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THE NATIVE ORCHID CONFERENCE JOURNAL

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Message from the President:

By now you will have heard the unfortunate news that the Board of the Native Orchid Conference decided to cancel this year's Symposium planned for June 25-29, 2020. The health and safety of everyone involved was our most important consideration, and we simply do not know what the situation will be two and a half months from now. That uncertainty, combined with unknowns like travel, accommodations, park closures, revised work schedules, potential personal financial issues, and perhaps revised personal priorities led us to the only prudent (albeit regrettable) decision. We hope that by making this decision early we reduce uncertainty about our plans and hopefully provide sufficient notice for everyone to cancel their travel plans. The good news is that we plan to hold the 2021 Symposium in the same place (Port Angeles, WA). Please save the dates of June 24-28, for the 2021 Symposium.

This issue of the Journal contains papers grouped around the theme of the 2019 Symposium in the Bruce Peninsula. Inside you will first find three comprehensive articles by Paul Catling and Brenda Kostiuk on the orchids of the Bruce Peninsula, based on decades of visits and research in the area. Next is a series of three field trip 'reports' from the 2019 Symposium by Rick Burian, Cathy Bloome, and Tom Sampliner. Following those articles is Tom's second contribution of the issue: the vast numbers, and enormous floral variation observed in *Cypripedium parviflorum* at the Symposium (and elsewhere) led him to pose some interesting questions on their nomenclature. Finally, this issue concludes with a second contribution by Rick Burian in the form of a 'teaser' article for the next Symposium: native orchids of Pacific Northwest, namely Mt. Hood, Oregon.

We hope you will find this issue a welcome diversion to the onslaught of difficult news of the Covid-19 pandemic. We will get through these difficult times, and the orchids will be waiting for us to come visit them. Stay safe everyone.

Ben Rostron
Edmonton, Alberta,
April, 2020.

ORCHIDS OF THE BRUCE PENINSULA

Part I: Introduction, history of study and a current checklist

Text by Paul M. Catling, Brenda.kostiuk@gmail.com

THE "BRUCE"

The Bruce Peninsula, as frequently defined (Bruce-Grey Plant Committee 1997), is 96 km long and approximately 30 km wide. It includes four ecodistricts: 6E-4 (most of the base), 6E-14 (the upper half often called the "Tobermory Ecodistrict"), and parts of 6E-2 and 6E-5 at the base (Wester et al. 2018, p. 377). Although the entire shorelines are of great biological interest with alvars, fens and dunes, particularly on the western (Lake Huron) shore, and limestone cliffs and talus on the eastern (Georgian Bay) shore, the Tobermory ecodistrict is the most wild. Here the landscape is dominated by coniferous and mixed forest on shallow soil over limestone. Unlike the other ecodistricts, this very distinctive one is limited to the Bruce Peninsula. The western shore rises very gradually while limestone cliffs on the eastern shore reach 172 m. The highest elevation is 283 m at Gillies Lake.

IMPORTANCE OF THE ORCHID FLORA

Orchids have long been part of the Bruce tourism brand and are ranked highly (ahead of the Bruce Trail and the Wiarton Willie statue) as a travel attraction by travel agents (e.g. Clark et al. 2007). Every year (for about 15 years now) there is an Orchid Festival hosted by "Friends of the Bruce District Parks Association" in partnership with Parks Canada, but this is actually a small part of the visitation by naturalists with wild orchids on their agenda. The 2019 Native Orchid Conference Symposium not only brought visitors from around the world, but this weekend event alone brought approximately $100,000 in off-season income to Bruce County businesses (personal observation). Some still remember a time 50 years ago when most of the cottages at Red Bay and hotels in Wiarton were rented by members of the Federation of Ontario Naturalists for viewing the orchids at Sauble Beach and Oliphant. Economic value of wild orchids to the Bruce is not new, but it has grown. Over the years the wild orchids have undoubtedly brought millions of dollars to the Bruce.

It is to be noted that this interest also contributed to protection long before Bruce Peninsula National Park existed. The Federation and some private landowners (including the well-known photographer, Dr. D.R. Gunn) purchased and protected orchid habitats at a number of sites, including Red Bay and Dorcas Bay. Some of these later became part of the park, or were taken over by other protective agencies and some are still in the hands of the original orchid enthusiasts. Others have been recently protected by the Nature Conservancy of Canada. Not just the money spent on recreation, but also these persistent conservation efforts illustrate the value of the natural experience of wild orchids on the Bruce.

It would be a mistake to value orchids so highly just because of popularity. They have also proven to be one of the most informative groups of organisms with regard to science and research related to evolution. "Orchids should be studied more because they epitomize evolution in its most dynamic aspect, the rapid production of an incredibly diverse array of species. The challenge is to understand how this has come about, and so intensive study of this largest angiosperm family is highly appropriate" (Chase et al. 2003).

HISTORY OF STUDY

One of the earliest floristic studies of the Bruce Peninsula region was that of Gibson and Macoun in 1875, called "The plants of the eastern coast of Lake Huron." Many botanists subsequently made reference to the unusual plant occurrences on the Bruce Peninsula including disjunctions and Great Lakes endemics (e.g. Fernald 1925, Klugh 1912, 1913). In fact some of the most influential North American botanists visited and/or wrote about the Bruce flora in the 1930s. They included M.L. Fernald of Harvard University (1935), G.L. Stebbins of the University of California (1935), V.C. Wynne-Edwards of McGill and Aberdeen Universities (1937) and Fr. Marie Victorin of the Montreal Botanical Garden (and its founder, 1938). More recent references to the unusual flora include those of Guire and Voss (1963), Marquis and Voss (1981) and Given and Soper (1981).

One of the earlier detailed references to orchids on the Bruce Peninsula is that of Morris and Eames (1929, e.g. p. 104 – *Platanthera unalascensis (as Piperia unalascensis),* and p. 202 *Listera convallariodes*). Frank Morris (writer) and Edward Eames (photographer) and their wives Elma and Belle (who accompanied them everywhere and should have been co-authors) made a 464 page book with field photos of all species of orchids in the Gray's Manual range. This book contained a vast amount of scientific and ecological information and was a remarkable accomplishment. Legendary Harvard orchidologist Oakes Ames praised them for "stimulating a keen interest." The foursome visited the Bruce to photograph one of its orchid specialties, the Alaska Rein Orchid (*Platanthera unalascensis*), which they found in June 1925 on the fishing islands and along the shore at Oliphant. Morris described a fetid odor of the flower only detectable within an inch or two. This species (Figure 1) has a very restricted distribution in eastern North America and the Bruce was one of the few places where they could find it. For more early information on the Alaska Rein Orchid on the Bruce, see Chapter 13 in "The Bruce Beckons" by W. Sherwood Fox (1952). In their text about the orchid, Morris and Eames provided a description of the rich natural garden in the area: "gay with flowers - Blue Bells, Orange Lilies, Painted Cups, Golden Ragworts, Puccoons, Lobelias, Pogonias, Calopogons, Narrow-leaved Sundews, Fringed Houstonias and Butterworts."

The first authoritative and extensive annotated list of the vascular plants of the Bruce Peninsula was that of P.V. Krotkov (1940). He spent four summers on the Bruce (1933-36) with bases at Tobermory, Stokes Bay, Lion's Head and Dyer's Bay. Other work such as Morton and Venn (1987) and the Federation of Ontario Naturalists' checklist with Thomson's (1970) notes added to Krotkov's work.

During the middle and late 20th century several major books made information on orchids of eastern North America widely available (Correll 1950, Fernald 1950, Luer 1975). For the Great Lakes region, Frederick Case's (1964, 1987) classic book, "Orchids of the Western Great Lakes Region" had by far the most influence. It was in 1986 that "Orchids of Ontario" by Whiting and Catling became available.

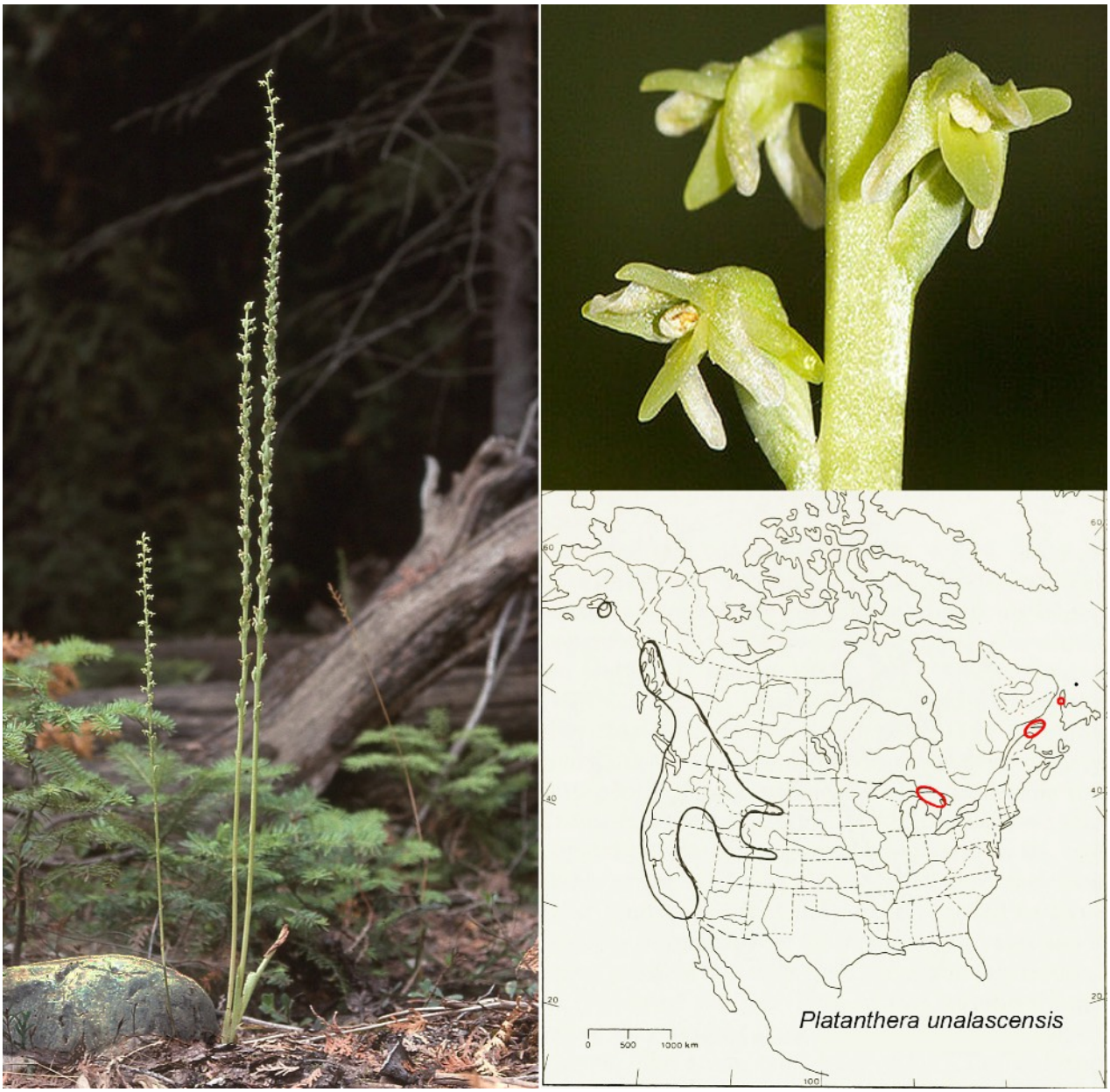


Figure 1. Alaska Rein Orchid (*Platanthera unalascensis*). Left, three stems on the Bruce Peninsula, photo by Dr. D.R. Gunn on 18 July 1978. Upper right, part of an inflorescence, Glacier Park, Montana, photo by Bill Bouton, 19 July 2011. CC-BY-SA-2.0. Lower right, Distribution in North America. The eastern disjunctions are outlined in red including the most recent discovery in western Newfoundland (Maunder 2008).

The first book specifically about the orchids of the Bruce Peninsula was published by the Bruce-Grey Plant Committee of the Owen Sound Field Naturalists in 1997. This very interesting, accurate, and informative work had enlisted the help of many of the most knowledgeable botanists of the time and included the excellent photos of D.R. Gunn. Naturally it became very popular.

Additional and updated information on Bruce Peninsula orchids is available in the recent book, "The vascular plants of the Bruce Peninsula, Ontario" (Johnson 2016, and see reviews - Oldham 2018 and Reznicek 2017). This is the second detailed flora of the Bruce, produced 76 years after the first by Krotkov in 1940. Johnson spent 45 years on the Bruce and was a very careful observer. His work is a major comprehensive update listing 1,380 species (compared to 858 listed by Krotkov in 1940). Johnson wrote about habitats and distributions in detail and he clearly had a very good understanding of plant ecology. His comments on orchids are very helpful.

With time the number of orchids (species and varieties) that had been found on the Bruce increased. Krotkov (1940) had 28, the Bruce-Grey Plant Committee (1997) and Johnson (2016) had 48, and the present list (Table 1) has 50.

STILL MORE TO LEARN

Despite authoritative work many questions remain concerning the classification, evolution, ecology, and management of Bruce Peninsula orchids. An example is provided by *Corallorhiza maculata*. Freudenstein's work on this group, distinguishing two varieties (in North America), was completed in 1987 and 1997 and summarized by Magrath and Freudenstein in 2003. Johnson knew that two varieties were present but was not able to record much about their status and ecology. The relationships of the colour forms to the varietal designations requires more study, but both varieties appear to have all four colour variants on the Bruce Peninsula. Heshka's (2006) article concerning identification and status of these varieties is a helpful reference. They may be separated as follows:

1a. Central lobe of lip expanded (dilated), the ratio of the dilated part to the middle lobe more than 1.5; floral bracts averaging 1-2.8 mm … *Corallorhiza maculata* var. *occidentalis*

1b. Central lobe of lip not or little expanded, the ratio of the dilated part to the base of the middle lobe less than 1.5; floral bracts averaging 0.5-1 mm … *Corallorhiza maculata* var. *maculata*

Another of the interesting questions involves var. *makasin* and var. *pubescens* of *Cypripedium parviflorum*. On the Bruce, the former comprises only 2% of the Yellow Lady's-slippers, the latter 95% and intermediates are said to make up 3% (Johnson 2016). The more recent character of the smooth (glabrous) uppermost entirely tubular (non-leafy) bract (at the base of the plant) of var. *makasin* versus the densely silvery pubescent uppermost tubular bract of var. *pubescens* requires more study along with the traditional size, fragrance and flower colour characters. The intermediates are either hybrids or variants of one or the other.

THE CURRENT CHECKLIST

The checklist here (Table 1) includes both major taxa (species and varieties) and forms (mostly colour variants often with a genetic basis). It is believed to be complete with regard to the former group, but possibly a few of the forms present are not listed as a result of being less frequently encountered and not recorded. Recent classification research has been followed unless otherwise noted below, and both scientific and common names generally follow Brouillet et al. (2010+). Author and publication abbreviations follow the World Checklist of Selected Plant Families (WCSP 2019). Generic names in brackets indicate recent alternative usage. An explanation for many of the decisions made to develop the current list can be found in the following paragraphs.

