Horticultural practice and the influence of climate in Ontario

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INTRODUCTION

It was recently suggested to me that horticulture is the only 'true' art form. While this statement may certainly be contested, mastering such craft, as with any artistic pursuit, takes practice. My time in horticulture has thus far been relatively brief. On approaching the end of an arts qualification, I realised my need for life outdoors, working with nature, and determined that plants, both 'wild' and cultivated, interested me greatly. This swift turn took place only two years ago in 2017. The RHS level 2 theory-based course on the Principles of Horticulture proved a vital introduction to botany, garden design, and cultivation, and 2018 saw me embark on a complementary practice-based course at Threave Garden (National Trust for Scotland).

During this time I became acutely aware of my limited experience with different types of garden, nature conservation areas, and general trends in plants to expect dominating such areas. This is why I decided that a study tour was necessary in order to focus on expanding my awareness of more plants, but also the context that surrounds gardens and the connections that arise between landscape, gardens, organisations, and inhabited environments.

STUDY TOUR

i. What

The tour comprised two elements:

The first element was a voluntary placement at an independently funded and privately owned botanical garden called Whistling Gardens. This afforded me 3 weeks to learn about its operation, compare it with 3 other botanical gardens, and explore nature conservation areas in the region.

The second element was a week dedicated to observing a contrasting region by traversing trails along lakeshores, canyons, rivers, parks, and hills.

Temple Garden used for weddings at Whistling Gardens [WG]. (Photo taken at WG).

The trail to Silver Falls [SF] is flooded when the River Kaministiquia is high. The land is kept wild and rugged, requiring frequent markers to aid navigation. (Photo taken at SF).

ii. Where

The tour took place in Ontario, Canada.

Whistling Gardens is based in Norfolk County, a southern region of agricultural plains with meadows and woodlands found at their borders. Small pockets of nature conservation areas are

mostly connected by ‘rail trails’. These are linear pedestrian pathways that trace former rail line routes.

Thunder Bay, the base for my fourth week, is a city in North-western Ontario. The ground has significantly more hilly terrain broken up by rivers and ravines. The region has large lakes to the south, east, and north. There is proportionally more parkland with several provincial parks, conservation areas, and other areas left uncultivated.

iii. Why

I chose Canada for multiple reasons.

Climate: As I have been informed time and again, it is no surprise why many Scottish people have moved to Canada. There are similarities to be found in both climate and landscape, from woodlands to the lushness of grasses, and the bleak bare rock reminiscent of the windswept Hebrides and north coast. The key difference is in the extremes of summer and winter, which is substantially farther ranging in Canada than the seasonal variations of Scotland.

Personal: I have visited Ontario once before, in 2005. I recall the mature woodlands, familiarity of climate, and my interest in the abundant wildlife.

PREPARATIONS

I intended to form basic profiles on each of the gardens I visited. I sought to include the following:

Background information on each site, soil and conditions, noteworthy features, impact/evidence of climate change, sustainable practices, aims of the site and challenges/restrictions.

I gained information about each site through either meeting a relevant staff member or owners, and sometimes by contacting the organisation post-visit for clarity. Compiling these profiles provided an understanding of the comparative climate shifts seasonally in regions of Ontario.

As for each of the conservation areas and nature sanctuaries, I set out with my camera and North-eastern American wildflower key. My approach to documenting flora diversity and presence was determined by what plants I noticed dominating or thriving in an area, while paying attention to less conspicuous or more unusual plants. Attempting a more thorough analysis would have limited the number of sites I would explore. It seemed prudent to have results for more areas, for the purposes of ascertaining the general dispersion of plants and creating an impression of what kinds were most prolific.

BRIEF OVERVIEW OF REGIONS WITHIN ONTARIO

i. Geology

Canada is broken down into several geological regions.

Norfolk County in South Ontario consists of low-lying flat sedimentary rocks of mainly limestone, sandstone, and shale, which have been deposited by retreating glaciers after the ice age. This surface layer is called the Interior Platform. Eskers occur noticeably in Whistling Gardens. Beneath this is the Canadian Shield of a harder ancient rock (The Canadian Encyclopedia, 2019).

Thunder Bay in North-western Ontario has a combination of flat plains and flat-topped hills with sharp cliffs. Immediately to the west, the older rock of the Canadian Shield can lie uncovered. In the Thunder Bay area, the plains are again covered by sedimentary rock, but the hills demonstrate where harder rock layers protrude through to the surface. Composed of granite and metamorphic rock, the ancient rock could be over 4 billion years old (ibid.). This rock is more often found as sills, which are layers that cap the sedimentary rock in roughly horizontal fashion (as opposed to cutting through, which are called dykes). Good examples of this are Sleeping Giant Provincial Park (where the hard rock layers are diabase igneous rock), Mount McKay, and Kakabeka Falls. The caps or sills are not so readily eroded, unlike the sedimentary layers beneath, which create the steep cliffs and the cascade of the Falls. It is not by chance that Mount McKay is reminiscent of the Salisbury Crags in Edinburgh, as both consist of volcanic rock. Thunder Bay is perched on the edge of Lake Superior, the largest freshwater lake in the world (Geology.com, 2019), which evidences the effects of the glaciers that scoured the ancient rift in the tectonics, creating a basin for water to collect within.

The sedimentary layer thus can be shallow to non-existent in many areas, creating a challenge for plant cultivation.

The Nipigon valley to the north of Thunder Bay demonstrates the 'basin' effect, leading to Lake Superior from the surrounding flat-topped hills with steep cliffs. (Photo taken at Eagle's Ridge along the Nipigon Recreational Trail [NRT]).

More rock than garden: the shallow ground can be challenging in the Illingworth's garden [IL]. (Photo taken at IL).

ii. Climate

Weather across Ontario is inconsistent from year to year. Every horticulturalist, gardener, and plants person I have conversed with during my visit has cited climate-based issues as the main challenge to gardening in Canada.

Norfolk County is not good for growing seeds, according to a staff member at a local seed store, William Dam Seeds. Frost kills off most plants before they have time to go to seed. Many crops and flowers, notably pumpkins, were maturing early during my visit. Plants have to endure extreme temperatures differences between summer and winter. Some years there are very wet periods, sudden cool spells, and variable storm activity. Droughts and flooding are progressively becoming serious issues in this region.

The Thunder Bay area also struggles with flooding and inconsistent weather patterns regarding temperatures and rainfall. Snowfall is variable, which can affect the amount of protection plants receive from vicious winter cold. The health of wildlife populations has also been noted for its

fluctuations in relation to changes in temperatures. Spring is considered short here, lasting approximately 6 weeks, according to plantsperson Robert Illingworth.

