainwater is slightly acidic, with a pH of 5.0 to 5.5; distilled water is neutral, with a pH of 7.0; and fen water has a pH of 5 to 7. Many plant species grow in slightly acidic to slightly alkaline conditions. However, some plants, such as certain rhododendron species (*Rhododendron *spp.), grow in acidic conditions.*

Pool-Creek Flowering Plants

Herbaceous vegetation related to pool-creek tufa deposits is best seen where a bubbling warm pool has become established at a discharge site and at related drainage creeks.

Seep monkeyflower (*Erythranthe guttata*) and watercress (*Nasturtium officinale*) thrive in, and adjacent to, the warm pool and adjacent drainage creek I explore. Seep monkeyflower is restricted to the edges of the pool and creek, although I read that it can grow on a range of substrates, including harsh serpentinite rock and soils, where high concentrations of metals and the high magnesium-to-calcium ratio of the soil is poisonous to many plants. Watercress floats in the warm pool, growing in and along the edges of calcium-rich creeks that drain the warm pool and issue from limestone bedrock elsewhere in the area.

Watercress, a native of Eurasia, is relatively rare in northern British Columbia, leading some to suggest it was introduced to the tufa area by European settlers who used the plant as a culinary herb. Note also that Atlin is located in Canada Plant Hardiness Zone 1b, where you would not expect

Photograph by Andy Fyon

*Seep monkeyflower (*Erythranthe guttata*) thrives along the edge of the warm pool and along the creek that drains the pool into the calcareous fen.*

Photograph by Andy Fyon

*In some areas, where groundwater springs no longer discharge, tufa consists of hard, consolidated rock. The green vegetation appears to be wild chives (*Allium schoenoprasum*).*

PHOTOGRAPH BY ANDY FYON

*Kalm's lobelia (*Lobelia kalmii*) is a calcicolous specialist species.*

PHOTOGRAPH BY ANDY FYON

The sparsely vegetated tufa areas are open and gently sloped, consisting mostly of wet, unconsolidated calcium carbonate muds and crusts. Atlin Lake sits in the background.

watercress to survive the long, cold winters. Its year-round presence is a testament to geological processes that created the warm groundwater spring, which dramatically moderates the micro-climate and enables watercress to survive year round.

Climate strongly influences distribution patterns of most, if not all, plants and other biota. Within a climatic region, plant distributions often reflect differences in the local geological history, topography and substrate, which together create different habitats. That said, trying to identify specific substrate-plant relationships is challenging because geology is only one determinant.

Another line of evidence supporting the micro-climate moderation by geological processes is the unfortunate presence of introduced red cherry shrimp in the warm pool. This shrimp species requires a habitat equivalent to Canada Plant Hardiness Zone 12! Yet, due to the warm geothermal waters, this shrimp survives year round in Atlin's warm pool.

Unconsolidated to Consolidated Tufa Flowering Plants

The open, gently sloped, wet, unconsolidated tufa ranges in texture from boot-sucking muck to semi-consolidated calcareous surface crust to rare occurrences of rocky tufa. Despite being poorly vegetated, this habitat supports a number of herbaceous plants. Kalm's lobelia (*Lobelia kalmii*) and marsh grass-of-Parnassus are two common calcicolous specialist species growing on this limy habitat.

Geologic materials are described as consolidated or unconsolidated. Consolidated material is rock. Limestone rock is consolidated calcareous mud. Unconsolidated material consists of loose material such as wet mud, silt, sand, or gravel. Mucky tufa is unconsolidated

calcareous material.

I distinguish between the thin, crumbly tufa crust, about one centimetre thick (two-fifths of an inch), and easily broken up by hand, and the consolidated tufa rock, which is hard and thicker, about 20-40 centimetres (eight to 16 inches), and cannot be broken by hand.