References supporting some changes include:

Bateman et al. (2003) for *Platanthera unalascensis* (Note that the suggested *Platanthera foetida* is a homotypic synonym) instead of *Piperia unalascensis*.

Bateman et al. (2009) for *Amerorchis rotundifolia* to *Galearis rotundifolia.*
Catling (2012, 2017, 2019) and Sheviak (2002, 2011) for *Platanthera* spp.
Coleman (2018a, b) and Sheviak (1993, 1994, 1995, 2010) for *Cypripedium parviflorum*
Pace and Cameron (2017) and Larocque (2019) for *Spiranthes cernua* to *S. incurva* (although there are still some knots here*)*.

Goodyera repens var. *repens* and var. *ophioides* are now usually combined under *G. repens* (Kallunki 2002) so although both are included for the Bruce Peninsula in the listing by the Bruce Peninsula Orchid Festival (suggesting that both are present), they should be treated as a single taxon. However, the plants with white reticulate-veined leaves can be called *Goodyera repens* f. *ophioides*, a possibly desirable action pending a study of geographic relationship related to this colour variation.

Some changes such as *Listera* to *Neottia* are supported by molecular phylogenetic studies that suggest that mycoheterotrophy (which separated the two genera) can be evolved more easily than previously thought

and is not necessarily an indicator of close relationship. This change has been adopted by the World Checklist of Selected Plant Families (WCSP 2019).

Elven and Murray (2008) made two new combinations: *Limnorchis aquilonis* (Sheviak) Rebrist. & Elven and *Limnorchis huronensis* (Nutt.) Rebrist. & Elven. Elven (2016) noted that the latter new combination was superfluous, which is true in view of the earlier *Limnorchis huronensis* (Nutt.) Rydb. A general statement of Elven in the same publication is also of interest: *"*We accept the segregate genera [*Limnorchis* and *Lysiella*] for the [Panarctic Flora] Checklist but they are not well supported by molecular evidence (see Bateman et al. 2009 and references therein) and may have to be merged (again)". Some support was provided by Gamarra et al. (2008) who found differences in seed patterns between Section *Limnorchis* and the rest of *Platanthera* but their sample was rather small. *Platanthera sensu lato* is accepted by 5 recent authorities (http://apps.kew.org/wcsp/synonomy.do?name_id=157008) and used in the World Checklist of Selected Plant Families (WCSP 2019). It has also been adopted in Canadian lists (Brouillet 2010+). Finally, recent work by experts in both of the biodiversity hotspots and likely areas of origin of *Platanthera*, i.e. Asia and North America, have used the name *Platanthera* in the broad sense (Sheviak 2002, Efimov 2016), and this is the most appropriate way to proceed at the present time.

The genus *Coeloglossum* is claimed to be "now widely accepted as a synonym of *Dactylorhiza*" (Fay et al. 2015), but a number of authors have outlined difficulties with this view. Furthermore Elven (2016) uses *Coeloglossum* in the Panarctic checklist and so does Brouillet et al. (2010+) in the Canada list, perhaps based on the discussion in Sheviak and Catling (2002). WCSP (2019) uses *Dactylorhiza*. Elven has focussed some attention on the variation within *Coeloglossum viride* by accepting 3 subspecies in the Panarctic checklist, but that was "not because we are confident with the decision" (Elven 2016). The genus name *Coeloglossum* is used here and the previously recognized infrataxa are lumped as done in Sheviak & Catling (2002).

Corallorhiza striata var. *vreelandii* was initially reported from the Bruce Peninsula as the synonym *Corallorhiza striata* f. *fulva* (Whiting & Catling 1986, p. 95), although it is not reported from Ontario by Magrath and Freudenstein (2003).

Platanthera orbiculata var. *macrophylla* is accorded full species rank, contrary to WCSP (2019), based on the excellent work of Reddoch and Reddoch (1993).

Table 1. Checklist of the orchids of the Bruce Peninsula with scientific names, authorities, publications and common names.

Species /Taxon
Aplectrum hyemale (Muhl. ex Willd.) Torr., Comp. Fl. N. Middle Stat.: 322 (1826). PUTTYROOT
Arethusa bulbosa L., Sp. Pl.: 950 (1753). DRAGON'S-MOUTH
Calopogon tuberosus (L.) Britton, Sterns & Poggenb., Prelim. Cat.: 52 (1888). TUBEROUS GRASS PINK
Calypso bulbosa* var. *americana (R.Br.) Luer, Native Orchids U.S. & Canada excluding Florida: 336 (1975). CALYPSO
Coeloglossum (*Dactylorrhiza*) ***viride*** (L.) Hartm., Handb. Skand. Fl.: 329 (1820). FROG ORCHID
Corallorhiza maculata Raf., Amer. Monthly Mag. & Crit. Rev. 2: 119 (1817). *f. maculata* *f. flavida* (M.Peck) Farw., Amer. Midl. Naturalist 10: 208 (1927). *f. punicea* (Bartlett) Weath. & J.Adams, Contr. Gray Herb. 158: 39 (1945). *f. intermedia* (Farw.) Farw., Amer. Midl. Naturalist 10: 208 (1927). SPOTTED CORALROOT
Corallorhiza maculata Raf. var. ***occidentalis*** (Lindl.) Ames, Enum. Orchids U.S. & Canada: 22 (1924). WESTERN SPOTTED CORALROOT
Corallorhiza odontorhiza var. ***pringlei*** (Greenm.) Freudenst., Harvard Pap. Bot. 1(10): 25 (1997). PRINGLE'S CORALROOT
Corallorhiza striata Lindl., Gen. Sp. Orchid. Pl.: 534 (1840). *f.* ***striata*** *f.* ***flavida*** (T.A.Todsen & Todsen) P.M.Br., N. Amer. Native Orchid J. 1: 14 (1995). STRIPED CORALROOT
Corallorhiza striata var. ***vreelandii*** (Rydb.) L.O.Williams, Ann. Missouri Bot. Gard. 21: 343 (1934). VREELAND'S CORALROOT
Corallorhiza trifida Châtel., Spec. Inaug. Corallorrhiza: 8 (1760). EARLY CORALROOT
Cypripedium acaule Aiton, Hort. Kew. 3: 303 (1789). *f.* ***acaule*** *f.* ***albiflora*** E.L.Rand & Redfield, Fl. Mt. Desert Isl.: 154 (1894). PINK LADY'S-SLIPPER

Cypripedium arietinum R.Br. *in* W.T. Aiton, Hortus Kew. 5: 222. (1813). *f.* ***arietinum*** *f.* ***albiflorum*** House, Bull. New York State Mus. Nat. Hist. 243-244: 48 (1923). RAM'S-HEAD LADY'S-SLIPPER
Cypripedium parviflorum Salisb. var. ***makasin*** (Farw.) Sheviak, Amer. Orchid Soc. Bull. 62: 403 (1993). NORTHERN YELLOW LADY'S-SLIPPER
Cypripedium parviflorum var. ***pubescens*** (Willd.) O.W.Knight, Rhodora 8: 93 (1906). LARGE YELLOW LADY'S-SLIPPER
Cypripedium reginae Walter, Fl. Carol.: 222 (1788). *f.* ***reginae*** *f.* ***albolabium*** Fernald & B.G.Schub., Rhodora 50: 230 (1948). SHOWY LADY'S-SLIPPER
Epipactis helleborine (L.) Crantz, Stirp. Austr. Fasc., ed. 2, 2: 467 (1769). BROAD-LEAVED HELLEBORINE
Galearis (*Amerorchis*) ***rotundifolia*** (Banks *ex* Pursh) R.M. Bateman, Ann. Bot. (Oxford) 104: 439. (2009). SMALL ROUND-LEAVED ORCHID
Galearis spectabilis (L.) Raf., Herb. Raf.: 72. (1833). *f.* ***spectabilis*** *f.* ***gordinieri*** (House) Whiting & Catling, Naturaliste Canad. 109: 277 (1982). SHOWY ORCHIS
Goodyera oblongifolia Raf., Herb. Raf.: 76 (1833). MENZIES' RATTLESNAKE-PLANTAIN
Goodyera pubescens (Willd.) R.Br. in W.T.Aiton, Hortus Kew. 5: 198 (1813). DOWNY RATTLESNAKE-PLANTAIN
Goodyera repens (L.) R.Br. in W.T.Aiton, Hortus Kew. 5: 198 (1813)., *f.* ***repens*** *f.* ***ophioides*** (Fernald) P.M.Br., N. Amer. Native Orchid J. 1: 14 (1995). DWARF RATTLESNAKE-PLANTAIN
Goodyera tesselata G.Lodd., Bot. Cab. 10: t. 952 (1825). CHECKERED RATTLESNAKE-PLANTAIN
Liparis loeselii (L.) Rich. subsp. ***loeselii***, De Orchid. Eur.: 38 (1817). LOESEL'S TWAYBLADE
Malaxis monophyllos (L.) Sw. var. ***brachypoda*** (A.Gray) P.Morris & Eames, Our Wild Orchids: 358 (1929). NORTH AMERICAN WHITE ADDER'S-MOUTH
Malaxis unifolia Michx., Fl. Bor.-Amer. 2: 157 (1803). GREEN ADDER'S-MOUTH

Neottia (*Listera*) ***convallarioides*** (Sw.) Rich., De Orchid. Eur.: 37 (1817). BROAD-LIP TWAYBLADE
Neottia (*Listera*) ***cordata*** (L.) Rich., De Orchid. Eur.: 37 (1817). HEART-LEAVED TWAYBLADE
Neottia (*Listera*) ***ovata*** (L.) Bluff & Fingerh., Comp. Fl. German., ed. 2, 2: 435 (1838). EGG-LEAVED TWAYBLADE
Platanthera aquilonis Sheviak, Lindleyana 14: 193 (1999). TALL NORTHERN GREEN ORCHID
Platanthera clavellata (Michx.) Luer, Native Orchids Florida: 148 (1972). CLUB-SPUR ORCHID
Platanthera dilatata (Pursh) Lindl. ex L.C.Beck var. ***dilatata***, Bot. North. Middle States: 347 (1833). TALL WHITE BOG ORCHID
Platanthera flava (L.) Lindl. var. ***herbiola*** (R.Br.) Luer, Native Orchids U.S. & Canada excluding Florida: 214 (1975). NORTHERN TUBERCLED ORCHID
Platanthera hookeri (Torr.) Lindl. var. ***hookeri***, Gen. Sp. Orchid. Pl.: 286 (1835). HOOKER'S ORCHID
Platanthera hyperborea (L.) Lindl., Gen. Sp. Orchid. Pl.: 287 (1835). LEAFY NORTHERN GREEN ORCHID
Platanthera huronensis Lindl., Gen. Sp. Orchid. Pl.: 288 (1835). LAKE HURON GREEN ORCHID
Platanthera lacera (Michx.) G.Don in R.Sweet, Hort. Brit., ed. 3: 650 (1839). RAGGED FRINGED ORCHID
Platanthera leucophaea (Nutt.) Lindl., Gen. Sp. Orchid. Pl.: 294 (1835). EASTERN PRAIRIE FRINGED ORCHID
Platanthera macrophylla (Goldie) P.M.Br., Wild Fl. Notes 3: 23 (1988). GREATER ROUND-LEAVED ORCHID
Platanthera obtusata (Banks ex Pursh) Lindl. subsp. ***obtusata***, Gen. Sp. Orchid. Pl.: 284 (1835). BLUNT-LEAVED ORCHID
Platanthera orbiculata (Pursh) Lindl., Gen. Sp. Orchid. Pl.: 286 (1835). LESSER ROUND-LEAVED ORCHID
Platanthera psycodes (L.) Lindl., Gen. Sp. Orchid. Pl.: 294 (1835). *f.* ***psycodes*** *f.* ***albiflora*** (R.Hoffm.) R.E.Whiting & Catling, Naturaliste Canad. 109: 278 (1982). SMALL PURPLE FRINGED ORCHID
Platanthera (*Piperia*) ***unalascensis*** (Spreng.) Kurtz, Bot. Jahrb. Syst. 19: 408 (1894). ALASKA REIN ORCHID

Pogonia ophioglossoides (L.) Ker Gawl., Bot. Reg. 2: t. 148 (1816). *f.* ***ophioglossoides*** *f.* ***albiflora*** E.L.Rand & Redfield, Fl. Mt. Desert Isl.: 152 (1894). ROSE POGONIA
Spiranthes casei Catling & Cruise var. ***casei,*** Rhodora 76: 527 (1974 publ. 1975). CASE'S LADIES'-TRESSES
Spiranthes incurva (Jenn.) M.C. Pace, Syst. Bot. 42(4): 16 (2017) (previously part of *S. cernua*) INCURVED LADIES'-TRESSES
Spiranthes lacera (Raf.) Raf. var. **lacera**, Herb. Raf.: 44 (1833). NORTHERN SLENDER LADIES'-TRESSES
Spiranthes lucida (H.H.Eaton) Ames, Orchidaceae 2: 258 (1908). SHINING LADIES'-TRESSES
Spiranthes magnicamporum Sheviak, Bot. Mus. Leafl. 23: 287 (1973). GREAT PLAINS LADIES'-TRESSES
Spiranthes romanzoffiana Cham., Linnaea 3: 32 (1828). HOODED LADIES'-TRESSES

REFERENCES

Bateman, R.M., P.M. Hollingsworth, J. Preston, Y-B. Luo., A.M. Pridgeon, and M.W. Chase. 2003. Molecular phylogenetics and evolution of Orchidinae and selected Habenariinae (Orchidaceae). Botanical Journal of the Linnean Society. 142: 1–40

Bateman, R.M., K.E. James, Y. Luo, R.K. Lauri, T. Fulcher, P.J. Cribb, and M.W. Chase. 2009. Molecular phylogenetics and morphological reappraisal of the *Platanthera* clade (Orchidaceae: Orchidinae) prompts expansion of the generic limits of *Galearis* and *Platanthera.* Ann. Bot. 104(3): 431-445.

Brouillet, L., F. Coursol, S.J. Meades, M. Favreau, M. Anions, P. Bélisle and P. Desmet. 2010+. VASCAN, the Database of Vascular Plants of Canada. http://data.canadensys.net/vascan/ [accessed 5 March 2019]

Brown, J.R. 1985. Flowering dates for orchids of the Bruce Peninsula. The Plant Press 3(2): 47-49. [later incorporated in the guide by Bruce-Grey produced in 1997].

Bruce-Grey Plant Committee (Owen Sound Field Naturalists). 1997. A guide to the orchids of Bruce and Grey Counties, Ontario. Owen Sound Field Naturalists. 105 pp.

Case, F.W. 1964. Orchids of the Western Great Lakes Region. Cranbrook Institute of Science.

Case, F.W. 1987. Orchids of the Western Great Lakes Region, Revised Edition. Cranbrook Institute of Science.

Catling, P.M. 2012. Observations on the discreteness of *Platanthera aquilonis* and *P. hyperborea* across Canada. Native Orchid Conference Journal 9(4): 7-13 + cover.

Catling, P.M. 2017. Reasons to recognize the Newfoundland var. *abbreviata* of *Platanthera hookeri*. Native Orchid Conference Journal 14(3): 1-8.

Catling, P.M. 2019. Observations on the systematics of the *Platanthera aquilonis – P. dilatata* complex in Newfoundland. In press.

Catling, P.M. and R.E. Whiting. 1976. Ontario's Endangered Orchids. Ontario Naturalist, Vol. 16, #3.