Many sites experience both drought and flooding on the same ground. Several contacts also noted changes in the direction of prevailing winds. The hardiness of plants encompasses a range of growing conditions far more complex than temperature alone.

iii. Pests and diseases

Ontario has many of the typical pests and diseases found in the UK, including mealybug and scale insects. Some of the worst offenders in Ontario are emerald ash borer, asian longhorn beetle (a significant threat to maple trees), the brown spruce longhorn beetle, forest tent caterpillar (a native pest), butternut canker (which has decimated the Ontario population of *Juglans cinerea* by up to 80%), Dutch elm disease, and the native eastern spruce budworm (affecting mainly balsam fir and white spruce) (Natural Resources Canada, 2018)
Recent threats include box blight (several cases found in Ontario) as noted by Toronto-based plantsperson Marion Jarvie, phytophthora (various strains), beech bark disease and beech leaf disease (found in 5 Ontario counties with all European and Japanese specimens affected) as noted by Kevin Kavanagh of South Coast Gardens, and hemlock adelgid (on approach to Ontario).

Several locations showed significant signs of mildew, damping off, and other signs of rot due to damp and stressful weather conditions.

Stress shoots on *Fraxinus americana* (White Ash) at Humber Arboretum [HA], attacked by Emerald Ash borer. (Photo taken at HA).

Black knot fungus on several specimens at High Falls [HF]. (Photo taken at HF).

iv. Land use and typical plantings

The agricultural plains of Norfolk County are most popularly employed for apple, ginseng, hops, and pumpkin production. Soy and corn are decreasing while cannabis cropping is rising, according to Darren Heimbecker of Whistling Gardens. Conservation areas of this region consist of woodland, wildflower meadows, and rejuvenation projects for woodlands, marshes, and other nature sanctuaries. Wildflower meadows and woodlands contain many types of Aster. Wildflower meadows and other ‘wild’ borders around farming grounds are abundant in Goldenrods (*Solidago* spp.). The most common shrubs are *Cornus* spp. and *Rhus typhina*. Maples dominate the rail trail edges, along with other native trees and shrubs, including *Sassafras*, *Quercus*, and *Betula*. Smatterings of clovers, *Centaurea*, and *Prunella vulgaris* populate the verges of many sites.

***Eupithecia miserulata* on the flower of *Cichorium intybus* (chicory) along the trail crossing between meadow and woodland. (Photo taken at Ontario's Royal Botanical Gardens [RBG]).**

The parasitic plant of beech, *Epifagus virginiana* (Photo taken at Backus Heritage Conservation Area [BH]).

Thunder Bay's agricultural land, much smaller than Norfolk County, supports more livestock cultivation alongside crops. Barley and hay are major products along with winter wheat, soy, and potatoes (Thunder Bay Federation of Agriculture, 2019). Coniferous woodlands are vast and form a significant component of each vista. *Rhus* and *Solidago* are not as prolific here. There are dense pockets of pines and other conifers, maples, and birches. Lychen lavishly adorns most sites, with many areas supporting a ground cover of thick, spongy lichen. Wildflowers are abundant and dense. A large amount of fungi and mosses occur frequently with asters and *Cornus canadensis* among the ground-covering plants that form healthy undergrowth. Conservation through provincial parks occupies a significant majority of the land surrounding the city.

Blue berries of *Maianthemum canadense* among *Cornus canadensis* and other ground cover, which occurs in both north and south Ontario. (Photo taken at NRT).

Occasional wildflowers like *Euphrasia* sp. (Eyebright) occasionally occurred in drier terrain among infestations of *Pilosella officinarum* at sites like Golden Eagle Canyon [GEC]. (Photo taken at GEC).

REVIEW OF SITES

i. Gardens overview

Pr = privately owned, CO = charitable organisation, G = garden/s BG = botanical garden/s, N = nursery, V = varied, W = wet, D = dry, C = clay, L = loam, S = sand, Org = organic matter, ft = full-time, pt = part-time, se = seasonal, vol/vols = volunteer/s, st/sts = student/s, art. = artificial

Site	**Whistling Gardens (WG)**	**Toronto Botanical Garden**	**Royal Botanical Gardens**	**South Coast Gardens**
Type of site	Pr, BG, N	CO, BG	CO, BG	Pr, G and N

Size	20 acres (BG)	4 acres (to expand by 30 acres)	≈300 acres (gardens) ≈2,400 acres (nature sanctuaries)	2 acres (G) 22 acres (nature reserve) 80 acres (further surroundings)
Soil	V pH. Distinct and mixed areas of W, D, S, C. High Org	pH ≈ 7 L, pockets of S, C.	V pH, some high Org, areas of C-L to C.	pH ≈ 6.5 – 6.8 Lighter than WG.
Water features	Artesian spring, small lakes, fountain display (art.)	Wilket Creek, chlorinated pond (art.), water capture swales and sunken floor (art.)	Corner of Lake Ontario, creeks, Rock Garden river (art.)	Ephemeral pond, small pond (art.)
Staffing (horticultural)	1 ft (owner), 1 se	2 ft, 2 se, + vols	25, + vols	1 pt (for N)
Sustainability	Recycled materials Wildflower areas 2 4-D (aim to reduce)	Urban tolerant plants 1st registered straw bale building in Toronto with green roof L.E.E.D. – rubble wall (see below)	Biological controls where possible Companion planting for soil health and for attracting pollinators Irrigation used in rock garden	Native and wild species. Wildlife research. Woodland restoration
Significant pest/disease/weed	Birch bore Needle cast Scale *Conyza canadensis*	Gypsy moth *Acer platanoides* *Cynanchum louiseae* / *C. rossicum*	Fall webworms Gypsy moth Deer *Phragmites australis* *Glyceria maxima*	Rabbits Emerald ash borer

Site	**Niagara Botanical Gardens**	**Illingworth's gardens**	**Humber Arboretum**
Type of site	self-financed agency of the Ontario Ministry of Tourism, Culture & Sport, BG	Pr, N (new expansion into succulent and cacti propagation)	Tri-partnership: Humber College, City of Toronto, Toronto and Region Conservation
Size	99 acres	Woodland and rock garden situated within 210 acre property	250 acres
Soil	pH ≈ 7.9 – 8 Limestone close to surface.	pH "likely acid" Volcanic rock, sometimes close to	Variable

		surface. C.	
Water features	Sir Adam Beck Hydroelectric Station Reservoir (art.), Niagara River	Seasonal stream River and gorge at bottom	Humber valley river, pond (art.)
Staffing	7 ft, 4 st (usually 6)	2 ft (owners)	4 ft, 1pt, sts
Sustainability	Chemical spray 3 times annually in Rose Garden. Copper sulphate is still in use but has been banned in UK for several years now. Pure sulphur twice annually	Irrigate with hose Own seed and cuttings Donated plants	Dam catches runoff No chemical use (b/c of sts) Environmentally sensitive area Manual method research (hand wicking no longer acceptable) Stormwater pond restoration Filtration burns
Significant pest/disease/weed	Deer Japanese beetles Pine beetles Bronze birch borer Emerald ash borer American chestnut blight	Emerald ash borer Bears	Asian longhorn beetle Emerald ash borer American chestnut blight Dutch elm disease Butternut canker

a. Whistling Gardens (WG)

Darren Heimbecker began the creation and development of WG from a corn field in 2007. The agricultural space has been succeeded by a botanical garden that includes a substantial peony collection, formal gardens, rock garden, conifer beds, herbaceous borders, and numerous structural features such as bridges, architectural elements, fountains, and an aviary. He cites influences such as the designs of Adrian Bloom, Capability Brown, and Belgian landscaping. Darren's specialism and interest in conifers is most apparent with approximately 1,100 specimens in the Conifer Garden (Whistling Gardens, 2019) including *Abies durangensis* var. *Coahuilensis* and the Baishan Fir, *Abies beshanzuensis*, with other notable trees such as *Ulmus* 'Jaqueline Hillier'.