Where the tufa is less moist, mountain death camas (*Anticlea elegans*, formerly known as *Zigadenus elegans*) is present. As its ominous name suggests, this species contains toxic steroidal alkaloids that are poisonous to humans and domestic animals when consumed. Moose frequent the Atlin tufa area to consume mineral-rich water and plants, but I saw no evidence that moose, or any other herbivore, ate mountain death camas.

Lake Huron green orchid (*Platanthera huronensis*), hooded lady's tresses (*Spiranthes romanzoffiana*), sticky tofieldia (*Triantha glutinosa*) and western butterwort (*Pinguicula macroceras*) also thrive on the moist, unconsolidated and less common consolidated tufa. While I cannot find an authoritative source attesting to their calcicolous nature, these plant species are known to grow on other limy substrates, such as near calcareous seeps and fens and on alvars.

On the well-drained, drier, unconsolidated, crusty tufa areas, the calcicolous entire-leaved mountain avens (*Dryas integrifolia*) grows in its characteristic mound shape. It is considered a pioneer species of calcareous, gravelly and rocky barrens. Given Atlin's northern location and the calcareous tufa substrate, it was not surprising to see this arctic-alpine species present.

Other flowering plant species seen on the drier, unconsolidated, crusty tufa include multi-rayed goldenrod (*Solidago multiradiata*), shrubby cinquefoil (*Dasiphora fruticosa*) and star-flowered false Solomon's seal (*Maianthemum stellatum*), all of which grow on, and have a high tolerance for, the alkaline, calcium carbonate-rich tufa substrate. Although I visited the area late in the flowering season, I also saw balsam groundsel (*Packera paupercula*) in bloom, another species diagnostic of calcareous, alkaline substrates.

Photograph by Andy Fyon

*Multi-rayed goldenrod (*Solidago multiradiata*) has a high tolerance for the dry, alkaline, calcium carbonate-rich tufa substrate. The white-coloured material consists of dry tufa fragments and crust.*

Calcareous fens

Calcareous fens develop in water-saturated, low-relief areas adjacent to calcium-rich creeks that flow away from spring discharge sites. While I did not spend a lot of time in the fen, I noted the presence of watercress in the creeks and seep monkeyflower along the edges of the fen creeks. Foxtail barley (*Hordeum jubatum*), little yellow rattle (possibly *Rhinanthus minor*) and hooded lady's tresses were some of the flowering species in the vegetated fen. The striking American cow parsnip (*Heracleum maximum*) dots the transition zone between the calcareous fen and the boreal forest.

Tufa is available at many garden centres. It is commonly used in domestic rock gardens and as a specialized planter due to its porous and lime-rich character. Globally, tufa is not rare, but like with any natural substance, we need to ensure mining does not destroy sensitive habitats. As a result, a lot of the garden tufa sold, called hypertufa, is manufactured.

Geological processes created the geothermal springs that moderate the micro-climate in Atlin, helping to create a warm oasis in an otherwise harsh, cold northern area, thereby influencing the local plant life. Some of the species mentioned may be familiar to anyone who lives south of the 60th parallel, where Atlin is located. Some plant species, like marsh grass-of-Parnassus, are calcicolous plants adapted to thrive on an alkaline, calcareous, geological substrate that also grow much farther south. Others, such as shrubby cinquefoil, are generalists adapted to grow on a range of substrate types, including the calcareous tufa. Still others, like the introduced watercress, survive in Zone 1b because of the geologically influenced micro-climate.

Atlin does not disappoint with its scenic mountains, visible glaciers, alpine meadows, varied geology and fascinating plant species that occupy unusual geological habitats. If you visit, remember that this is a special place that merits respect and a light footprint.