Chase, M.W., K.M. Cameron, R.L. Barrett, and J.V. Freudenstein. 2003. DNA data and Orchidaceae systematics: a new phylogenetic classification. Pp. 69-89 in K.W. Dixon, S.P. Kell, R.L. Barrett, and P.J. Cribb (eds.). Orchid Conservation. Natural History Publications, Kota Kinabalu, Sabah. file:///C:/2019/Orchids%20-%20Bruce/Orchid%20refs/ChaseOrchidConsCh05part%20(1).pdf

Clark, D.I.M., J.A Harrison, and S.L.J. Smith. 2007. Bruce County – premier ranked tourist destination. County of Bruce Tourism Dept. http://www.mtc.gov.on.ca/en/publications/PR_Bruce_Main_Report.pdf

Coleman, R.A. 2018a. The genus *Cypripedium* of the United States and Canada, part 1. Native Orchid Conference Journal 15(1): 2-25.

Coleman, R.A. 2018b. The genus *Cypripedium* of the United States and Canada, part 2. Native Orchid Conference Journal 15(2): 1-25.

Correll, D.S. 1950. Native Orchids of North America, North of Mexico. The Chronica Botanica Co.

Efimov, P.G. 2016. A revision of *Platanthera* (Orchidaceae; Orchidoideae) in Asia. Phytotaxa 254(1): 1-233. http://dx.doi.org/10.11646/phytotaxa.254.1.1

Eliott, H.V. 1962. The Bruce Peninsula. F. O. N. Bulletin #97.

Elven, R. 2016. Annotated Checklist of the Panarctic Flora (PAF) Vascular Plants 1.0. Natural History Museum, University of Oslo. http://nhm2.uio.no/paf/

Elven, R. and D.F. Murray. 2008. New combinations in the panarctic vascular plant flora. Journal of the Botanical Research Institute of Texas 2(1): 433-436.

Fay, M.F., B. Sayers, and I Taylor. 2015. 802. *Dactylorhiza viridis*, Orchidaceae. Curtis's Botanical Magazine 32(1): 33-41.
Fernald, M.L. 1925. Persistence of plants in unglaciated areas of Boreal America. Mem. Gray Herb. 1.

Fernald, M.L. 1935. Critical plants of the upper Great Lakes region of Ontario and Michigan, Rhodora 37: 197-222, 238-262, 272-301, 324-341.

Fernald, M.L. 1950. Gray's Manual of Botany. D. Van Nostrand Co.

Fox, W.S. 1952. The Bruce Beckons, the story of Lake Huron's great peninsula. University of Toronto Press. 245 pp.

Freudenstein, J.V. 1987. A preliminary study of *Corallorhiza maculata* (Orchidaceae) in eastern North America. Contr. Univ. Michigan Herb. 16: 145–153.

Freudenstein, J.V. 1997. A monograph of *Corallorhiza* (Orchidaceae). Harvard Pap. Bot. 1(10): 5–51.

Gamara, R.P. Galán, I. Herrera, and E. Ortúñez. 2008. Seed micromorphology supports the splitting of *Limnorchis* from *Platanthera*. Nordic Journal of Botany 26: 61-65.

Gibson, J. and J. Macoun. 1873. Botany of the eastern coast of Lake Huron. Can. J. Science 14.

Given, D.R. and J.H. Soper. 1981. The arctic-alpine element of the vascular flora at Lake Superior. National Museum of Canada Publications in Botany 10: 1-70.

Guire, K.E. and E.G. Voss. 1963. Distribution of distinctive shoreline plants in the Great Lakes region. Michigan Botanist 2: 99-114.

Heshka, L. 2006. Plant of the month – Spotted Coralroot, *Corallorhiza maculata* (Rafinesque) Rafinesque. Native Orchid News (Native Orchid Conservation Inc.) 8(2): 2 pp. http://www.nativeorchid.org/news200604.htm

Hoffman, D.N., and N.R. Richards. 1954. Soil survey of Bruce County. Report 16, Ontario Soil Survey, Experimental Farms Service and the Ontario Agricultural College. 110 pp. with maps (N & S) 1:63,360. http://sis.agr.gc.ca/cansis/publications/surveys/on/on16/on16_report.pdf

Johnson, J. 1990. Vascular Flora of Three Regions Comprising Bruce and Grey Counties, Ontario, With Emphasis on Rare Taxa. Ontario Ministry of Natural Resources.

Johnson, J. 2016. The Vascular Plants of the Bruce Peninsula, Ontario. Privately published. (joejohnson.book@gmail.com). 297 pages.

Kallunki, J.A. 2002. *Goodyera* R. Brown. Pp. 514 in Flora of North America Editorial Committee eds. 1993+. Flora of North America North of Mexico. New York and Oxford, vol. 26. beta.floranorthamerica.org/Goodyera

Klugh, A.B. 1912. The plant formations of the Bruce Peninsula. Ontario Natural Science Bulletin 7.

Klugh, A.B. 1913. Notes on plant formations of the shores of Georgian Bay. Ontario Natural Science Bulletin 8.

Krotkov, P.V. 1940. Botanical Explorations in the Bruce Peninsula, Ontario. Transactions of the Royal Canadian Institute No. 49, Vol. 23, part 1: 1-65.

Larocque, M. 2019. Splitting the *cernua* atom. Native Orchid Conference Journal 16(1): 4-8.

Luer, C.A. 1975. Native Orchids of the United States and Canada. New York Botanical Garden.

Magrath, L.K. and J.K. Freudenstein. 2003. 56. *Corallorhiza*. Flora of North America 26. http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=242102227

Marquis, R.J. and E.G. Voss. 1981. Distributions of some western North American plants disjunct in the Great Lakes region. Michigan Botanist 20: 53-82.

Maunder, J.E. 2008. The status of the Alaska Rein Orchid (*Platanthera foetida*) in Newfoundland and Labrador. Species Status Advisory Committee Reports No. 14. 16 pp.

Morton, J.K. and J.M. Venn. 1987. The flora of the Tobermory Islands, Bruce Peninsula National Park. Dept. Of Biology, University of Waterloo. 92 pp.

Morris, F. and E. Eames. 1929. Our Wild Orchids. Charles Scribner's Sons.

Oldham, M.J. 2018. Book Review: "The vascular plants of the Bruce Peninsula, Ontario." Field Botanists of Ontario Newsletter 30(2): 10.

Pace, M.C. and K.M. Cameron. 2017. The Systematics of the *Spiranthes cernua* Species Complex (Orchidaceae): Untangling the Gordian Knot. Systematic Botany 42(4): 1-30. https://doi.org/10.1600/036364417X696537

Reddoch, A.H. and J.M. Reddoch. 1993. The species pair *Platanthera orbiculata* and *P. macrophylla* (Orchidaceae): taxonomy, morphology, distributions and habitats. Lindleyana 8: 171–187.

Reznicek, A.A. 2017. Book Review: "The vascular plants of the Bruce Peninsula, Ontario." Great Lakes Botanist 56: 91-93.

Sheviak, C.J. 2002. *Platanthera*. Pp. 551-571 *in* Flora of North America Editorial Committee. Flora of North America North of Mexico, vol. 26. Oxford University Press.

Sheviak, C.J. 2011. *Platanthera huronensis* in the north, and the occurrence of P. hyperborean in North America. Native Orchid Conference Journal 8(2): 14-41.

Sheviak, C.J. and P.M. Catling. 2002. 29. *Coeloglossum* Hartman. p. 580 in Flora of North America vol. 26. Oxford University Press, New York.

Stebbins, G.L. 1935. Some observations on the flora of the Bruce Peninsula, Ontario. Rhodora 37 (434): 63-74.

Thomson, G.W. 1970. Vascular Plants of the Bruce Peninsula: a review with comments and additions. Michigan Botanist 9(1): 9-16.

Victorin, Fr. M. 1938. Phytogeographical problems of eastern Canada. American Midland Naturalist 19: 489-538.

WCSP. 2019. World Checklist of Selected Plant Families. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; http://wcsp.science.kew.org/ Retrieved 27 July 2019.

Wester, M.C., B.L. Henson, W.J. Crins, P.W.C. Uhlig and P.A. Gray. 2018. The Ecosystems of Ontario, Part 2: Ecodistricts. Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, ON. Science and Research Technical Report TR-26. 474 pp. + appendices

Whiting. R.E. and P.M. Catling. 1986. Orchids of Ontario. CanaColl Foundation, Ottawa. 169 pp.

Woodford. J. and G.M. Bartman. 1966. A garden northward. Ontario Naturalist 4(1).

Wynne-Edwards, V.C. 1937. Isolated arctic-alpine floras in eastern North America. Trans. Roy. Soc. Can. 31.

ORCHIDS OF THE BRUCE PENINSULA

Part II: Why are there so many orchids on the Bruce?

Text by Paul M. Catling and Brenda Kostiuk, Brenda.kostiuk@gmail.com

The Bruce Peninsula has more orchids than any southern Ontario County. For example, there are 50 orchids here compared to the nearby mainland areas of Parry Sound and Muskoka (together) which have 37 in a larger area (Figure 1, Appendix Table 1). Yellow Lady's-slippers are more common on the Bruce than anywhere else in Ontario. Other orchids are particularly common here such as Ram's-head Lady's-slippers (*C. arietinum*), Showy Lady's-slippers (*C. reginae*), as well as Small Purple Fringed Orchid (*Platanthera psycodes*), Coralroots (*Corallorhiza* spp.) and Rattlesnake-plantains (*Goodyera* spp.). The remarkable Bruce orchid flora is a consequence of both diversity and abundance and is mirrored by other plant groups such as ferns, and by the flora as a whole.

Figure 1. Comparison of the orchid floras of the Bruce Peninsula with 50 species versus nearby Muskoka and Parry Sound with 37 species. The red-outlined area and arrow shows the approximate position of Muskoka and Parry Sound further indicated by black border lines.

Explaining diversity and abundance, and the occurrence of plants and animals in general, is often not easy. Many interacting factors may be involved. In the present case three factors seem to play a major role. These are climate, substrate and disturbance. Each of these are discussed briefly.

CLIMATE

The correspondence of plant distributions to climatic characteristics leads biologists to believe that climate has a great deal to do with plant occurrence. For example, the similar geographic limits of so many plants in southern Ontario led to the recognition of the Carolinian zone (Fox and Soper 1952a, b, 1952c, Soper 1956, 1962). In this case the zonal boundary, based on a few hundred very similar plant distribution limits, is similar to the frost-free period, growing degree days and other isolines.

(1) Cooler than normal

The climate of the Bruce may be viewed as moderate as well as warm and cool. Basically the Lake Huron shore and the northern area are cool. Climatic data from Canadian Climate Normals 1981-2010 station data for Tobermory, Wiarton, and Ottawa provide a useful indication of trends (Figures 2 and 3, data available at http://climate.weather.gc.ca/climate_normals/). In the summer Tobermory at the tip of the peninsula is cool, Wiarton is warmer, and Ottawa, distant from the lake with a continental climate is warmest (Figure 2). The opposite situation exists in the winter with Ottawa being the coldest, Wiarton being less cold (Figure 3). Tobermory is not shown here due to lack of data.

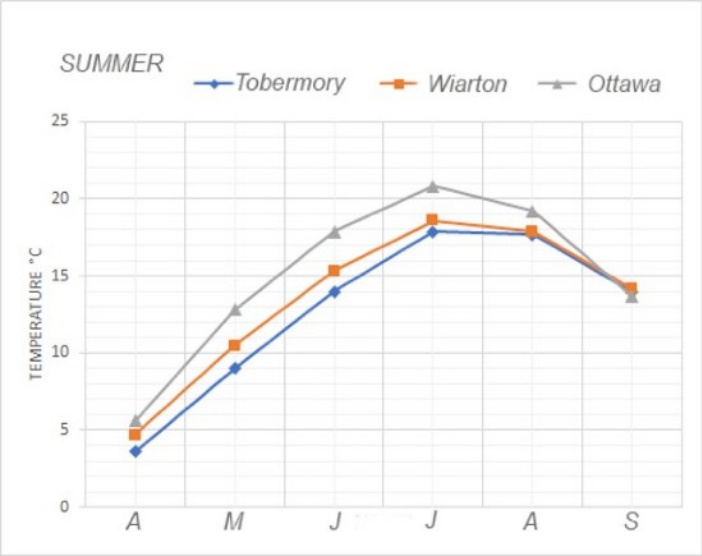


Figure 2. Average summer temperatures for Tobermory, Wiarton and Ottawa 1981-2010. Data available at http://climate.weather.gc.ca/climate_normals/.

Figure 3. Average winter temperatures for Wiarton and Ottawa 1981-2010. Data available at http://climate.weather.gc.ca/climate_normals/.

Wester et al. (2018) note that "Cooler-than-normal summers help sustain boreal and subarctic plant species." Some of the plants are disjunct from the cool areas to the north and west including Cut-leaved Anemone (*Anemone multifida*), Western Thimbleberry (*Rubus parviflorus*), and Alpine Bluegrass (*Poa*

alpina) and others are discussed by Guire and Voss (1963), Marquis and Voss (1981) and Given and Soper (1981). One of the best examples of these Bruce disjuncts is the Alaska Rein Orchid (*Platanthera unalascensis*) found in the mountains of western North America, disjunct in the east to northern Lake Huron, a few places at Anticosti in the Gulf of St. Lawrence and a small area of Newfoundland (see map in # 1 of this series). Other cool-climate orchids present and near the southern limit of their North American distributions include Small Round-leaved Orchid (*Galearis rotundifolia*), *Calypso* (*Calypso bulbosa* var. *americana*), Striped Coralroot (*Corallorhiza striata*), Menzies' Rattlesnake-plantain (*Goodyera oblongifolia*), Broad-lip Twayblade (*Neottia convallarioides*) and Blunt-leaved Orchid (*Platanthera obtusata*).

(2) Warmer than normal

Since the climate of the Bruce Peninsula is milder than surrounding areas and has a longer frost-free period, and is a northern extension of a generally more southern hardiness zone, the southern part of the Bruce has species at their northern limits such as Spicebush (*Lindera benzoin*) and orchids such as Puttyroot (*Aplectrum hyemale*) and Showy Orchis (*Galearis spectabilis,* Figure 4), both plants of the more southern deciduous Maple-Beech forest. With climate warming species that appear to be moving north such as Purple Twayblade (*Liparis liliifolia*) may soon occur in plantations on sandy soils around Hepworth and Sauble Beach (except that urbanization is becoming a limiting factor). Pringle's Coralroot *Corallorhiza odontorhiza* var. *pringlei* may have only arrived in this region in 1987, but was lost when the habitat was clearcut around 1999 (Johnson 2016). It appears to be spreading northward (Oldham and Consiglio 2018).

Figure 4. Showy Orchis (*Galearis spectabilis)* is one of the more southern orchids that occurs on the Bruce near the northern limit of its distribution in Ontario. It is also a species that increases with minor disturbance in deciduous Maple-Beech forest.

Plant hardiness zones[1] show where plants are able to survive, especially their northern limits. Note that hardiness zone 6a extends narrowly further north here than anywhere else in Canada (https://www.nrcan.gc.ca/home). Its low end is near the shore of Lake Erie whereas the upper end reaches the Bruce Peninsula. This orientation, due to the effect of Lake Huron, is an interesting departure from the general east to west orientation of hardiness zones and helps to explain the northern limits of southern species at the base of the peninsula.