***Juniperus chinensis* 'Whistling Gardens'. (Photo taken at WG).**

Darren uses a hedge of Hibiscus syriacus 'Marina' to provide late floral interest. (Photo taken at WG).

Aside from the substantial requirements to maintain such a collection, several challenges were noted. The main one is not simply that the climate does not allow particular plants to grow, but also that seasonal variation threatens existing plantings. While the cold of winter (reaching down to -20°C) may prove bearable, increasing late frosts into May create a freezing and thawing that can overwhelm plants, such as Jerusalem artichoke. *Kniphofia* can survive winter, depending on if snow sufficiently protects the crown. The intensity of seasonal conditions also poses problems.

View of the Conifer Beds. (Photo taken at WG).

***Sempervivum* 'Starshine', one of a collection that survive the winter. (Photo taken at WG).**

WG officially opened in 2012 and used to have an *Acer* collection. The coldest winters on record in 2013 and 2014 were severe enough to destroy the collection along with most *Cornus* spp., and many evergreen trees. Hedging cedar never recovered from severe winter wind burn. Excessive wet is poor for peonies, for example, and recent early summers have become unusually cool and damp, leading to fungal issues. Conversely, hot, dry summers create drought areas. Winter can arrive early with snow from mid-winter, limiting the time for plants to store up energy or go to seed.

Darren's approach is to try plants out, but realistically focus on plants that he knows can cope with a fluctuating climate. With minimal chemical use, due to reduce to zero over the next few years, WG supports a healthy soil with rich organic matter, and a good biodiversity profile with frogs, toads, snakes, mink, and numerous birds, insects, and other creatures.

View of the Rock Garden. (Photo taken at WG).

Common garden spider. (Photo taken at WG).

b. Toronto Botanical Garden (TBG)

I met with the Director of Horticulture, Paul Zammit, who started in 2009 at the garden, opened in 2006. This non-profit organisation collaborates with Toronto City Council, who manage the adjoining parkland, which is due to be taken under the care of TBG. The garden reflects Paul's passion for conserving native species, such as the threatened Kentucky coffeetree (Ontario

Government, 2019), and encouraging pollinators and sustainability with grasses, wildflowers, and interplantings of herbs. As Paul remarked, a single bur oak (*Quercus macrocarpa*) provides a feeding ground for more than 500 insect species. The garden includes parsley, goldenrods, *Sassafras*, *Trillium* spp., *Arecema* spp. and pawpaw, to name a few. The kitchen garden promotes plants with culinary uses that are simultaneously excellent food sources for a range of wildlife. When the car park was renovated, the debris had to remain on site and became a rubble wall, which was then planted into and made a feature. This was in accordance with the Leadership in Energy and Environmental Design (LEED) certified green building of Toronto.

The main challenges are financial and climate related. TBG is open to the public as wished by its original owners and thus has no entry free, instead raising funds from workshops, space rental, tours, Toronto City Council, tree dedications, and substantial contributions from the Garden Club. The owners (Milne House) and latter funding party restrict control over vision and development of the garden. Water management is the largest issue for the site; hence there are water capture and permeable surface solutions, intended to store up to 60, 000 litres. Weeds such as Dog strangling vine (*Cynanchum louiseae* / *C. rossicum*) and Norway maple (*Acer platanoides*) become more of a challenge due to the limited number of staff members.

Green roof of native plants to the left, a bank of English ivy for low maintenance ground cover and source of nectar in the foreground, *Acer* spp. and sculptures lead towards rest of gardens. (Photo taken at Toronto Botanical Gardens [TBG]).

Rubble wall planted up at the edge of the car park. (Photo taken at TBG).

As part of Paul's pursuit of native species and sustainable practice, he is keen to plant more conifers for their year-round interest and low maintenance demands. Other plants, such as *Cotoneaster* spp. have suffered in recent years due to changes in climate.

c. Royal Botanical Gardens (RBG)

After visiting several of their sites, I was fortunate enough to discuss a few queries with Jon L. Peter, the curator and manager of plant records for the RBG. The RBG covers an area of 2,700 acres. The first site was the Rock Garden, covering 7 acres, and initial construction beginning in late 1929. It was proposed as a solution to the eyesore of former gravel pits and involved the transportation of 10,000 tonnes of limestone from the Niagara Escarpment (Peter, 2018). The Rock Garden has gone through several renovations since this time. It deviated from its original 'true' alpine plantings by moving to 3 seasons of annual plantings. Recent years have progressed towards sustainable practices, with conscious decisions to select plants that are more drought-tolerant and good for pollinators. RBG also has an arboretum, a lilac garden, rose garden, and manages several nature sanctuaries including Cootes Paradise Marsh to the South, and Rock Chapel and part of the Escarpment to the North of the area. The majority of plants in the Rock

Garden seem more fitting with a woodland garden. The arboretum provided some impressive specimens, including the *Gleditsia triacanthos*, while also demonstrating the persistence of the foliar damage affecting *Aesculus*, where none of the young saplings stood unscathed.
As with other areas, RBG have suffered particularly in the past two years with flooding in areas where this was previously not an issue. This is due to high water levels in the Great Lakes. Seasonal cycles are not consistent from year to year. Two bad winters particularly affected the Rock Garden with extreme temperatures and fluctuations that killed off many marginally hardy plants. Staffing can be an issue where exhibitions mean less time is focused on the collections.

Winding pathways traverse down the original stone blocks, forming spectacular entry points to the rest of the rock garden (Photo taken at RBG).

***Lobelia siphilitica* at the edge of the woodland trail. Also present at BH. (Photo taken at RBG).**

Various methods of control are in place. Glyphosate was applied in some of the marshland to target *Phragmites australis* and *Glyceria maxima*. It used mainly on invasive plants in the 'natural' areas, usually ones that are toxic to humans, and some limited use within garden spaces when permitted. Numerous biological controls are used in the gardens. Volunteers control pests in the Rock Garden by hand-picking. Companion planting is used both for beneficial insects and to cultivate the soil (e.g. iron aids roses, which is released by *Allium* spp.). A new Master Plan and Strategic Plan are due to be released in 2020, but otherwise the aim of RBG is to "dedicate our expertise in horticulture, conservation, science and education to connect people, plants and place for the purpose of nurturing and preserving healthy growing life on our planet" (RBG, 2019).