***Andy Fyon** is a retired geologist with a keen interest in the relationship between local geology and plant life. To view his work, visit **ontariobeneathourfeet.com/**, **facebook.com/Andy.wildflowers** and **instagram.com/andyfyon/**.*

New & Noted

Finding the Mother Tree: Discovering the Wisdom of the Forest
by Suzanne Simard
Published by Allen Lane: Penguin Random House Canada, 2021
345 pages, colour and black and white photographs, Critical Sources and Index

In *Finding the Mother Tree*, forest ecologist Suzanne Simard presents ground-breaking research that may radically change the way we think about forests and trees. Contrary to the stubborn belief among foresters and powerful policy-makers that trees compete for scant resources, a philosophy that has justified clearcutting of irreplaceable old-growth forests, Simard has proven that trees communicate through their complex root systems and mycorrhizal connections, helping one another and other forest organisms to survive natural disasters and man-made deterrents, and even to thrive.

This book is part memoir, part illumination of Simard's scientific discoveries. She painstakingly weaves decades of dedicated research in the field with up-close, often painful glimpses into her life's joys and challenges. I, for one, came away from the book filled with admiration not only for her achievements, but also for her strength, honesty and warmth.

Her quest for understanding began in childhood, growing up in the Monashee Mountains of British Columbia in a generations-old family of woodsmen and loggers. She tells a poignantly funny anecdote about the family dog, Jiggs, falling into the outhouse pit, necessitating the excavation of soil around the site to free the dog. How does this relate to Simard's later discoveries? Even then, as a curious child with a great love of trees, she watched the colourful layers of fungal webbing in the soil unfold as the men frantically dug. In later years, she would learn that these gossamer strands were the communication and support networks of the forest.

As a young person, she began work with a large logging operation and found her place evaluating new plantings of tiny trees where the forest had been clearcut. Her initial investigations into why a large number of these "little yellow seedlings" were dying led to her lifelong search for answers as to why some tree seedlings fail and others live. "My instinct has always been to listen to what living things are saying," she notes, leading her on a remarkable journey.

Often faced with skepticism and discrimination in a male-dominated profession, Simard's ideas and questions were met by the decision-makers with derision, despite her rigorous trials. Driven by boundless curiosity and concern for forest life, she gathered data that confirmed time and again why regulated practices and assumptions in the logging industry were detrimental to establishing healthy, new forests. But those with the power to affect change in the industry refused to accept the validity of her findings.

She discovered that the forestry industry's well-established "free-to-grow" policy – where all the remaining, "competing" shrubs and trees must be removed from a clearcut through chemical herbicide use or slashing to allow the newly planted trees to grow to their optimal size – was not supported by scientific research. The assumption that trees compete against each other for resources (light, water, nutrients) and the belief that saplings will grow better, faster with all "competition" annihilated has seemingly vindicated forestry practices in British Columbia and all over the globe. And yet the results have been catastrophic. Simard's research detailing the complex and interdependent nature of forests allows us to finally comprehend that there are sure to be cascading effects when humans harvest huge forested areas. The flooding and fires that occurred in British Columbia in 2021 shortly after this book was published are clear examples. We can't even call them "natural" disasters anymore!

Faced with the likelihood of dismissal from her government job for her heretical findings, Simard accepted a position (which she still holds) at the University of British Columbia. There she proceeded with field and lab research, discovering a supportive environment with resources and students to assist.

At the book's conclusion, I was disappointed that Simard doesn't call her readers to action. She is carefully apolitical, but there can be little doubt that she does not support current resource-use policies, instead sharing her radical notion with anyone who will listen – "The old trees were the mother trees of the forest. The hubs were *Mother Trees*. … With the elders tending to the young. … *Mother Trees connect the forest*."

As Simard navigated her own serious health challenges, she discovered that the extensive, complex connections among trees through their "wood wide web" suggested a parallel with the human nervous system. Delving deeply into the specialized mycorrhizae that connect specific trees, she admits that, in this book, she has only touched the surface of the vast array of fungi and other organisms with which trees have mutualistic relationships. She also readily acknowledges that local First Nations have known and respected these communications and connections since time immemorial. Sadly, their reverent way of living with the trees and all of nature has not been honoured by the

Continued on page 14

Continued from page 13

forestry industry or any other resource-based industry, to the detriment of the planet and us all.