(3) Moderation

Johnson (2016) writes with respect to Large Yellow Lady's-slippers on the Bruce that "Road verges through wooded bedrock country provide the best shows of all." Many concur, adding that if vegetation is mowed or cut, orchids in some places outside the Bruce are often on south sides of the roads where shading reduces direct light and therefore heat. We collected some data to help explain the occurrence of orchids with regard to light and moisture and the effect of lowering temperature. Although this was a very simple demonstration using a standard garden light meter and moisture recorder, it does result in a diagram that is helpful to an explanation (Figure 5). The site is a road over a limestone plateau in Marlborough Forest south of Ottawa, eastern Ontario.

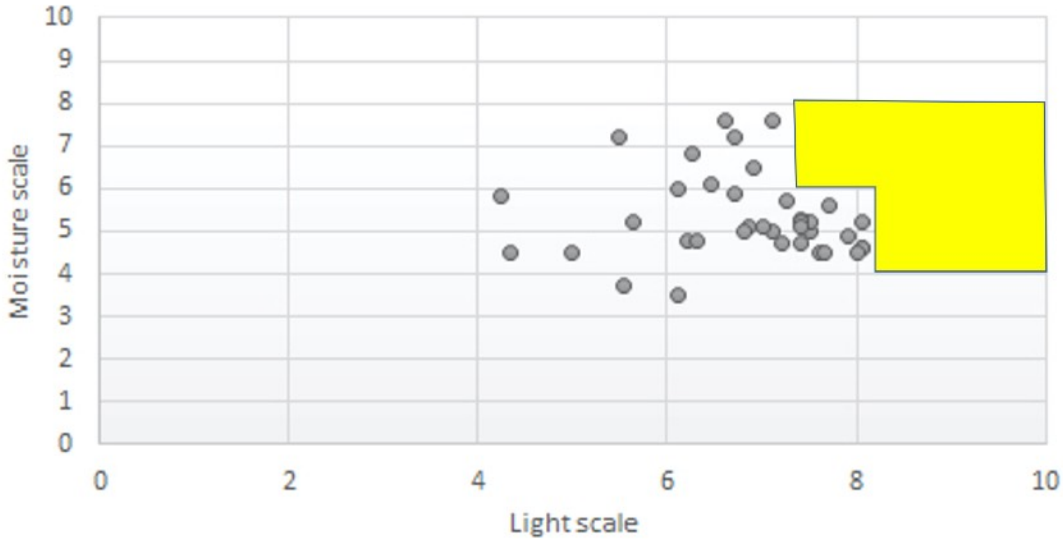


Figure 5. Dots are points of orchid occurrence plotted according to amount of light and soil wetness. The yellow area represents the increase in light that might be accommodated with a decrease in air temperature, i.e. an approximate doubling of habitat occupation.

The data is points of orchid occurrence plotted according to amount of light and soil wetness. On the moisture scale, values below 3 were too dry and those above 8 were too wet. On the light scale values below 4 were in dark forest and above 8 were bright and sunny all day. An interesting question is why the higher light sites here were not used. This is likely due to the increased heat associated with higher light. A

reduction in air temperature as a result of being on a peninsula surrounded by cool water may enable colonization of parts of this diagram experiencing more light. In fact sufficient cooling may enable areas of more continuous full sunlight to be occupied, i.e the yellow area in the diagram. This could result in a doubling of the available habitat - the yellow-shaded area added to the area with dots. On the Bruce certain of these sun-loving orchids can increase occurrence on the light scale without the adverse effects of temperature. Possibly these plants grew in a relatively cool periglacial environment for thousands of years and are adapted to it, rather than to present day extremes. Heat may have a negative effect as a result of accumulation or a few very severe heat events, or of course both.

SUBSTRATE

We alluded above to the fact that the Bruce has more orchids than Muskoka and Parry Sound together, but we did not indicate the reasons for it. These may be many, but one that is very likely to play a major role is the calcareous substrate of the Bruce. Of the orchids that are found in Muskoka and Parry Sound but not on the Bruce, most are well-known calciphiles requiring high calcium and high pH (Appendix Table 1). Around the world many species of orchids are associated with high calcium in limestone, dolomite, marble, chalk, or gypsum rock.

There is substrate variation in the Bruce that includes localized acidic conditions on well-drained sand, on humic material in bogs and conifer swamps and in Tobermory Bog. This allows some species of orchids favouring acidic conditions, such as Green Adder's-mouth (*Malaxis unifolia*) to occur rarely.

DISTURBANCE

(1) Fire

Slash (branches left from cutting) are blamed for providing excess fuel for the great fire of 1908. Now, more than 100 years later, this fire has remained in people's minds. Descriptions of the losses are readily found online and people have come to associate fire with human carelessness and devastation. It is not uncommon to see sentiments like "May God protect us from anything like that ever happening again." This leads to the idea that fires are to be put out, and fires are certainly a threat to increasing urban settings in forested areas. Furthermore, the devastation of fires in various parts of North America in recent years is still vivid in our minds. Consider the fires in 2011 at Slave Lake in northern Alberta, in 2016 at Fort McMurray in northern Alberta, in 2017 in British Columbia and in 2018 in California. An important question is whether or not these thoughts lead to a helpful view of fire.

Fires are a natural process that provides a continuing succession of habitats for a diversity of species. One hundred years earlier, a fire produced the pines that were cut on the Bruce around 1908. The fires require the open habitats and they are also often responsible for the release and dispersal of seeds that begin the new forest. Fires have probably occurred over thousands of years and many species are not only adapted to

them but require them. This means that fires deserve more consideration in protection of nature. Many ecologists have described the importance of fire and throughout much of North America it is now a well-established management tool, and one that can be used, not only to benefit plants and animals, but also to reduce catastrophic fire events for people.

One of the most helpful sources to assist Ontario with decisions regarding preliminary fire management goals, objectives and options for maintaining and restoring fire-dependent ecosystems in protected areas was produced by the Ontario Ministry of Natural Resources (Van Sleeuwen, 2006). This report (see also text box) provides a summary of how ecosystems interacted with fire in the past, under a minimum of human influence, and how fire processes can be used as a tool to help restore ecological integrity to protected area landscapes. It was prepared as part of a tool kit supporting fire management planning for provincial parks and conservation reserves. One of the first things to note here is that fires are a natural process that occurred long before any humans arrived in North America.

A balanced view of Fire

Fire is an ecological process fundamental to maintaining the diversity and ecological integrity of many ecosystems in Ontario. However, fire also has the capacity to cause significant and widespread ecological, economic, and social impacts. Long term fire suppression to protect these values has negatively impacted ecosystem health by causing shifts in species composition, accumulations of biomass, insect infestations, poor regeneration, and degradation of wildlife habitat. Fire suppression has also caused significant accumulations of flammable fuels, which in turn, threaten the surrounding landscape.

Van Sleeuwen, 2006.

During the mid- and late Holocene (the last 11,700 years), the southern portion of the peninsula supported a rich deciduous forest, dominated by *Acer saccharum* and *Fagus grandifolia*, while the northern portion was dominated by a forest with a much higher proportion of conifers (Bennett 2011). This forest may have been very similar to the current forest. We know that much of the forest of the upper Bruce Peninsula was White Pine since that is what was being cut in the outer Bruce Peninsula in ca. 1900. The return times (average times between fires) for forests containing White Pine, which includes modern forest types, is given below (Van Sleeuwen 2006, Eastern Deciduous Forest, pp. 79, 81).

White Pine – Red Pine (+ White Cedar, White Birch, Balsam Fir) - 12-300 years
White Birch-Aspens-Conifer (+ Balsam Fir, Cedar, White Pine, White Spruce) - 66-104 years
Jack Pine (alone or with White Pine, Red Pine, White Cedar) - 15-35 years

Van Sleeuwen (2006) noted that "Prior to modern intervention, white and red pine stands experienced a variable fire regime of low intensity fires at short intervals punctuated by stand-replacement fires at longer intervals" (Van Sleeuwen 2006, p. 94). The mean fire interval is 12-300 years (Van Sleeuwen 2006, p. 81).

We suggest that not only were there always fires on the Bruce, but there were also always fires in the parklands and forests south of the glacial margin, and that orchids (and other plants and animals) adapted to these disturbances to the forest caused by fire. Johnson (2016, p. 103) writes of one of the peninsula's "specialty" orchids, Ram's-head Lady's-slipper (*Cypripedium arietinum*), "it has a high tendency to occur where forest fires had occurred a century ago. These fires likely benefitted it." This observation is of particular interest because it involves the Bruce, but in fact variable, but often beneficial effects of fire have been reported for orchids worldwide. Duncan (2012, p. 14) notes: "Fire is important for many Victorian (Australia) orchids and most significant Victorian habitats for orchids are regularly burnt (Jones 1988). Many orchid species in these habitats not only survive a fire, they have adopted fire as a major component of their life cycle, flowering more profusely following a summer bushfire."

(2) Large Mammals

Apart from people, Beavers (*Castor canadensis*) may be the most important in tree removal at the present time. Only a short time ago (11,500 years) in front of the continental ice sheet where the orchids currently occupying the Bruce Peninsula had been evolving for hundreds of thousands of years, there were much larger Mastodons (*Mammut americanum,* Figure 6) averaging 2.3 m (7 ft 7 in) but reaching over 3.25 m (10.7 ft) in height at the shoulders, and Jefferson's Giant Sloths (*Megalonyx jeffersonii*) to 3-4 m (9-12 ft) long. These and other large mammals inhabited eastern North America throughout the Pleistocene, that is from 2.5 million years ago, until 11,500 years ago. Palaeoecologists believe that these large mammals had a major effect on shaping the habitats of the period.

Figure 6. This was the first life-size restoration of the American Mastodon (*Mammut americanum*) based on the famous skeleton found at Cohoes, New York in 1866. Height at shoulder 8 feet, 11 inches, length 14 feet, approx. weight 18,000 pounds, on display at State Museum Education Building in 1922. This large mammal, which became extinct as recently as 11,000 years ago, may have influenced the present day characteristics and ecology of many native North American plants including terrestrial orchids.

The mixed forests and parklands south of the glacial margin are believed to be the origin of some of the flora of central Ontario, including the Bruce Peninsula endemics. Yellow Lady's-slippers and other orchids were part of this flora south of the Great Lakes which they apparently shared with the megafauna.
One wonders what kind of impact these mammals had, but it seems likely to have been substantial in maintaining large areas of open and semi-open successional scrub forest. They ate trees and shrubs and trampled areas of range probably to various degrees in a mosaic pattern defined by their predators.

This situation may have existed for millions of years and only stopped about 11,000 years ago with the decline of the megafauna. The Bruce peninsula orchids were likely subject to substantial megafaunal disturbance for a very long period, and very likely became adapted to it. This may explain their need for a level of disturbance. To understand the present plant ecology it may be necessary to think beyond the most recent fraction of a drop in the bucket to the past time that defined current species.

It was in 1946 that Curtis wrote an article about the use of mowing to manage and maintain the Small White Lady's-slipper in Wisconsin. Surely it has not taken us 73 years to learn that the same machines that we use to destroy habitats can be used to create them by mimicking large mammals. Figure 7 illustrates the use of a Forestry Mower to maintain Large Yellow Ladies'-slipper habitat in Minnesota.

Figure 7. This composite photo taken off a web site designed to show management of Yellow Lady's-slipper habitat in Dakota Co. Minnesota by a group called "Friends of the Mississippi River (FMR). A principal threat is shading out of habitat by introduced Common Buckthorn (*Rhamnus cathartica*) which forms competing walls of dense growth now controlled by Forestry Mowers operated in winter to reduce impact on native herbaceous vegetation. https://fmr.org/news/2018/04/12/control-buckthorn-protect-native-plants

(3) Human landscape modifications such as hydro lines, trails, and harvesting

In many extensive areas of eastern North America power transmission line rights of way (hydro line corridors) are the only habitats left that support populations of rare orchids. A taxonomically diverse array of early successional species, including native orchids, are favoured by vegetation management under transmission lines (Wagner et al. 2014).

Effects of harvesting can be helpful. We are aware of several examples of minor disturbance to woodlands involving removal of scattered trees, development of trails and local bulldozing, that apparently led to colonies of hundreds of plants of Showy Orchis (*Galearis spectabilis*). One location had 700 plants in an area of 9 m^2.

The disturbance that occurs along trails as a result of human traffic has been shown to be an overall benefit to orchids (Catling & Kostiuk 2011, Catling 2012). Since some of this research has involved the Bruce, where orchids are significant with regard to tourism, a few additional observations may be appropriate. Firstly, it is unfortunate to lose any of the benefits of disturbance as a result of trampling. Therefore, it is still a good idea to remind people to be careful not to trample rare plants. Although this may not have much effect on children (and why should it?), it will result in extra care from photographers. Secondly, it has been suggested to Park Officials that cameras can be used to monitor rare orchids along trails with warnings of such monitoring so that poaching (theft) of orchids can be reduced, and the accessibility of rare species by trails may become much less of a problem. The positive impact of trails is not surprising considering the impacts of Pleistocene megafauna.

(4) Other disturbances

Other phenomena which destroy forests to create new habitat for orchids include: (a) flooding, (b) forest diseases, and (c) outbreaks of tree-feeding insects. Any of these can be important on a local basis.

OTHER PLACES WITH DIVERSITY AND ABUNDANCE OF ORCHIDS ARE SIMILAR

If the features that we have associated above with high diversity and abundance of orchids on the Bruce Peninsula are also characteristic of other rich orchid habitats, this would support them as the important factors. Such a consideration could be lengthy, but we can consider a single example. The first place that comes to mind is Newfoundland (Brown 2003).

The outstanding work of M.L. Fernald in characterizing the flora of Newfoundland was extended by Ernest Rouleau who completed it with a very helpful atlas (Rouleau & Lamoureaux 1996). More recently the comprehensive annotated checklist by Meades and Meades (2018) has proved very useful and there is also a valuable orchid flora (Voitk and Voitk 2006) as well as a book about the limestone barrens (Burzynski et al. 2016). Using these sources we prepared a table of Newfoundland orchids. It included 45 species of

which 15 are largely confined to the limestone barrens of the western coast. This limestone area is 40 km^2 (Burzynski et al. 2016, pp. 6-7) while the island is 108,860 km^2. The limestone barrens occupy approximately 0.00037% of the island land area, but contain 33% of the island orchids.

Of course the statistics make it an orchid hotspot, but it is known as one for many reasons. There are places on this coast where thousands of flowers of Large Yellow Lady's-slipper can be viewed at the same time (Burzynski et al. 2016, p. 69), as on the Bruce, and the Alaska Rein Orchid is also disjunct and isolated here, as on the Bruce. And yes, as on the Bruce, the remarkable abundance and diversity of orchids (and other rare plants) here is correlated with a specific cool but moderate climate, limestone substrate, and disturbance. The disturbance here may be largely a consequence of wind (Burzynski et al. 2016, pp. 62-68).

AN IDEA

To summarize: many plants on the Bruce Peninsula, including orchids, do well in a calcareous, relatively cool and moderate environment, that has experienced disturbance, and this unusual combination of factors explains why there are so many orchids on the Bruce. There is still the question … why is this so?