Caterpillars of the Hickory tussock moth occurred at several sites in southern Ontario including RBG, BH, and multiple Toronto Conservation areas. Its numbers were noticeably higher this year (CBC/Radio-Canada, 2019). (Photo taken at RBG).

Many different kinds of berry grew at the edge of trails, some poisonous, and some edible like this wild grape. (Photo taken at RBG).

d. South Coast Gardens (SCG)

Kevin Kavanagh moved to the location of SCG in 2005, beginning with a bare field. His background in hardy plants is rooted in botany and ecology, rather than a horticultural approach. He worked in native conservation until about 12 years ago with organisations such as World Wildlife Fund (WWF) and Nature Conservancy Canada. His interest in South-eastern America inspires his collection of Carolinian species, perceiving that Lake Erie poses a physical barrier for many native species of the USA from reaching Canada. Plants are structurally employed to create discrete, enclosed spaces, connected by narrow winding trails with plans to extend these trails in the back section of the garden. He is keen to include more evergreen broadleaf specimens for winter interest and experiment with what plants can survive winter conditions.

North Carolinian high altitude *Rhododendron* sp., south of the Smoky Mountains. A remarkable forest fire charred everything except this single specimen. There is only one specimen in the wild. It has a reddish tinge but it is not from damage or disease. The cuttings hold it but Kevin does not think it is genetic, residing within the plant itself. (Photo taken at SCG).

Native Bottle gentian, pollinated by bees, which scramble into the flowers that stay closed. (Photo taken at SCG).

Wind is an additional factor in the challenge of climate conditions because winds have a 600km to roll and build across Lake Erie. Flooding is a newly developing problem for spring, which lasted for 6 weeks this year with 4 inches of sitting water. Water again is the emphasis for summer, with dry conditions posing more of a threat than the heat. Kevin spends time looking at local climate records to find patterns. He explained that there is a shift north in hardiness zones by 100-250km in recent years in North America. On a larger scale, the problem, Kevin elaborated, is the polar vortex and buckling of the jet stream where the differential in temperature is weakening. Plants leaf out sooner, but are subject to late frosts. It is bad for birds and could lead to collapse of migrant insectivores. It can mean loss of seed crop and dieback in spring. Whereas protection can be applied in a domestic garden, it is not practical on landscaped land.

SCG prioritises sustainability and conservation. Kevin has been testing the hardiness of plants such as *Parnassia palustris* (which used to need winter protection but no longer), *Cercis Canadensis* 'Ruby Falls' (gets hit to the snow line, but mounds back up), and *Lagerstroemia indica* (Crape myrtle, which others said would not survive in the area). The majority of the plants are either wild collected, donated, rare, or native, and weave together a canvas of exquisite specimens. Native *Senna* is swarmed in pollinators, tending to be more vigorous in the garden than in the wild. The *Stewartia pseudocamelia* produces beautiful bark to complement the dappled light of its sheltered corner. A small smattering of bottle gentians ornament the border of a small *Rhododendron* collection and each one of these has a story to offer. The *Rhododendron* 'Sandra Hilton', for example, is very hardy, named by David Hinton for his daughter who suffered a terminal illness and the original plant tolerated -35°C.

***Parnassia palustris* . (Photo taken at SCG).**

***Thamnophis sirtalis sirtalis*, common garter snake found near SCG. (Photo taken at Backus Heritage Conservation area [BH]).**

SCG is also a site for research. Kevin collaborates with others who document wildlife changes. This can vary from a group that monitors rare species of reptile, to student visits to carry out basic snake monitoring. Kevin has recorded at least 226 different species of birds in the garden (South Coast Gardens, 2019) with aims to expand into Lepidoptera observations as well as generally diversifying the garden to appeal to more pollinators. There is woodland restoration taking place with white, black, red, and dwarf oak. He is keen to propagate wild and rare material, especially if it is hard to source or find in distribution.

e. Niagara Botanical Gardens (NBG)

The garden started in 1936/1937 followed by a significant bulk planting in 1946 with 4 students, and further mass planting in the 1970s. There are now 6 students per year who attend the School of Horticulture offered by the NBG. I met with Darrell Bley who has taught at NBG for 24 years so far and holds an interest in straight species. The ground is escarpment stone (limestone). The glacier was scraped clean, leaving very little soil. Soil was brought in so that trees can be planted. As a result, the growth rate is better at WG because there is more soil and is richer in organic matter. There is an arboretum, a native grass and wildflower meadow, a sheltered (deer-protected) area for vulnerable plants (several *Rhododendron* spp.), a rock garden, as well as other collections of trees and more typical bed plantings such as the Rose Garden, an area that is sprayed with chemicals three times a year.

The rock garden contained many delicate plants still in flower, unfortunately not sufficiently labelled or familiar to me. (Photo taken at NBG).

***Ephedra minima* thrives on the rock garden at NBG but died at WG. Darren also pointed out many mature healthy tree specimens that would not grow so well at WG. (Photo taken at NBG).**

Unlike the inconsistency of winter conditions elsewhere, NBG benefits from a ‘medium’ snowfall each year. It is of a fluffy flake structure that creates a 1-2 inch blanket that protects many of the plants over winter. This forms as a result of the spray coming from the 11 acre reservoir, 0.5km from the garden. It is possibly this slightly more stable environment that enables the rock garden to cope better here than at WG.

***Achillea* sp. nestled among rocks, sheltered by conifers and small maple trees. (Photo taken at NBG).**

Deadly nightshade, located a good distance from the 'edibles' bed. (Photo taken at NBG).

With regard to the grasses, Darrell explained that 90% of prairie habitat has long gone from North America, replaced by farmland, which is where buffalo had formerly roamed. One of the aims for NBG is to re-establish windbreaks. Darrell expects this project to take the next 7-8 years to complete, and envisions a backdrop of different firs behind swathes of ground-covering junipers. He hopes to include *Abies firma* and *A. Fraseri* into the collection with *A. normandii* and *A. homolepis*.

Blue ash (*Fraxinus quadrangulata*) is 'threatened' in Ontario. This specimen is kept healthy and resilient with a serum injection to its base. (Photo taken at NBG).

One of my favourite specimens: *Cedrus libani* ssp. *atlantica* 'Pendula'. (Photo taken at NBG).