Please read this book. It's important that we heed the scientists who think outside their own specialties and make the critical links that broaden our knowledge of – and care for – the natural world. You may find yourself slowed down by the long, unpronounceable words Simard uses in her detailed explanations, but forge on and gather the big ideas and the gentle, thoughtful observations. Simard has made a huge contribution to human understanding of trees that will, we hope, influence and guide how we value, preserve and use this living resource.

Review by Catherine Goddard

Continued from page 1 – **American Beech**

beech tree (*Fagus sylvatica*) – sent to Nova Scotia from Great Britain to celebrate Queen Victoria's Golden Jubilee in 1897.

According to this story, clinging to the bark of that tree were the agents of destruction – beech scale insects with the scientific moniker *Cryptococcus fagisuga*. These insects specialize on beech trees and make their living by inserting their sharp mouth parts into beech bark and sucking sugar-rich sap. (A native scale insect also sometimes participates in beech bark disease, but to a lesser degree than *C. fagisuga*.)

The European beech scale insects were likely accompanied by a fungal accomplice called *Neonectria faginata*. This beech pathogen is suspected to be of European origin and is the primary fungal villain in this story. A lesser rogue called *Neonectria ditissima*, possibly a North American native, is another fungus sometimes implicated.

Photograph by Don Scallen

American beech in November

Beech bark disease is known as a "complex" due to these fungus-insect relationships. The fungi gain access to the circulatory system of the trees through the holes that the scale insects bore. Once entry is gained, a beech tree's days are usually numbered.

By the 1940s the forests of Nova Scotia, where American beech may have once been the most common large deciduous tree species, were left in shambles. The dead and dying beech were referred to as "snap trees" because they broke so easily in the wind.

BBD spread from Nova Scotia into Quebec and the New England states by the 1960s. It continued its march westward, sweeping the entirety of New York State by the end of the 1980s. In the Adirondacks, 80% of American beech trees over 40 centimetres (16 inches) in diameter were dead by 1980. Beech bark disease now afflicts beech trees throughout most of their extensive range.

Beech trees periodically produce abundant nut crops in events called masting. These mast years are a boon for many birds and mammals that consume the nuts, including turkeys, blue jays, ruffed grouse and deer. They are nutritious, containing 17% fat and 11% protein – greater in both measures than oak acorns. The fat content is vital for bears seeking to build their fat stores prior to winter. Studies indicate that bear sows produce far more cubs the springs following heavy beech mast years.

Photograph by Don Scallen

*American beech and eastern hemlocks (*Tsuga canadensis*) often associate in the forest. Might supportive mycorrhizal connections exist between the two species?*

To access the nuts, bears climb beech trees, often leaving signature claw marks on the smooth bark. Aloft, they bend branches towards them, strip them of nuts and then tuck the branches underneath their bodies for support. These "bear nests" can be seen anywhere bears and large beech trees coexist.

Like bears, populations of deer mice rise and fall in response to beech nut production. In years following heavy masting, deer mice populations explode, and predators like coyotes, bobcats, weasels, owls and hawks benefit. Populations of American marten also closely follow beech nut trends. These arboreal members of the weasel family feed on the small mammals that eat beech nuts, but they also eat the nuts directly.

Some surprising implications flow from mammal-beech nut interactions. In a study from the Adirondacks in New York State, bear-human conflicts increased after low beech nut years.

The bears did not become more aggressive, they were simply forced to look for food in the wrong places, like garbage cans and bird feeders. Like bears, American martens search for alternate food sources following low beech nut years. With fewer mice they turn their attention to nesting birds. The takeaway? Beech trees interact with the ecosystems they inhabit in complex and important ways.