Consider the following idea. The abundance of orchids and orchid diversity on the Bruce are associated with disjunctions of boreal plants and occurrence of northern Lake Huron endemics, both of which are believed to be relicts of the landscapes on the south edge of the continental glacier. The most recent ice-front landscape lasted for 115,000 years but the present unglaciated landscape of the Bruce Peninsula is less than 11,700 years old. The Quaternary or Pleistocene glaciations began 2.58 million years ago. Thus, with some interruptions, the ice front environment probably influenced plant evolution for a long period. It may have been a more or less open Spruce, Aspen and Oak parkland, and mixed forest with both southern and boreal elements (as suggested by the presence of Chipmunks and Lemmings together). An adapted ice front flora may have survived in the cool and moderate environment of the Bruce Peninsula but became rare and largely disappeared elsewhere as the boreal forest spread across much of eastern North America. The ice-front environment was cool due to cool wind blowing off the ice but was also mild due to its southern position and perhaps descending air. Glacial deposition had left high calcium substrates. Differential movement of ice lobes, wind, meltwater, and fire, the latter resulting from cool and drying summer conditions would have made disturbed and successional habitats widespread. The Pleistocene megafauna may also have contributed to significantly disturbed conditions.

Here is the thought: Just as the Bruce has Pleistocene ice-front relicts, the diversity and abundance of orchids is a relict of an environment (climate and ecology) to which they were adapting over hundreds of thousands of years. In short, the Bruce is equivalent to the evolutionary past of the orchids.

FOOTNOTE

[1] A plant hardiness zones map shows the different zones in Canada where various kinds of plants will most likely survive. The map is based on a formula using seven important variables that influence plant survival: 1. Monthly mean of the daily minimum temperatures of the coldest month 2. Mean frost-free period (above 0°C) in days 3. Amount of rainfall from June to November 4. Monthly mean of the daily maximum temperatures of the warmest month 5. A winter harshness index related to rainfall in January 6. Mean maximum snow depth 7. Maximum wind gust in 30-year period. The original map was developed by Agriculture and Agri-Food Canada in the early 1960s based on average values from 1930 to 1960. This new map uses 1981 to 2010 averages. For more information on Hardiness Zones, which are developed in a different way in Canada and the US, see McKenney et al. (2001, 2007).

REFERENCES

Bennett, K.D. 2011. Holocene history of forest trees on the Bruce Peninsula, southern Ontario. Canadian Journal of Botany 70(1): 6-18.

Brown, D.M., G.A. McKay, and C.C. Chapman. 1980. The Climate of Southern Ontario. Climatological Studies No. 5, Atmospheric Environment Service, Environment Canada, Hull, Quebec. 67 pp.

Brown, P.M. 2003. Two weeks and 38 orchids in western Newfoundland. On the Fringe (Journal of the Native Plant Society of Northeastern Ohio) 21(2): 1-7.

Brouillet, L., F. Coursol, S.J. Meades, M. Favreau, M. Anions, P. Bélisle & P. Desmet. 2010+. VASCAN, the Database of Vascular Plants of Canada. http://data.canadensys.net/vascan/ (consulted on 2019-06-17)

Bruce-Grey Plant Committee (Owen Sound Field Naturalists). 1997. A guide to the orchids of Bruce and Grey Counties, Ontario. Owen Sound Field Naturalists. 105 pp.

Burzynski, M., H. Mann, and A. Marceau. 2016. Exploring the limestone barrens of Newfoundland and Labrador. Gros Morne Co-operating Association, Rocky Harbour, Newfoundland. 367 pp.

Catling, P.M. 1996. In situ conservation. pp. 15-23 in Orchids - status survey and conservation action plan. E. Hagsater and V. Dumont, editors. International Union for Conservation of Nature (IUCN). Species Survival Commission. Cambridge. United Kingdom.

Catling, P.M. 2012. Some additional observations of a positive impact of trails on terrestrial orchids and some data from along a road. Native Orchid Conference Journal 9(1): 6-10.

Catling, P.M. and B. Kostiuk. 2011. Some wild Canadian orchids benefit from woodland hiking trails – and the implications. Canadian Field-Naturalist 125 (2): 105-115.

Chapman, L. J. and D. E Putnam. 1966. The Physiography of Southern Ontario. Univ. of Toronto Press.

Correll, D. S. 1950. Native Orchids of North America, North of Mexico. The Chronica Botanica Co.

Duncan, M. (2012). Response of Orchids to Bushfire: Black Saturday Victoria 2009 – Natural values fire recovery program. Department of Sustainability and Environment, Heidelberg, Victoria. 28 pp.

Fernald, M. L. 1950. Gray's Manual of Botany. D. Van Nostrand Co.

Folkes, P. 1973. The History of the Bruce Peninsula: An Overview. Ontario Ministry of Natural Resources.

Fox, W.S. 1952. The Bruce beckons, the story of Lake Huron's great peninsula. University of Toronto Press. 245 pp.

Fox, W.S. and J.H. Soper. 1952a. The distribution of some trees and shrubs of the Carolinian zone of southern Ontario, part 1. Trans. Royal Canadian Inst. 29 (II): 65-84.

Fox, W.S. and J.H. Soper. 1952b. The distribution of some trees and shrubs of the Carolinian zone of southern Ontario, part 3. Trans. Royal Canadian Inst.30 (II): 99-130.

Fox, W.S. and J.H. Soper. 1953. The distribution of some trees and shrubs of the Carolinian zone of southern Ontario, part 2. Trans. Royal Canadian Inst. 30 (I): 3-32.

Given, D.R. and J.H. Soper. 1981. The arctic-alpine element of the vascular flora at Lake Superior. National Museum of Canada Publications in Botany 10: 1-70.

Guire, K.E. and E.G. Voss. 1963. Distribution of distinctive shoreline plants in the Great Lakes region. Michigan Botanist 2: 99-114.

Hoffman, D.N., and N.R. Richards. 1954. Soil survey of Bruce County. Report 16, Ontario Soil Survey, Experimental Farms Service and the Ontario Agricultural College. 110 pp. with maps (N & S) 1:63,360. http://sis.agr.gc.ca/cansis/publications/surveys/on/on16/on16_report.pdf

Hoganson, J.W. and H.G McDonald. 2007. First report of Jefferson's Ground Sloth (*Megalonyx jeffersonii*) in North Dakota and palaeoecological significance. Journal of Mammalogy 88(1): 73-80. https://www.researchgate.net/publication/228691506 http://sis.agr.gc.ca/cansis/publications/surveys/on/on16/index.html , https://static1.squarespace.com/static/52bb9733e4b09788115247ec/t/55c8b8e0e4b0d290d9e50a7b/1439217888606/otfV21N2June2003.pdf

Johnson, J. 2016. The Vascular Plants of the Bruce Peninsula, Ontario. Privately published. (joejohnson.book@gmail.com). 297 pages.

Krotkov, P. V. 1940. Botanical Explorations in the Bruce Peninsula, Ontario. Transactions of the Royal Canadian Institute No. 49, Vol. 23, part 1: 1-65.

Luer, Carlyle A. 1975. Native Orchids of the United States and Canada. New York Botanical Garden.

Marquis, R.J. and E.G. Voss. 1981. Distributions of some western North American plants disjunct in the Great Lakes region. Michigan Botanist 20: 53-82.

McKenney, D.W., Hutchinson, M.F., Kesteven, J.L., Venier, L.A. 2001. Canada´s plant hardiness zones revisited using modern climate interpolation techniques. Can. J. Plant Sci. 81: 129-143.

McKenney, D.W., J.H. Pedlar, K. Lawrence, K. Campbell, and M.F. Hutchinson. 2007. Beyond traditional hardiness zones: using climate envelopes to map plant range limits. BioScience 57(11): 929-937.

Meades, S.J. and W.J. Meades. 2018. Flora of Newfoundland and Labrador. https://newfoundland-labradorflora.ca

Oldham, M.J. and J. Consiglior. 2018. Autumn Coralroot (*Corallorhiza odontorhiza*), an update on its distribution in Ontario. Field Botanists of Ontario Newsletter 30(2): 4-6.

Phillips, D. W. and J. A. W: McCulloch. 1972. The climate of the Great Lakes Basin. Environment Canada Climatological Studies No. 20.

Putnam. D. F. and L. J. Chapman. 1938. Southern Ontario Climate. Scientific Agriculture Vol. 28.

Rouleau, E. and G. Lamoureux. 1992. Atlas of the vascular plants of the island of Newfoundland and of the islands of St. Pierre and Miquelon. Fleurbec. 777 pp.

Schik, K. 2018. What is the best way to control Buckthorn and protect native plants? FMR News. https://fmr.org/news/2018/04/12/control-buckthorn-protect-native-plants

Soper, J.H. 1956. Some families of restricted range in the Carolinian flora of Canada. Trans. Royal Canadian Inst. 31 (II): 69-90.

Soper, J.H. 1962. Some genera of restricted range in the Carolinian flora of Canada. Trans. Royal Canadian Inst. 34 (I): 3-56.

Stadelmann, L.P. 1973. The late glacial and postglacial history of the Bruce Peninsula, Ontario. M.Sc. thesis, University of Waterloo.

Van Sleeuwen, M. 2006. Natural fire regimes in Ontario. Ontario Ministry of Natural Resources, Queen's Printer for Ontario, Toronto. 143pp.

Voitk, A. and M. Voitk. 2006. Orchids on the rock. Gros Morne Co-operating Association, Rocky Harbour, Newfoundland. 96 pp.

Webber, L.R. and D.W. Hoffman. Origin, classification and use of Ontario soils. Ontario Dept. of Agriculture and Food. Publication 51. 58 pp. http://agrienvarchive.ca/land_use/download/origin_classif_use_ON-soils_1967.pdf

Wester, M.C., B.L. Henson, W.J. Crins, P.W.C. Uhlig and P.A. Gray. 2018. The Ecosystems of Ontario, Part 2: Ecodistricts. Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, ON. Science and Research Technical Report TR-26. 474 p. + appendices

Whiting. R. E and P. M. Catling. 1986. Orchids of Ontario. CanaColl Foundation, Ottawa. 169 pp.

Appendix Table 1. Bruce Peninsula Orchid Checklist (principle taxa – species and varieties) in alphabetical order with calciphile status and comparison with Muskoka and Parry Sound. *Goodyera repens* var. *repens* and var. *ophioides* are now usually combined under *G. repens* so although both are included for the Bruce Peninsula in the listing by the Bruce Peninsula Orchid Festival, they are treated as synonyms here. The plants with plain green leaves (var. *repens*) should be recognized as a form (a minor taxon not to be listed here). All listings are supported by correctly identified specimens in dried plant collections (herbaria) of universities and museums and by photographs. The scientific and common names are those used by VASCAN (Brouillet et al. 2010+) and recommended in recent published research. Note that this serves as a current list for the Bruce Peninsula if *Neottia bifolia* and *Platanthera blephariglottis* are excluded. "X" means present, "R" means present but rare.

Species /Taxon	**Calciphile**	**Bruce Penninsula**	**Muskoka / Parry Sound**
Aplectrum hyemale PUTTYROOT		X	X
Arethusa bulbosa DRAGON'S-MOUTH		R	X
Calopogon tuberosus TUBEROUS GRASS PINK		X	X
Calypso bulbosa var. *americana* CALYPSO	X	X	
Coeloglossum viride FROG ORCHID		X	X
Corallorhiza maculata var. *maculata* SPOTTED CORALROOT		X	X
Corallorhiza maculata var. *occidentalis* WESTERN SPOTTED CORALROOT		X	?
Corallorhiza odontorhiza var. *pringlei* PRINGLE'S CORALROOT		X	
Corallorhiza striata var. *striata* STRIPED CORALROOT	X	X	R
Corallorhiza striata var. *vreelandii* VREELAND'S STRIPED CORALROOT	X	X	
Corallorhiza trifida EARLY CORALROOT		X	X
Cypripedium acaule PINK LADY'S-SLIPPER		X	X

Cypripedium arietinum RAM'S-HEAD LADY'S-SLIPPER	X	X	
Cypripedium parviflorum var makasin NORTHERN YELLOW LADY'S-SLIPPER	X	X	
Cypripedium parviflorum var. pubescens LARGE YELLOW LADY'S-SLIPPER	X	X	R
Cypripedium reginae SHOWY LADY'S-SLIPPER	X	X	
Epipactis helleborine BROAD-LEAVED HELLEBORINE		X	X
Galearis (*Amerorchis*) *rotundifolia* SMALL ROUND-LEAVED ORCHID	X	X	
Galearis spectabilis SHOWY ORCHIS		X	
Goodyera oblongifolia MENZIES' RATTLESNAKE-PLANTAIN		X	X
Goodyera pubescens DOWNY RATTLESNAKE-PLANTAIN		R	X
Goodyera repens DWARF RATTLESNAKE-PLANTAIN		X	X
Goodyera tesselata CHECKERED RATTLESNAKE-PLANTAIN		X	X
Liparis loeselii LOESEL'S TWAYBLADE		X	X
Malaxis monophyllos var. brachypoda NORTH AMERICAN WHITE ADDER'S-MOUTH	X	X	
Malaxis unifolia GREEN ADDER'S-MOUTH		R	X
Neottia (*Listera*) *bifolia* (*L. australis*) SOUTHERN TWABLADE			X
Neottia (*Listera*) *convallarioides* BROAD-LIP TWAYBLADE		X	R
Neottia (*Listera*) *cordata* HEART-LEAVED TWAYBLADE		X	X
Neottia (*Listera*) *ovata* EGG-LEAVED TWAYBLADE		X	

Platanthera aquilonis TALL NORTHERN GREEN ORCHID		X	X
Platanthera blephariglottis var. *blephariglottis* WHITE FRINGED ORCHID			X
Platanthera clavellata CLUB-SPUR ORCHID		R	X
Platanthera dilatata var. *dilatata* TALL WHITE BOG ORCHID	X	X	
Platanthera flava var. *herbiola* NORTHERN TUBERCLED ORCHID		R	X
Platanthera hookeri var. *hookeri* HOOKER'S ORCHID		X	X
Platanthera hyperborea LEAFY NORTHERN GREEN ORCHID		X	X
Platanthera huronensis LAKE HURON GREEN ORCHID	X	X	
Platanthera lacera RAGGED FRINGED ORCHID		R	X
Platanthera leucophaea EASTERN PRAIRIE FRINGED ORCHID	X	X	
Platanthera macrophylla GREATER ROUND-LEAVED ORCHID		R	X
Platanthera obtusata subsp. *obtusata* BLUNT-LEAVED ORCHID		X	X
Platanthera orbiculata LESSER ROUND-LEAVED ORCHID		X	X
Platanthera psycodes SMALL PURPLE FRINGED ORCHID		X	X
Platanthera (*Piperia*) *unalascensis* ALASKA REIN ORCHID	X	X	
Pogonia ophioglossoides ROSE POGONIA		X	X
Spiranthes casei var. *casei* CASE'S LADIES'-TRESSES		R	X
Spiranthes incurvum (previously *S. cernua s. l.*) INCURVED LADIES'-TRESSES		X	X

Spiranthes lacera var. *lacera* NORTHERN SLENDER LADIES'-TRESSES		X	X
Spiranthes lucida SHINING LADIES'-TRESSES	X	X	R
Spiranthes magnicamporum GREAT PLAINS LADIES'-TRESSES	X	R	
Spiranthes romanzoffiana HOODED LADIES'-TRESSES		X	X
	15	50	37

ORCHIDS OF THE BRUCE PENINSULA
Part III: Is the Bruce Orchid Flora Changing?