NBG suffers with pine beetles that bore into pine and spruce, and after 25 years, the population shows no sign of waning. There are not many of the *Pinus cembra* left at NBG. American chestnut is on the verge of extinction from blight and as a result there is a lot of work to find resistant seedlings. Darrell described how they combated a scale infestation with multitudes of wasps and yellowjackets that go for the honeydew and cleared up the problem in 3 years. They also determined that *Betula* imports are more vulnerable to bronze birch borer because they produce Rhododendrol for longer, which attracts the pest. Thus, NBG seeks to preserve its collection while researching how pests and diseases interact with these plants to discover successful prevention of plant loss. Some specimens at NBG are especially impressive, including their framework of trees that shelter the *Rhododendron* collection, their cutleaf *Rhus*, rare Carolinian American sweetgum (*Liquidambar styracifflua*), mature *Ginkgo biloboa*, and Yellowwood (*Cladrastis lutea*).

f. Illingworth's Gardens (IG)

Rob and Sharon moved to the site in the early 1970s. They saved the *Betula*, but they struggle here and they are not long-lived up to 40 years if grown from the previous stump. Most plants are grown from seed or cuttings. Unlike the relatively flat ground of Southern Ontario (i.e. WG, SCG, and NBG), their woodland and rock gardens occupy sloping ground that descends towards the river. Many of the alpines have not fared well here, but that can partly be due to the heavy clay soil rather than ensuring an appropriate medium of sand or grit. The majority of the rock garden is a clay bank with gravel on top. There was a healthy growth of *Campanula thyrsoides*, *Adonis vernalis*, *Penstemon*, *Dianthus*, Thyme, *Drabis, Douglasia*, *Dodceatheon frigidum*, *Gypsophila cerastioides,* and *Acantholimon*. Sharon has been trying *Eriogonum* for 3 years, and some seem to just about be coping.

Verbascum virgatum. **(Photo taken at IL).**

Lupinus lepidus **var.** ***lobbii*** **seeds around the garden. (Photo taken at IL).**

As Rob summarised, the rock garden is more rock than garden. The rock is very close to the surface and it is the same very hard, old, volcanic rock as found at Sleeping Giant Provincial Park. Thus, the garden requires careful maintenance or it would be lost to the woodland. Irrigation is required as water drains easily and the stream is not always present. There are *Rhododendron* spp. and *Azalea* spp., but most broadleaf evergreens are not hardy enough. Similarly, only silver and columbine saxifrage seem to cope with harsh winters. Storms have taken out several trees.

Lichen-covered ground near the gorge where strong winds have taken down trees. (Photo taken at IL).

The Rock Garden is situated within the woodland. If it was not carefully maintained, the woodland would reclaim it. (Photo taken at IL).

As with Southern Ontario, weather is inconsistent. IG did not reach 30°C this summer, but previously reached 39°C another year. Frosts can begin in the first week of September in Neebing but had not occurred yet this year (end of September). Beans have frozen in the lowland before the end of August before now. The first frosts only arrived in October last year. Snow levels can also fluctuate dramatically and thus plants may not get the shelter they normally require. Rob added

that the generally warmer summers are casing moose to suffer as they do not eat as much in the heat, leaving them without enough strength to survive the winter. Wood ticks have been increasing in the last 10 years, and deer ticks have arrived in the last few years.
Amid an assortment of rare and international specimens, I particularly like the Japanese catalpa, offering a later seasonal interest and the Russian conifer, *Microbiota decussata*, whose foliage turns brown/purple when cold in autumn. Rob and Sharon agreed that their biggest challenge, partly due to the climate, is to be more selective so that their collection remains manageable between the two of them.

***Microbiota decussata* used as a dramatic cover for a bank, offering a complex tonal range of light and shadows amid its finger-like branches. (Photo taken at IL).**

***Betula papyrifer* with mature silvery peeling bark. Birch struggle in the garden. (Photo taken at IL).**

g. Humber Arboretum (HA)

I met with Lynn Short to tell me more about the site. Lynn is working as part time faculty at Humber College, and part time at the Aboriginal Resource Centre, with an interest in invasive plant control and managing a project on manually controlling *Phragmites australis* subsp. *australis*. Humber Arboretum consists of ornamental gardens, including a formal arboretum, and surrounding woodland and 'natural' areas in collaboration with Humber College, which teaches and researches horticulture. It was created in 1977 in conjunction with the Humber Valley, managed by the tri-partnership of Humber College, City of Toronto, Toronto and Region Conservation. This claim on the valley land occurred after a severe hurricane in 1954 that washed out farms, homes, bridges, and drowned 80 people. The land became public and deemed unsuitable for habitation and farming. The gardens are planted and maintained by students, who can work there in summer.

***Catalpa speciosa* at the edge of the Arboretum, next to college buildings. Interpretation boards demark areas of the garden. (Photo taken at HA).**

Outdoor classroom in the woodland. (Photo taken at HA).

Flooding has increased in frequency. The bridge at Black Creek had to be redesigned because what was formerly named the 100 year flood is happening more often. A recent flood caused devastation to basements and sewers across the region. 60% of the tree canopy was chestnut, but has been wiped out by blight. Storm water pond restoration has been significant for collecting run-off from the college. There are also filtration burns.

HA have observed changes in their bird inventory and adapt seed mixes to support diversity in pollinators. The positive thing about the Asian longhorn beetle is that it cannot fly, so the control is to cut down trees with a 1km radius. It could threaten the maple industry without adequate control. The non-native species of *Juglans* have a bit more resistance to butternut canker than native species, but seed is not necessarily resistant. HA are grafting cuttings to black walnut (*Juglans nigra*), and there is more research to be done. The Clairville dam is used to prevent sea lamprey coming upstream to spawn, but opened at select times to allow passage for salmon. Chemicals are not used due to the presence of students. The pesticide rules changed recently so that hand wicking is now not an acceptable practice. There is currently applied research funding to investigate appropriate manual methods with testing plots for different strategies. The School is keen to give practical experience to students in addition to coursework.

From the top of the Arboretum, looking down towards wildflower meadows; the valley and river lie beyond. (Photo taken at HA).

In addition to conducting research, students maintain event spaces and ornamental schemes within the garden. Native species are mixed in with other plantings. (Photo taken at HA).

ii. Conservation sites by habitat

Before discussing trends of the various sites traversed, I have included a brief tabular overview to indicate prominent flora and fauna that I encountered there. I have grouped them firstly by region, and then by habitat through which to compare. I have attempted to confirm my identifications through online resources, including iNaturalist, Tree Canada, Ontario Wildflowers, and Pl@ntNet.

Conservation sites in Southern Ontario		
Habitat	**Wildlife Presence**	**Notable Specimens**
Marsh: RBG and Long Point (LP)	Grasshoppers (including *Melanoplus bivittatus*) Butterflies (monarchs and commas) Caterpillars (of hickory tussock moth and eupithecia moth) Birds (turkey vultures, wood ducks, flickers, and nuthatch)	Bashful bulrush *Phragmites australis* *Monarda fistulosa Iris pseudacorus* *Larix laricina*, *Populus tremuloides*, *Betula papyrifera*,