A counterintuitive finding of the State University of New York (SUNY) is the presence of *more* beech trees, not fewer, in many areas ravaged by BBD. Many beech groves in forests are clones, growing from the surface roots of a parent tree. The parent trees can inhibit the growth of their clonal offspring while they are healthy, but when they die from BBD or some other cause, multiple clones arise from their roots. Thus, as BBD knocks out big, old trees, swarms of clonal youngsters replace them.

The resultant beech "thickets" are a cause for concern for some foresters and ecologists. The small beech trees in the thickets grow close together, shading and out-competing other plant species, including ferns, shrubs and wildflowers. The thickets also result in a dense layer of lignin-rich leaves, which likely inhibits the growth of other plants. So, an unexpected consequence of BBD is more, but smaller, beech trees and diminished forest diversity.

Most of us living in the range of American beech are now witness to what is described in ecological circles as the "aftermath forest" – the forest that BBD has created. A few glimmers of hope can be found in this forest. It has become obvious that beech trees are resilient. Henry Steeghs reports that Nova Scotian forests, now plagued by BBD for over a century, still have lots of beech trees, though most are small, in the range of 15 to 20 centimetres (six to eight inches) in diameter, the size they manage to attain prior to succumbing to the disease. In the Adirondacks, beech

PHOTOGRAPH BY DON SCALLEN

The disfigured bark characteristic of advanced beach bark disease

trees remain a major forest species but, like the Nova Scotian trees, they are much smaller on average than they were prior to BBD.

Not all remaining beech trees are small. A small fraction appear immune – perhaps one in a hundred. These have been sought out by government agencies to create seed orchards of putatively resistant trees. Michigan is one jurisdiction doing this.

Henry Steeghs of Nova Scotia is helping, albeit on a small scale. He seeks big, healthy beech growing among the dead and the dying, thus demonstrating their probable resistance to the disease. He climbs into the canopies of these trees and cuts small, healthy branches. With this precious bounty in hand, he returns home to begin the difficult process of grafting them to rootstock. Henry realizes his individual efforts may be quixotic, but he is driven by his passion for the species. He hopes to pass the torch on to a team that will carry on and expand his project.

Another glimmer of hope in the beech tree saga comes from Stacy McNulty, associate director of research in the Department of Environmental Science and Forestry at SUNY. Though Adirondack beech trees have been devastated by BBD, her research has revealed that beech nut production has increased since the 1980s. Individual trees produce fewer nuts; however, on a landscape scale, with larger numbers of small trees, beech nut production can be maintained at a high level. This is good news for wildlife. However, McNulty cautions that the relationship of beech trees and BBD is fluid. Change is a given.

Negative change appears ready to trump the positive. Two recently introduced pathogens are adding insult to the injury that BBD has visited upon our beech trees. But, to be frank, "insult" grossly understates their potential threat, for both can be killers. One is beech leaf disease, first identified in North America in Ohio in 2012 and now found in several U.S. states and Ontario. Caused by a leaf-feeding nematode, likely from Asia, it can kill infected beech trees in as little as six years. The second threat is the beech-leaf mining weevil, an insect from Europe, which, like the beech leaf nematode, was first noticed in North America in 2012. The weevils, spreading through Nova Scotia, can kill trees quickly.

The mighty beech tree that supported my friends' fort is long gone. So are the neighbouring giants that once flourished nearby. But their clonal progeny persist. When I visited the site this winter, their dry leaves fluttered, illustrating a phenomenon called marcescence, the tendency of some deciduous trees to retain their dead leaves during winter.

My love for beech endures. I salute the lonely mission of Henry Steeghs and others striving to grow disease-resistant beech trees. I salute beech trees, for they are true survivors. However, as threats continue to pile on, that survivability could be pushed past the breaking point. If that happens, a critical food larder for wildlife will shutter its doors and our relationships with these magnificent trees will drift into the realm of memory and regret.

***Don Scallen** is the author of* Nature Where We Live.

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