Text by Paul M. Catling and Brenda Kostiuk, Brenda.kostiuk@gmail.com

Changes in the status of plants on the Bruce Peninsula may have already occurred. Here we consider some orchid examples. The future of orchids on the Bruce Peninsula is likely tied to the factors accounting for their diversity and abundance (see Part II in this series). Changes in these factors are thus a key consideration with respect to the future of orchids on the Bruce. We consider the likelihood and implications of changes and make some predictions. Another way of understanding the future of Bruce orchids is to consider the changes that have already occurred.

Figure 1. Calypso (*Calypso bulbosa* var. *americana*). Photo by G.M. Bartman taken on the Bruce.

DECLINE OF CALYPSO

One of the generally agreed upon changes in the status of Bruce Peninsula orchids is the decline of Calypso (*Calypso bulbosa* var. *americana,* Figure 1). It had declined in much of southern Ontario by 1986 when its current and historic distribution was mapped by Whiting and Catling (1986, p. 9). Its decline was attributed to loss of habitat and groundwater, but some now suspect that climate warming may have also played a role, even at that early stage. Johnson (2016) was under the impression that Calypso had disappeared from the lower part of the peninsula by 2016. Prior to that at least eight localities were known along the peninsula (Figure 2). Whether it has entirely gone from all of the cold swamps in the south is unknown, but it does seem safe to say that it has at least become less common on the southern part of the peninsula. This may be related to climate change. Mean summer temperatures at Wiarton have increased since 1981 (http://climate.weather.gc.ca/climate_normals/).

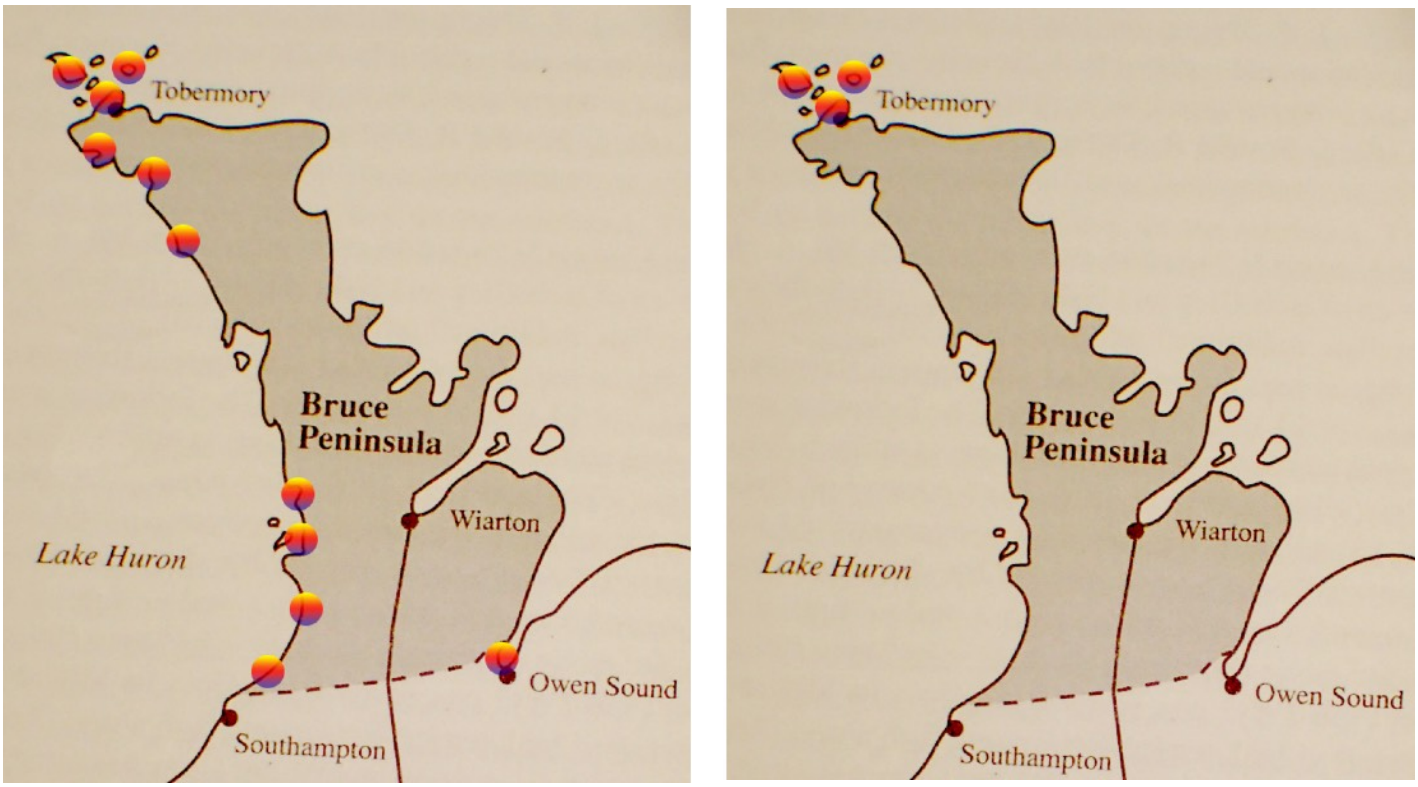


Figure 2. Records of Calypso on the Bruce prior to the 1980s (left) and after (right).

A number of other boreal orchids may be declining in the southern part of the peninsula, such as the Alaska Rein Orchid (*Platanthera unalascensis*) and Blunt-leaved Orchid (*Platanthera obtusata*) but data is insufficient to support decline of these at the present time.

INCREASE OF INCURVED LADIES'-TRESSES

If some boreal orchids have declined on the Bruce, some southern species might have increased. A good example of increase is Incurved Ladies'-tresses (*Spiranthes incurva,* Figure 3). Krotkov (1940) did not record it at all, and in the 1970's it was only known from the Sauble Beach area (Figure 4 top) in the southwest corner of the peninsula. It is now known throughout the Bruce (Figure 4 bottom). Johnson (2016, p. 110) noted that it was "obviously spreading northward since 1969" and a general northward spread of this species in Ontario with respect to its northern limits was documented by Catling and Oldham (2011).

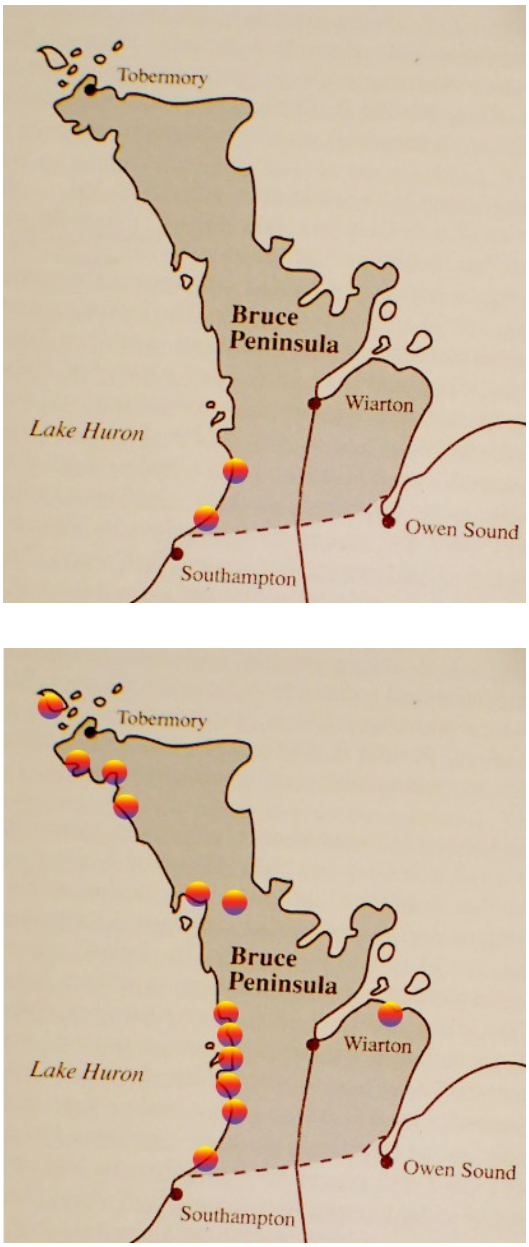


Figure 3. (left) Incurved Ladies'-tresses (*Spiranthes incurva*). Photo by P.M. Catling in Muskoka, Ontario.
Figure 4. (right) Records of Incurved Ladies'-tresses on the Bruce- 1970's (top) and at present (bottom).

A recent arrival on the Bruce is Pringle's Coralroot (*Corallorhiza odontorhiza* var. *pringlei,* Figure 5). It was first discovered in this region in 1987 near Sauble Falls and may become more well established in the sandy substrates of southwestern Bruce, but it is easily overlooked and varies in its appearance from year to year, making its status difficult to determine. It also appears to be spreading northward (Oldham and Consiglio 2018).

Figure 5. Pringle's Coralroot (*Corallorhiza odontorhiza* var. *pringlei*) is late blooming, easily overlooked and varies in its appearance from year to year. It was first discovered on the Bruce in 1987 when D.R. Gunn took this photo near Sauble Falls on 15 August.

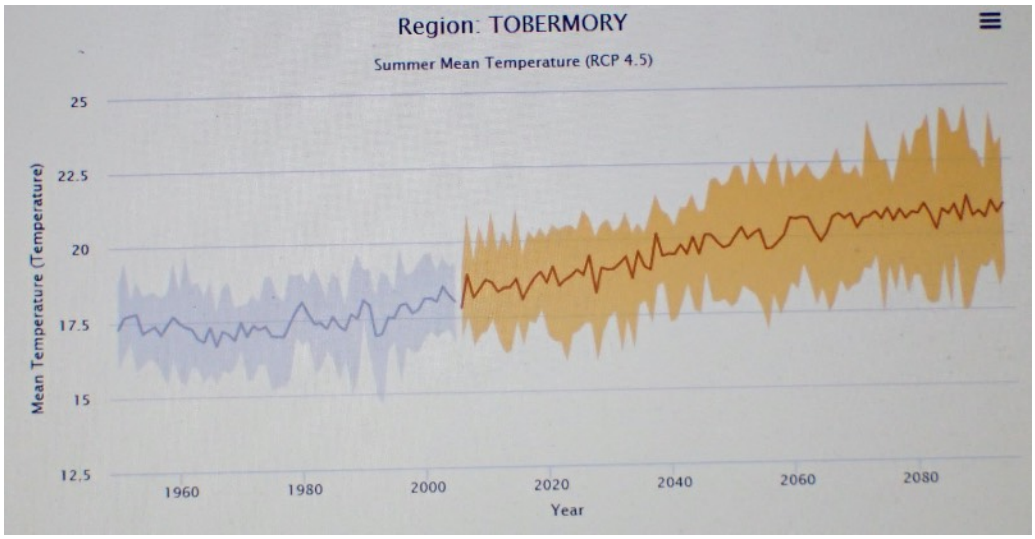
A WARMING CLIMATE - NO LONGER AN ARGUMENT?

The changes outlined above are of interest and suggest that changes have occurred, with the decline of cool-loving species and the increase of warm-loving species, due to a warming climate. We would not want to pin climate warming on the evidence provided by Bruce orchids, but nor do we have to. They are simply part of a supportive trend. The fact and the truth is that climate warming is happening. The following is from the prairie climate centre and the climate atlas of Canada: "The climate science community is made up of researchers from geology, astrophysics, oceanography, atmospheric physics and many other disciplines. Surveys show that 97% or more of these scientists agree that the planet is warming and that humans are the cause. This is an amazing amount of agreement, because scientists advance our knowledge of the world by challenging each other's evidence and ideas. They don't just agree with one another without very good reasons. Only solid conclusions win this kind of massive acceptance, and only then after years and years of testing and review" (https://climateatlas.ca/climate-change-basics).

TEMPERATURE AND PRECIPITATION PROJECTIONS

We have already noted above that summer temperatures have increased in the Bruce Peninsula over the past 30 years. A look at Tobermory over a longer period and into the future is more distressing. We used a low representative concentration pathway (RCP = 4.5) which indicates greenhouse gas concentration trajectories. Temperature is expected to increase by 2 °C by 2050 (Figure 6). Also a problem for cool-loving species, very hot days will increase from less than 1 to 4.4 by 2050 (Figure 7, Climate Atlas of Canada https://climateatlas.ca/data/grid/422/25C_2060_85).

It might be that an increase in precipitation would compensate for these temperature increases, but no change in precipitation is projected in the Climate Atlas.



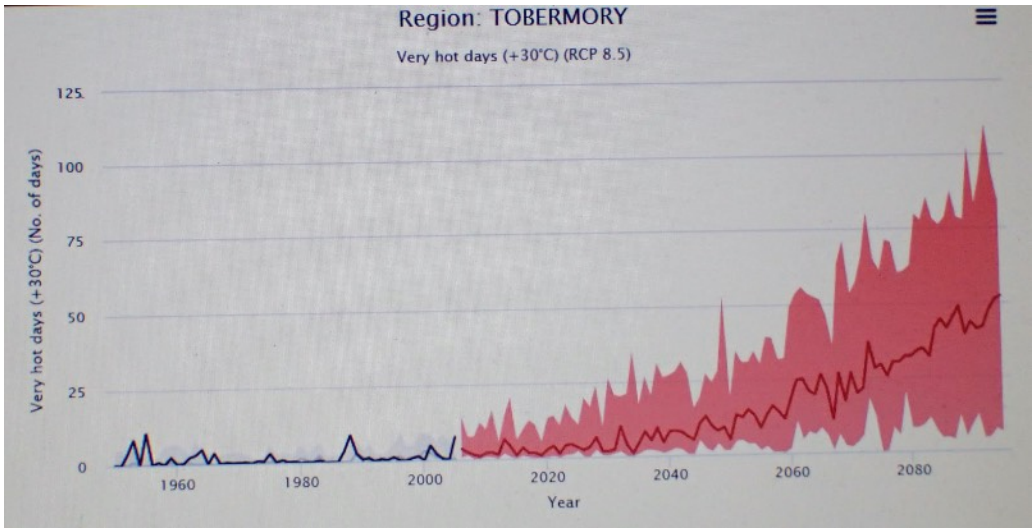


Figure 6. (top) A projection of summer mean temperatures for Tobermory.
Figure 7. (Bottom) A projection of very hot days for Tobermory.