Woodland: RBG and Escarpment (ESC), Turkey Point (TP), Backus Heritage (BH), and Toronto Conservation areas (TC)	Grasshoppers (including *Melanoplus bivittatus*) Butterflies (monarchs, swallowtails, sulphurs) Caterpillars (of hickory tussock moth) Birds (turkey vultures, merlin, wood pecker) Snakes (garter) Other insects: praying mantis, cicada, bush katydid, mosquitoes Whitetail deer	Jewelweed, *Mitchella repens*, *Medeola virgiana*, *Toxicodendron radicans*, *Hepatica nobilis* var. *acuta*, *Epifagus virginiana*, *Phegopteris hexagonoptera*, *Cornus* spp., *Sassafras*, *Rhus typhina*, *Malus*, *Quercus* spp., *Pinus strobes*, *Berberis thunbergii*, *Carya* spp., *Prunus serotina*., *Fagus* spp., *Fraxinus profunda*.
Conservation sites in North-western Ontario		
Habitat	**Notable specimens**	
Lake Superior Coast: Sleeping Giant Provincial Park (SGP), Nipigon River Recreational Trail (NRT), Finger Point (FP), Little Trout Bay (LTB), and Mountain Mink Trail (MMT)	*Parnassia palustris*, *Prunella vulgaris*, yellow jewelweed, *Maianthemum canadense*, *Cornus canadensis*, *Vaccinium angustifoium*, *Monotropa uniflora, Clintonia borealis* *Cornus* spp., *Larix laricina*, *Physocarpus*, *Tsuga*, *Betula papyrifera*, American green alder, *Sorbus americana*, *Abies balsamea*, *Crataegus monogyna*, *Rosa acicularis*, *Aralia spinosa*	
Waterfalls: High Falls (HF), Silver Falls (SF) and Kakabeka Falls (SF)	Eyebright, *Lotus corniculatus*, *Corydalis flavula* American green alder, *Sorbus americana*, *Salix*, *Corylus cornuta*,	
Canyons: Golden Eagle Canyon (GEC) and Ouimet Canyon (OC)	Eyebright*, Clintonia borealis*, *Lotus corniculatus* American green alder, *Rosa acicularis*, *Viburnum opulus*,	
Woodland: Thunder Bay Centennial Park (TB)	*Echinacea purpurea, Aralia nudicaulis, Equisetum sylvaticum* *Rhus typhina*, *Prunus serotina*, *Sorbus americana*	

The most noticeable difference between South and North-western Ontario is the presence of wildlife. This is likely the result of seasonal difference. Temperatures at the warmest time of day in the South began overcast with 19°C, rose to highs of 29°C, with 27°C at the end of the third week. The North-west began with its highest of 20°C, and descending to lows of 14°C with mornings feeling noticeably colder. Autumn had set in and thus wildlife was quietening down, especially insects. The only exception to this was along the Lake Superior coast, where I observed chipmunks, grasshoppers (including *Melanoplus bruneri*), moths (including *Lambdina fervidaria*), birds (including barred owl, woodpecker), foxes, and whitetail deer.

***Melanoplus bivittatus* near wildflower scrubland. (Photo taken at ESC).**

Barred owl (Photo taken at MMT).

As one might expect of Canada, the most dominant genus for both regions was *Acer.* The second largest group of plants common to both were the asters. Their blooms persisted throughout the month and dominated edges of trails rather than occurring deeper into wilder terrain. They also seemed restricted in areas of less fertile land, i.e. along the River Kaministiquia that leads to Silver Falls where rocks form the majority of the surface with dense underlying substrates. These shallow grounds also proved ideal for plantains and the creeping stems of various brambles, climbers, and wild sarsaparilla (*Aralia nudicaulis*), and the smaller beauties, including *Prunella vulgaris*.
While staying in the North-western region, moving between the north of the Thunder Bay area and the south of Thunder Bay showed a remarkable difference in the proportion of Fall colours. Flora across the region remained consistent in accordance with habitat types.

Common parasitic plant, *Monotropa uniflora*, known as Indian pipe. (Photo taken at SGP).

Typical clump of coral fungus in north-western Ontario (Photo taken at SGP).

The moisture in the air in the region of Thunder Bay was immediately apparent on each day of exploration. Visually, the diversity of ground cover expanded to include vast numbers of fungi, mosses, clubmosses, and lichen that had not been present in Southern Ontario. The majority of fungi in the south had been the occasional brittle-gill mushrooms. SGP in the North-west presented scores of clubmosses, multi-layered beds of lichen, and coral and lobster fungi as well as brittle-gills and other disc-like varieties, with colours altering according to the trees that they grew upon. From woodland, to coast, to canyons, there were coral fungi to be found.

Typical ‘prairie’ wildflowers of the South that did not appear to extend northwards were the goldenrods that dominated the Norfolk County and Toronto meadow lands and plants such as *Echinacea purpurea*, the purple coneflower.

***Bidens* sp. at edge of woodland trail. (Photo taken at RBG).**

***Solidago* sp. borders the woodland and thrives in the meadows. (Photo taken at BH).**

iii. Importance of trails and conservation

Plant diversity in conservation areas similarly requires conscientious working. Elaine Toombs, a PhD student researching First Nations mental health and resilience in Thunder Bay, led me to discover the importance of trails. As we hiked in SGP, Elaine described First Nations peoples as the original stewards of the forest. The trail networks involve trampling the ground, cutting back obscuring branches, and keeping a narrow open space from ground level. This space enables wildflowers to flourish without becoming overwhelmed by taller undisturbed ground covering plants. Although animal tracks enable a similar effect, and a lot of these trails may be following animal pathways, it is the continued traversal of them that maintains the diversity of this marginal habitat.

The conservation areas of the Toronto area preserve trees such as *Prunus serotina*. (Photo taken at TC).

The underlying rock layers contribute to the production of delicate habitats. (Photo taken at TC).

Establishing routes also means that there are areas that can be retained as undisturbed land. Trails facilitate a monitoring of habitat health that evaluates plant abundance and wildlife presence. From here, unique areas can be detected and protected for vulnerable species.
Woodland restoration is a major project within these conservation areas, as well as in other sites such as SCG. GEC plants and replaces many red, black, jack, and white pine on their site for example. In Southern Ontario, several projects are aiming to replenish mature woodland. The Rock Chapel site and escarpment (ESC) at RBG demonstrate systematic successional forest planting, using the various stages as an educational resource, especially with the population of endangered *Morus rubra* (Red Mulberry) to be found there. HA have environmentally sensitive areas cordoned off, and RBG similarly have restricted areas of wildlife sanctuaries to minimalise foot traffic and

habitat disturbance. Gardens like WG, TBG, SCG and NBG use their gardens as educational resources for research and to teach the public and students about the necessity of conservation.

Different stages of woodland restoration can be observed and traversed at the escarpment. (Photo taken at ESC).

The dry heat of summer is evident in the baked dust of the ground. In some areas there were mosses growing on cracked ground, suggesting extremes of wet and dry. (Photo taken at ESC).

CONCLUSIONS

The theme that been most prominent in this trip is climate struggle: finding ways to work with and adapt to the climate. The challenges it poses are numerous, from the extremes of seasons, to inconsistent weather patterns, high water table, shallow ground, and other impediments that limit plant selection and healthy growth.

During my time at WG, one of my main jobs was cutting back the peonies. So much of the foliage suffered from various fungal infections, rotting turning black, and generally coming to an abrupt end. This was similar to the early ripening of crops, such as pumpkin where the stress of weather was inducing a premature move towards fruiting and dormancy. While some plants were proving reasonably successful as hardy and sustainable plantings, many plants newly introduced to the garden would be considered ‘experiments’, subject to the whims of consistent weather to test their endurance.