PREDICTING IMPACT ON ORCHIDS

(1) Plant Hardiness

Many gardeners and farmers think that the Hardiness Zones on maps, which indicate the climatic limits of plants, are relatively stable. In the April 2014 issue of BioScience, an article appeared entitled "Change and Evolution in the Plant Hardiness Zones of Canada" (D.W. McKenney et al.) indicating that plant hardiness zones have shifted to the north. Shifts from 1961 – 1990 and 1981 – 2010 include: Toronto has changed from 6a to 7a, Tobermory has changed from 5a to 5b, and Owen Sound from 5b to 6a (http://www.planthardiness.gc.ca/?m=22&lang=en&prov=Ontario&val=O). Further shifts are anticipated. Thus landscapes are changing climatically but their living components may not be changing at the same rate. A landscape such as the Bruce Peninsula had a plant hardiness profile (Figure 8, blue box) that was within the hardiness zone limits (Figure 8, blue lines) of all species listed. Fast forward to ten years from now at the recent rate of change and the Bruce Peninsula landscape hardiness zones will have shifted (Figure 8, red box) so that *Calypso bulbosa* var. *americana* and *Galearis rotundifolia* will no longer occupy the landscape box, which however will then have more space available for *Liparis liliifolia* and *Sprianthes ovalis* var. *erostellata* (both more southern species neither of which has yet been found on the Bruce).

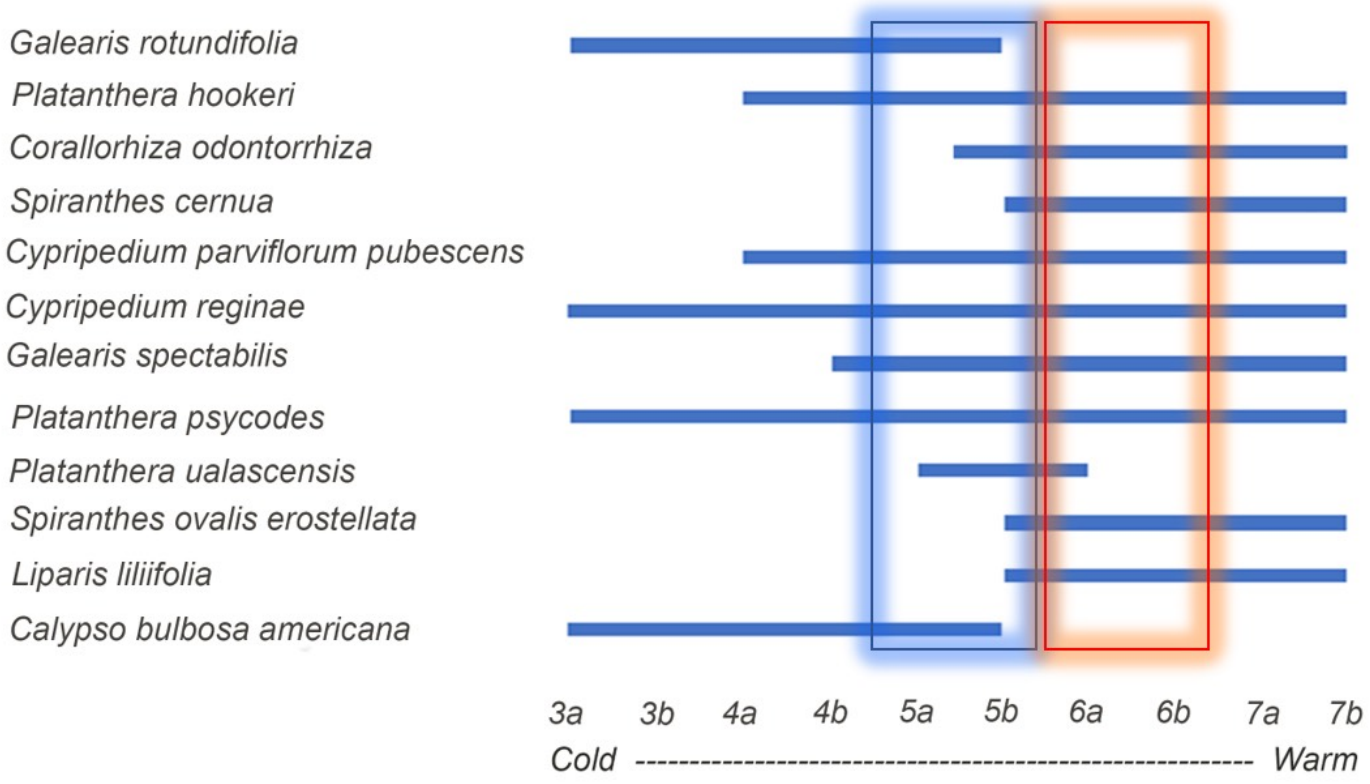


Figure 8. Hardiness zone profiles (blue lines) for 12 orchids showing the zones represented on the Bruce 30 years ago (inside blue box) and those present 10 years from now (red box) after an anticipated shift (well underway) is complete.

Limitations to this kind of prediction include the coarse spatial nature of the zones and the relatively unsystematic assignment of zones to plants. McKenney et al. (2007) proposed using climate envelopes to map the potential ranges of plants and to use these to predict climate change impacts. They describe limitations but advantages are clear. Using this method, an entire future climate range can be predicted. For example, the southern limit of the climate range of Sugar Maple will move north to the northern limit of Ohio (McKenney et al. (2001, 2007). Declines in Sugar Maple have already been noted in the northeast, and published in a few studies.

VULNERABILITY TO CLIMATE CHANGE

Recently, nine Ontario orchids were among species evaluated for susceptibility to climate change (Brinker et al. 2018). "Vulnerability" was defined as the degree to which a species is susceptible to and unable to cope with the adverse effects of climate change. NatureServe's Climate Change Vulnerability Index (CCVI) was used to assess the relative vulnerability of a representative group of 280 plant species in Ontario's Great Lakes Basin. This index incorporates exposure-weighted scoring of multiple factors that could affect species' vulnerability into a Microsoft Excel workbook. It considers a variety of results with a Monte Carlo simulation. In the spreadsheet, users enter numerical and categorical responses to questions about risk factors related to species exposure, climate change sensitivity, and adaptive capacity. An index score is calculated from the entries on exposure and sensitivity, and converted to a categorical vulnerability score.

Table 1. Vulnerability of nine Ontario orchids to climate change (Brinker et al. 2018).

Species	Vulnerability
Aplectrum huemale	moderate
Cypripedium arietinum	moderate
Cypripedium candidum	high
Cypripedium passerinum	moderate
Isotria medeoloides	high
Liparis liliifolia	low
Malaxis paludosa	high
Platanthera grandiflora	moderate
Platanthera leucophaea	high
Spiranthes magnicamporum	low
Triphora trianthophora	high

The focus is on species' intrinsic traits and physiological characteristics rather than geographic range size or anthropogenic threats, allowing comparisons among species with differing conservation statuses or range sizes.

Brinker et al. (2018) noted that "five of the vascular plant species with "high" vulnerability were orchids, which often need both specific insect pollinators (e.g., Bowles 1991) and mycorrhizal fungi for seedling germination and overall fitness (e.g., McCormick et al. 2009, 2012, Rock-Blake et al. 2017, Fay et al. 2018)." It was also noted that northern Lake Huron endemics and arctic alpine disjuncts were particularly susceptible.

EVALUATION OF SOME ADDITIONAL BRUCE PENINSULA ORCHIDS

We used the same Index (CCVI) to evaluate some additional Bruce Peninsula Orchids (Figure 9). Both Calypso and Alaska Rein Orchid are "extremely likely to substantially decrease or disappear by 2050." Large Yellow Lady's-slippers are "likely to decrease significantly." Even the commonest orchid on the Bruce, the introduced Broad-leaved Helleborine (*Epipactis helleborine*) "will decrease by 2050."

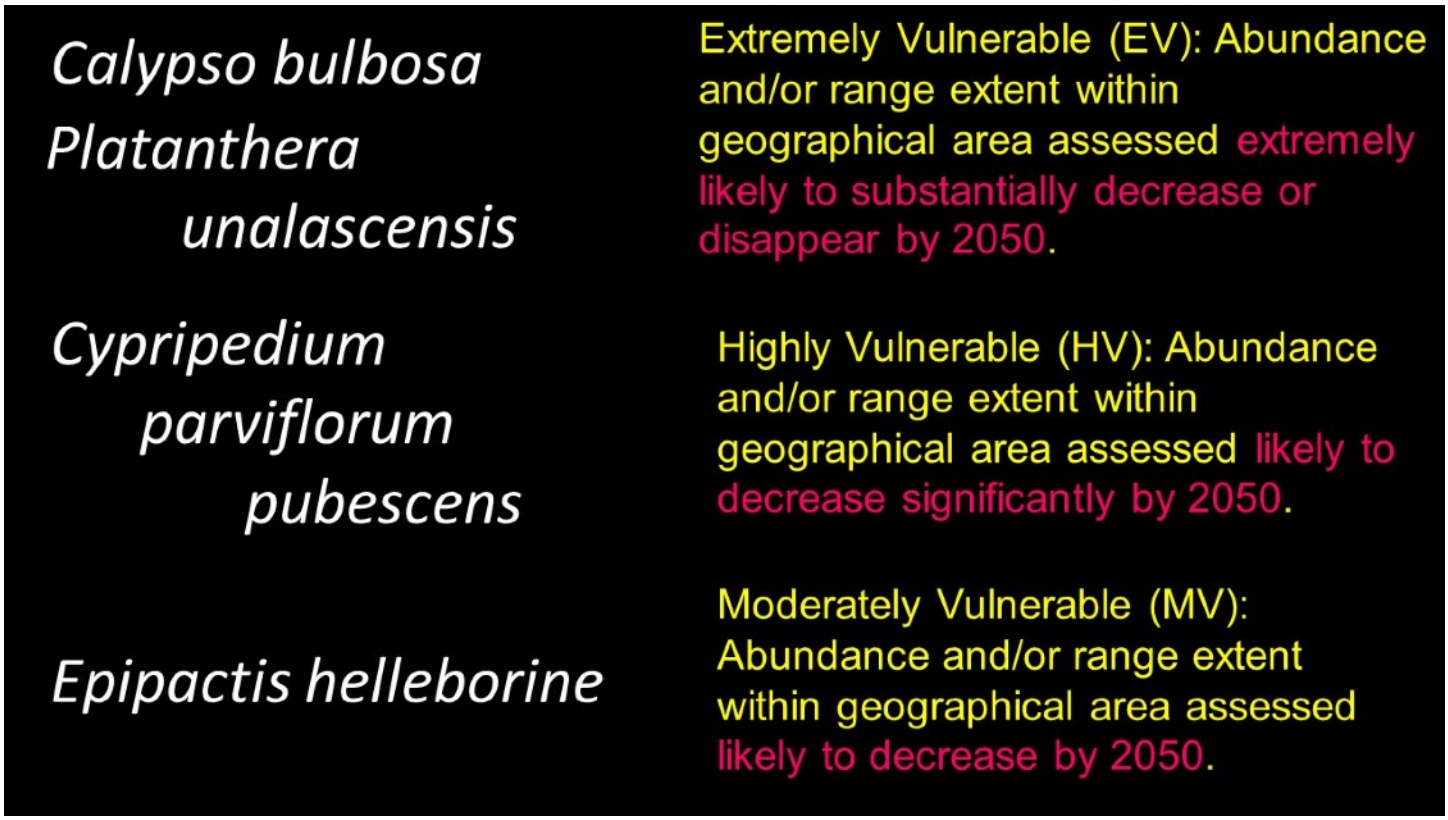


Figure 9. Results of climate change vulnerability assessment for four Bruce Peninsula orchids.

OTHER CONSIDERATIONS

The discussion up to this point has centered around climate change. The substrate of the Bruce Peninsula will not change but it will run out north of Manitoulin Island where acidic granite, quartzite, etc. will predominate. This would block the northward spread of a calcareous-adapted flora, but the special climate cannot move north anyway because it is dependent on Lake Huron. Considering a change in the earth's axis is beyond the scope of the present writing.

Disturbance has also been indicated as a major factor in Bruce orchid diversity and abundance (Part II in this series). As the peninsula becomes increasingly urban and manicured, habitat will be lost. Habitat that is part of parks and reserves may become less suitable without management. Although climate change may be a major future impact, the usual management issues relating to succession, fire, human-use, invasive species and water level manipulation will play a role in determining future status. Specifically, although orchids and other flora are a tourist attraction, the capability and resolve to manage the resource for its benefit may be inadequate. Protection efforts have been impressive, but it is, of course, not just a matter of closing the playground and/or putting a fence around it.

OLD AND NEW ORCHIDS

Although some of the orchids that we have associated with the unusual flora of the Bruce will probably soon disappear due to climate and ecological changes, at least some others will likely move in. People have speculated for years about finding new orchids on the Bruce Peninsula. Small White Lady's-slipper (*Cypripedium candidum*) was dubiously reported from near Cape Croker, and has been excluded from the Bruce flora. However, its occurrence in Stoco Fen in Hastings, approximately 300 km east of the Bruce, is in a kind of fen habitat that is widespread on the Bruce. White Fringed Orchid (*Platanthera blephariglottis*) has been suggested as a potential occurrence in Tobermory Bog. Future possibilities for new orchids on the Bruce include: (1) Purple Twayblade (*Liparis lilliifolia* Figure 10), now at Frontenac Park, Ontario, and near Montreal (COSEWIC 2010,

Figure 10. Purple Twayblade (*Liparis liliifolia*) is expected to establish in the southern Bruce Peninsula over the next few decades. If both Calypso and Lily-leaved Twayblade occur together on the Bruce it will likely only be for a few years while the former dies out and the latter becomes established. Photo of a painting by Louise Shaw, used with permission of Harvard University Archives.

Environment Canada 2016), and (2) Northern Oval Ladies'-tresses (*Spiranthes ovalis* var. *erostellata*), now along the St. Lawrence River in New York near Cornwall, Ontario (Daniel & Johnson, 2017).

It seems unlikely that the anticipated new orchids will be enough to replace the special diversity and large numbers of the old orchids. Although there are some limits to what can be done about climate change, a great deal can be done to improve management for the benefit of thousands of people and for a local economy based on wild orchid tourism. Let us hope for the best!

REFERENCES

Daniel, S., and A. Johnson. 2017. *Spiranthes erostellata* var. *erostellata* (Orchidaceae) new to New York. Phytoneuron 2017-72: 1-5.

Environment Canada. 2016. Recovery Strategy for the Purple Twayblade (*Liparis liliifolia*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 41 pp.

COSEWIC 2010. COSEWIC assessment and status report on the Purple Twayblade (*Liparis liliifolia*) in Canada. Committee on the status of Endangered Wildlife in Canada. Ottawa. Xii + 25 pp. (www.sararegistry.gc.ca?status/status_e.cfm

Brinker, S.R., M. Garvey and C.D. Jones. 2018. Climate change vulnerability assessment of species in the Ontario Great Lakes Basin. Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, ON. Climate Change Research Report CCRR-48. 85 p. + append. http://www.climateontario.ca/MNR_Publications/CCRR-48.pdf

Brown, D.M., G.A. McKay, and C.C. Chapman. 1980. The Climate of Southern Ontario. Climatological Studies No. 5, Atmospheric Environment Service, Environment Canada, Hull, Quebec. 67pp.

Bruce-Grey Plant Committee (Owen Sound Field Naturalists). 1997. A guide to the orchids of Bruce and Grey Counties, Ontario. Owen Sound Field Naturalists. 105 pp.

Catling, P.M. and M.J. Oldham. 2011. Recent expansion of *Spiranthes cernua* (Orchidaceae) into northern Ontario due to climate change? Canadian Field-Naturalist 125(1): 34-40.

Correll, D. S. 1950. Native Orchids of North America, North of Mexico. The Chronica Botanica Co.