I spoke with Marion Jarvie, a renowned plantsperson based near Toronto with over 40 years of experience, about the growing of alpines in Ontario. Marion explained that they were better off in regions situated at a higher altitude, such as gardens in Calgary, but even these places were changing now.

Paul Zammit’s move at TBG towards drought-tolerant plants is at least partially in recognition of the general challenge that a fluctuating environment presents. He noted the poor growth of *Cotoneaster* spp., which I also noticed with one specimen at WG with sparse visible new growth to speak of.

At NBG, Darren (from WG) discussed with Darrell the challenges faced by conifers with regards to insect pests and fungal and bacterial infections. The increase in insect populations has been noted by several plantspeople for its impact on both cultivated and wild lands. They speculated about the warmer summers that have enabled some wildlife to populate areas progressively northwards. Similarly, milder winters to the west mean that insect populations are not as effectively reduced, resulting in the devastations of woodlands by engorged swarms.

Cardinals nest and forage in trees at the edge of the gardens. (Photo taken at WG).

Bald-faced hornet. (Photo taken at SCG).

Lynn at HA affirms that the abundance of ticks have substantially increased, adding that 10 years ago they were never talked about because the winters were too cold. Kevin at SCG concurs with the destabilising effect of changes in climate with regards to wildlife shifts. He informed me of moose found in the north of Ontario completely covered in ticks. Moose are also suffering directly from changes in temperatures. The hotter summers cause the moose to refrain from eating sufficiently and thus die in the winter from a lack of energy stores against the harsher coldness.

Many of the gardens demonstrate a proactive attitude to responding to these climate challenges. Their methods of sustainable practice vary, but centre upon plant choices and effective water management. All of the gardens include pollinator-friendly plants and areas of native species and wildflowers. TBG particularly reduces the need for additional resources by choosing drought-tolerant plants and by capturing water. NBG makes use of the nearby reservoir for water, whereas RBG requires partial irrigation. Changes to the management plan for the rock garden at RBG indicate vast improvements nonetheless, regarding its sustainability. There is evident reluctance to cease using chemical controls, but a consensus in the need to move away from such products. Research conducted at RBG,SCG, NBG, and HA affirms the necessity of working with the environment and gardens from an ecological perspective, in that a sustainable equilibrium must work in harmony with and encourage wildlife diversity.

The high water table means flat ground can quickly flood. (Photo taken at WG)

The Current River that bounds Thunder Bay Centennial Park is shallow, but a flood management plan prevents floods through dams and reservoirs. (Photo taken at TB).

Learning of the significance of water management in Southern Ontario led me to explore the extent of this in Thunder Bay. I made contact with Julia Prinselaar at EcoSuperior, a non-profit green

community organisation. One of their intiatives works with homeowners to create storm water detention ponds, and rainwater gardens. Their work is vital due to water damage that occurs in the region. The project began after rainfall 7 years ago that caused sewage to overwhelm the water treatment plant. This scheme looks at where water should be saved, where to move water, and sourcing low impact sites for contaminated water as well as recommending suitable native plants for residents' gardens.

Jon (RBG) summarised to me what others throughout the trip have expressed: phenology patterns are off-track. Darren's network of contacts at other gardens of horticultural excellence not only facilitated an enriched experience for myself, but evidenced the vital work of collaboration and knowledge exchange. Horticulture in Ontario is not vast. Those I connected with spoke of the decline in garden centres and the closure of nurseries both provincially and nationally. These few gardens are thus precious and truly remarkable. The recognised need for conservation and ecological awareness in maintaining a healthy biodiversity has become a principal guiding factor in garden direction and progression.

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APPENDIX

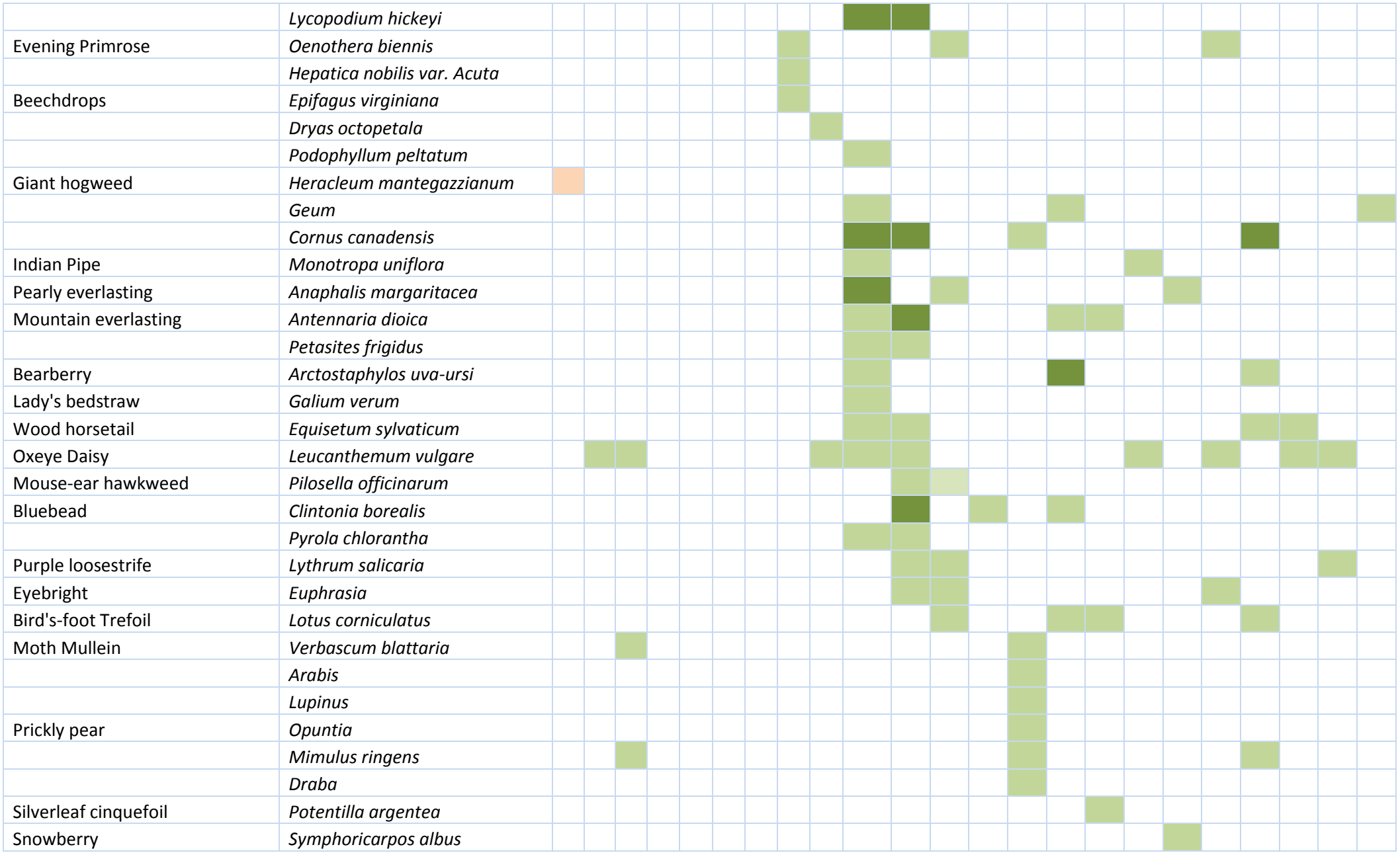
Below is an approximate tabular summary of plants identified at each site visited, where orange indicates plants noted as problematic. Locations correspond as follows:

1 = WG 2 = TBG 3 = RBG 4 = ESC 5 = TP 6 = SCG 7 = LP 8 = BH 9 = NBG 10 = SGP 11 = NRT 12 = GEC
13 = OC 14 = IL 15 = FP 16 = HF 17 = LTB 18 = MMT 19 = SF 20 = KF 21 = TB 22 = TC 23 = HA

		Location																						
Common Name	**Botanical name**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Canadian goldenrod	*Solidago canadensis*																							
Blue-stemmed goldenrod	*Solidago caesia*																							
Dog strangling vine	*Cynanchum rossicum & C. louiseae*																							
Fleabane	*Erigeron*																							
Daisy fleabane	*Erigeron strigosus*																							
Pokeweed	*Phytolacca americana*																							
Burnet	*Sanguisorba*																							
Purple coneflower	*Echinacea purpurea*																							
Yellow flag (invasive)	*Iris pseudacorus*																							
Dwarf lake iris (native)	*Iris lacustris*																							
	Trillium																							
Foamflower	*Tiarella*																							
	Lobelia cardinalis																							
	Lobelia siphilitica																							
Wild bergamot	*Monarda fistulosa*																							
Coral bells	*Heuchera*																							
Joe Pye weed	*Eutrochium maculatum*																							
Grass-of-Parnassus	*Parnassia palustris*																							
	Rudbeckia																							
Aster (unknown)																								
Smooth blue aster	*Symphyotrichum laeve*																							
Swamp aster	*Symphyotrichum puniceum*																							

Late purple aster	*Symphyotrichum patens*																							
Arrow-leaved aster	*Symphyotrichum urophyllum*																							
Calico aster	*Symphyotrichum lateriflorum*																							
Large-leaved aster	*Eurybia macrophylla*																							
Flat-topped white aster	*Doellingeria umbellata*																							
New England aster	*Symphyotrichum novae-angliae*																							
Panicled aster	*Symphyotrichum lanceolatum*																							
Heath aster	*Symphyotrichum ericoides*																							
Heart-leaved aster	*Symphyotrichum cordifolium*																							
Riverbank grape	*Vitis riparia*																							
Garlic mustard	*Alliaria petiolata*																							
Harebell	*Campanula rotundifolia*																							
White/Yellow sweetclover	*Melilotus albus/officinalis*																							
Christmas fern	*Polystichum acrostichoides*																							
Sensitive fern	*Onoclea sensibilis*																							
Rusty woodsia (fern)	*Woodsia ilvensis*																							
Tatarian honeysuckle	*Lonicera tatarica*																							
American jumpseed	*Persicaria virginiana*																							
Clearweed	*Pilea pumila*																							
White Baneberry	*Actaea pachypoda*																							
Red Baneberry	*Actaea rubra*																							
Great Blue Lobelia	*Lobelia siphilitica*																							
Bramble (various)																								
Raspberry	*Rubus odoratus*																							
Wild carrot	*Daucus carota*																							
Chicory	*Cichorium intybus*																							
Knapweed/Brown Knapweed	*Centaurea/ C. jacea*																							
Milkweed	*Asclepias syriaca*																							
Burdock	*Arctium* spp.																							
Selfheal	*Prunella vulgaris*																							
	Bidens																							

Sweet wormwood	*Artemisia annua*	
	Artemisia campestris	
Teasel	*Dipsacus*	
Yellow jewelweed	*Impatiens pallida*	
Orange/common jewelweed	*Impatiens capensis*	
Hedge parsley	*Torilis arvensis*	
	Asarum canadense	
Partridgeberry	*Mitchella repens*	
Wild sarsaparilla	*Aralia nudicaulis*	
Canada mayflower	*Maianthemum canadense*	
Greater plantain	*Plantago major*	
Nipplewort	*Lapsana communis*	
Fireweed	*Erechtites hieraciifolius*	
Ragweed	*Ambrosia artemisiifolia*	
Indian cucumber root	*Medeola virgiana*	
Poison ivy	*Toxicodendron radicans*	
Elder	*Sambucus*	
Woodsorrel	*Oxalis & O. corniculata*	
Meadow-rue	*Thalictrum*	
Soapwort	*Saponaria officinalis*	
	Lespedeza capitata	
Nodding spurge	*Euphorbia nutans*	
	Scandix pecten-veneris	
Bottle gentian	*Gentiana andrewsii*	
Cup plant	*Silphium perfoliatum*	
	Phragmites australis	
Bloodroot	*Sanguinaria canadensis*	
	Viola triloba	
Clubmoss		
Shining clubmoss	*Huperzia lucidula*	
	Lycopodium obscurum	


Lycopodium hickeyi
Evening Primrose
Oenothera biennis
Hepatica nobilis var. Acuta
Beechdrops
Epifagus virginiana
Dryas octopetala
Podophyllum peltatum
Giant hogweed
Heracleum mantegazzianum
Geum
Cornus canadensis
Indian Pipe
Monotropa uniflora
Pearly everlasting
Anaphalis margaritacea
Mountain everlasting
Antennaria dioica
Petasites frigidus
Bearberry
Arctostaphylos uva-ursi
Lady's bedstraw
Galium verum
Wood horsetail
Equisetum sylvaticum
Oxeye Daisy
Leucanthemum vulgare
Mouse-ear hawkweed
Pilosella officinarum
Bluebead
Clintonia borealis
Pyrola chlorantha
Purple loosestrife
Lythrum salicaria
Eyebright
Euphrasia
Bird's-foot Trefoil
Lotus corniculatus
Moth Mullein
Verbascum blattaria
Arabis
Lupinus
Prickly pear
Opuntia
Mimulus ringens
Draba
Silverleaf cinquefoil
Potentilla argentea
Snowberry
Symphoricarpos albus

Meadow salsify	*Tragopogon pratensis*																							
White campion	*Silene latifolia*																							
Lowbush blueberry	*Vaccinium angustifolium*																							
	Anemone virginiana																							
	Corydalis flavula																							
	Dicentra																							
Broad beech fern	*Phegopteris hexagonoptera*																							
	Liatris spicata																							
Devil's Trumpet	*Datura metel*																							
Aizoon Stonecrop	*Phedimus aizoon*																							
Bashful bulrush	*Trichophorum planifolium*																							
Yellow fairybells	*Prosartes lanuginosa*																							
Drooping sedge	*Carex prasina*																							
Panicled Ticktrefoil	*Desmodium paniculatum*																							