Johnson, J. 2016. The Vascular Plants of the Bruce Peninsula, Ontario. Privately published. (joejohnson.book@gmail.com). 297 pages.

Krotkov, P. V. 1940. Botanical Explorations in the Bruce Peninsula, Ontario. Transactions of the Royal Canadian Institute No. 49, Vol. 23, part 1: 1-65.

McCormick, M.K. , D.F. Whigham, J.P. O'Neill, J.J. Becker, S. Werner, H.N. Rasmussen, T.D. Bruns, and L. Taylor. 2009. Abundance and distribution of *Corallorhiza odontorhiza* reflect variations in climate and ectomycorrhizae. Ecological Monographs 79(4): 619-635.

McCormick, M.K., D.L. Taylor, K. Juhaszova, R.K. Burnett, D.F. Whigham, and J.P. O'Neill. 2012. Limitations on orchid recruitment: not a simple picture. Molecular Ecology 21: 1511–1523.

McKenney, D.W., M.F. Hutchinson, J.L. Kesteven, and L.A. Venier. 2001. Canada´s plant hardiness zones revisited using modern climate interpolation techniques. Can. J. Plant Sci. 81: 129-143.

McKenney, D.W., J.H. Pedlar, K. Lawrence, K. Campbell, and M.F. Hutchinson. 2007. Beyond traditional hardiness zones: using climate envelopes to map plant range limits. BioScience 57(11): 929-937.

Oldham, M.J. and J. Consiglior. 2018. Autumn Coralroot (*Corallorhiza odontorhiza*), an update on its distribution in Ontario. Field Botanists of Ontario Newsletter 30(2): 4-6.

Rock-Blake, R., M.K. McCormick, H.E.A. Brooks, C.S. Jones, and D.F. Whigham. 2017. Symbiont abundance can affect host plant population dynamics. American Journal of Botany 104: 72–82.

Whiting. R. E and P. M. Catling. 1986. Orchids of Ontario. CanaColl Foundation, Ottawa. 169 pp.

THE 2019 NATIVE ORCHID CONFERENCE SYMPOSIUM ON THE BRUCE PENINSULA

Photo essay by Rick Burian, bur.rick@att.net

The picturesque village of Tobermory sits on Little Tub Harbour at the north end of the peninsula.

The conference started with a reception at the Tobermory Princess Hotel. About 75 participants attended the symposium this year.

Presentations were held at the Tobermory Community Center near the hotel.

Left: Paul Catling gave a talk on the reasons that there are so many species of orchids on the Bruce. Paul is the technical advisor to the NOC Journal and was a research scientist with Agriculture Canada.

For many, the field trips to look for orchids are the highlight of the annual conference. Two programs of outings were designed with half of the participants doing one of the two routes on one day and the other route on the second day. The other half did the trips in the opposite order. The groups were further divided each day with half of those starting at one spot and ending at the last location while the others did the reverse order preventing overcrowding, lessening the impact and allowing more time for photography. The first day of field trips was very rainy and many got soaked. Crazy orchid enthusiasts!

The Oliphant Fen has a great boardwalk for public access to the natural area. On our last day the sun was out enough to get the first buds to open on the Bog Candle, *Platanthera dilatata var. dilatata*.

The Oliphant Fen during a downpour.

Left: *Neottia ovata*, the Common Twayblade, an escape from Europe, has now spread some distance from across from the barn on Adis Road where the first plant was discovered a few years back. It is supposedly called the Egg-leaf Twayblade in Ontario.

Below: John Gange photographing *Neottia ovata*

Left: Though we found a few plants in other locations, this patch of *Corallorhiza trifida*, the Early Coralroot, had the most pristine flowers and the largest numbers. It was just up the road from the twayblade area.

A beautiful patch of Indian Paintbrush, *Castilleja coccinia.* Right: Black flies and mosquitoes were most bothersome in the late afternoon and the netting helped a little.

The mixed hardwood forest was a good site for ferns and wildflowers with a few orchids along the edges.

Goodyera oblongifolia is a species of orchid known by the common names Western Rattlesnake Plantain and Giant Rattlesnake Plantain. It is found throughout the western part of the US and Canada and into the Great Lakes region and Canadian Maritime Provinces.

Left: An exposed section of escarpment wall with nice plants of the Fragile Fern (*Cystopteris fragilis*) observed by David McAdoo Below: *Polygala paucifolia* (Gaywings or Fringed Polygala) is beautiful but not an orchid.

Bruce Peninsula National Park is located on a part of the Niagara Escarpment. The park comprises 156 square kilometers (60 square miles or 38,500 acres) and is one of the largest protected areas in southern Ontario, forming the core of UNESCO's Niagara Escarpment World Biosphere Reserve. The park offers opportunities for many outdoor activities, including hiking, camping, and bird watching. The park has trails ranging in difficulty from easy to expert, and connects to the Bruce Trail. A climb up 112 steps on a 20 meter (65 foot) viewing tower provides visitors with aerial views of the surrounding park and Georgian Bay.

There are 20 or more ferns found on the peninsula: Hart's Tongue Fern

An alvar is a biological environment based on a limestone plain with thin or no soil and, as a result, sparse grassland vegetation. Often flooded in the spring, and affected by drought in midsummer, alvars support a distinctive group of prairie-like plants. Most alvars occur either in northern Europe or around the Great Lakes in North America. This stressed habitat supports a community of rare plants and animals, including species more commonly found on prairie grasslands. Lichen and mosses are common species. Trees and bushes are absent or severely stunted. The primary cause of alvars is the shallow exposed bedrock. Flooding and drought, as noted, add to the stress of the site and prevent many species from growing. Alvars comprise a small percentage of the Earth's ecosystems by land extent. Although some 120 exist in the Great Lakes region, in total there are only about 112 square kilometers (43 sq. mi) left across the entire Great Lakes basin, and many of these have been degraded by agriculture and other human uses. More than half of all remaining alvars occur in Ontario. Crevices in the limestone provide a distinctive habitat which is somewhat protected from grazing, and which may provide habitat for unusual ferns.

Bottom left: Lakeside daisy (*Tetraneuris herbacea var. glabra*), a rare and endangered plant found only in such environments.
Right: A boardwalk protects the fragile ecosystem on the surface of the rocks.

On the west shore of the peninsula, the Singing Sands Beach at Dorcas Bay has extensive sand flats, wooded dunes and a picnic area. The name comes from the sound made by winds whistling through the sand dunes. The gradient of the beach is so shallow that bathers can walk out for hundreds of meters. The fens and surrounding woods are home to many rare plants including at least 11 orchid species.

Left: *Cypripedium arietinum*, commonly known as Ram's Head Lady's-slipper, has a limited distribution across northeastern and central Canada and the U.S., from Quebec to Wisconsin. The tiny slippers are only 1/2-3/4" tall on plants 4-16" tall. It grows in coniferous or mixed forests, swamps, and mossy bogs, often near cedar, spruce, or juniper trees. It is considered globally vulnerable, and is rare or endangered throughout much of its range.
Right: Singing Sands is a good place to find *Iris lacustris,* Dwarf Lake Iris. Its range is limited to the Great Lakes area and it is considered threatened due to habitat loss.

The one orchid for which we were present at its perfect peak of blooming and one which was in absolute abundance was *Cypripedium parviflorum*, the Yellow Lady's-slipper. One could make a book of just that species. Lots of color and shape variations.

Bottom left: *Neottia (Listera) cordata,* the Lesser or Heart-leaved Twayblade, has red or green flowers and has a pair or ovate-orbicular glossy green leaves. They are pollinated principally by fungus gnats. It has a circumpolar distribution being found in Europe, Asia, Greenland and large parts of North America.

Flowerpot Island is an island in Georgian Bay, in the Canadian province of Ontario and is a part of Fathom Five National Marine Park. The island spans 2.1 kilometers (1.3 mi) from east to west, and 1.5 kilometers (0.93 mi) from north to south, and has a total area of 2 square kilometers (490 acres). It is 6.5 kilometers (4 miles) from Tobermory and only accessible by boat. The name of the island comes from two rock pillars on its eastern shore, which look like flower pots. A third flowerpot once stood, but tumbled in 1903. The Flowerpots are a type of sea stack, formed over many years as wind, rain, waves and ice hammered away at the cliff that once stood alongside the water's edge. The softer rock eroded more quickly, leaving the harder rock remaining in the shape of flowerpots with trees growing on top. Years ago there was some work to support the stacks and you can see some bricks and mortar but today the policy of the parks department is to let nature take its course so the pots will eventually fall though over time new ones will form. The main reason that we came to the island was of course for the plants. Fifteen species of orchids are reportedly found here as well as several ferns and other plants.

An interesting feature on the island is the marl pond which is lined with a mix of leached calcium carbonate and clay providing a unique environment for plants.

Above: The Bird's-eye Primrose (*Primula mistassinica)* is one rare plant that lives on the shores.

Left: *Corallorhiza striata*, the Striped Coralroot, has a wide distribution throughout western North America and in the upper eastern part of the US and Canada. It can grow from 4-26" tall in single stems or clumps. It likes rich soil and grows in coniferous to deciduous forests.

Calypso bulbosa var. americana, the Fairy Slipper, is typically 4-6 inches tall with pink to purple flowers with white lips marked with yellow. White or even peach colored forms are occasionally found. This species' range is circumpolar, and includes California, the Rocky Mountain states and most of the most northerly states of the United States; most of Canada; Scandinavia, much of European and Asiatic Russia; China, Mongolia, Korea and Japan. In the west of the continent is var. *occidentalis* which has a white lip with red markings and no yellow.

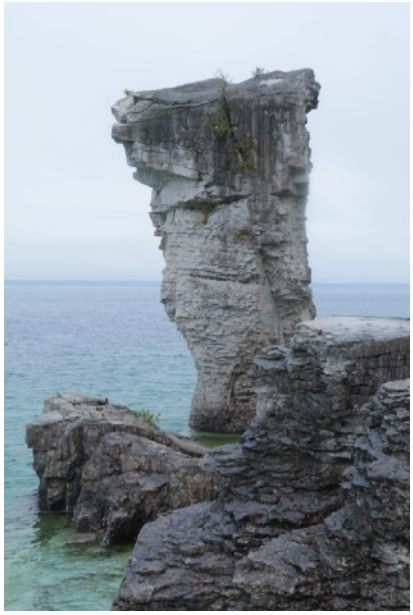
The sunsets from Bay Street in Tobermory near our lodging were pretty amazing

2019 FIELD TRIPS ON THE BRUCE PENINSULA

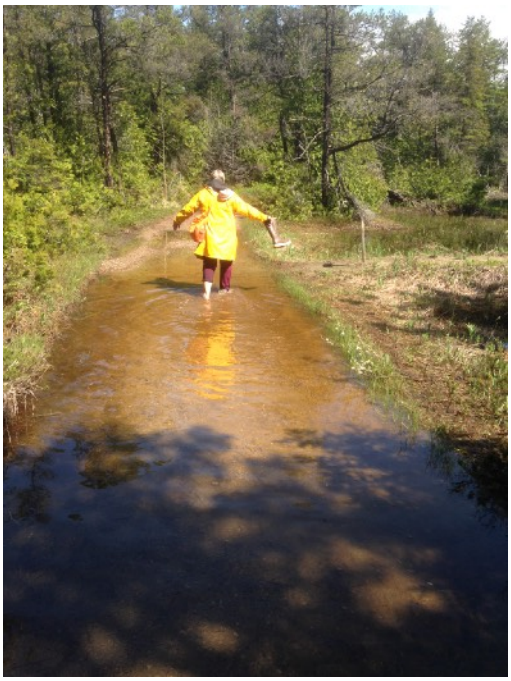
Text by Cathy Bloome, catbloome@gmail.com
Photos by Cathy Bloome, Mike Parsons and Janet Vinyard

Most years I try to make the NOC symposium, but on those off years I can't attend, I miss hearing about what happened, especially on the field trips. If you haven't been to a symposium, the usual method to manage the field trips is to get the attendees into groups. Each group will go to a different orchid site, rotating to different sites on other days. So, here's a fun report of Group 1 field trip adventures.

Needless to say, all of us in Group 1 thought we were the best group. We proved how sturdy we were by going out the first day to Flowerpot Island in an open speedboat on rough seas and rain! We all came prepared for the bad weather, but didn't refuse extra plastic ponchos that were given to us by the boat company. Since this year has been quite cool in the east, all the orchids seem to be about two weeks behind in blooming. Arriving at the island there was still light rain, but we all hit the trails in search of our treasures. Blooming orchids were hard to find, but some eagle eye scouts found some of the tiniest orchids in bloom. Two color varieties of Heart-leaved Twayblade, *Neottia (Listera) cordata,* had everyone lying on a wooden boardwalk, trying to get the best angle. Those boardwalks were lethal, being wet from the rain and moss. A few people fell and sustained bodily and camera injuries. No one had to be airlifted out though! There were other interesting plant families to be seen, like rare ferns and trilliums. The mosses that line the limestone walls were incredible! The structures that the island is named after are quite unusual. Not sure if I would call them flower pots. Everyone spent the maximum amount of time exploring the island. A few stragglers missed the first boat back to Tobermory, but caught the next one 15 minutes later.



We regrouped after lunch and headed over to Singing Sands for more orchid hunting. Rubber boots were necessary for this hike unless you didn't mind getting your feet wet. Lots of Ram's-head Lady's-slippers, *Cypripedium arietinum,* were found in perfect condition, including many large clumps. Everyone took turns with their cameras to get the best angle.



Next, we headed over to Bruce Alvar Nature Reserve. There was not much in the way of orchids, but it was such a unique habitat to see. Many rare plants populate this reserve. The Lakeside Daisy, *Tetraneuris herbacea,* (pictured above) was in full bloom. The reserve is reported to be home to the Massasauga Rattlesnake which we fortunately or unfortunately didn't see. You decide!

On Sunday there was a half day of unplanned field trips. Most went off to explore on their own, but it seemed like many of us ended up at what we called the "yellow gate trail." We found lots of Dwarf Lake Iris, *Iris lacustris,* pictured top left) in bloom and Yellow Lady's-slipper*s, Cypripedium parviflorum.* It was a long hike, but there was lots to look at. Many different types of butterflies were to be seen, including a Silver Blue (pictured right bottom).

On Monday, the second full day of field trips, our group headed south and started at Walker Woods. This was a boot-sucking bog. There were only a few Hooker's Orchids, *Platanthera hookeri*, in bloom, so we all lined up waiting our turn to photograph while balancing on downed logs. The next stop was Oliphant Fen. It was located on a beautiful bay and had a nice boardwalk. There were a few plants of Tall White Bog Orchid, *Platanthera dilatata,* just beginning to open. Hanging off the edge of the boardwalk required some good balance. Glad to report no one fell over the edge.

Then we headed over to see an Egg-leaved Twayblade, *Neottia (Listera) ovata*. This plant had everyone lying on the side of a busy road, while others made sure that passing cars didn't run over the photographers.

Next we waded up a trail through one foot of water to see a large clump of Early Coralroot, *Corallorhiza trifida*. With all this lying on the ground, we worked up quite an appetite. Our lunch was spent at a small town beach. The scenery and company were outstanding!

Our last stop was at Petrel Point Nature Reserve. The reserve had several boardwalk trails. Not many orchids were in bloom, except for Yellow Lady's-slippers, *Cypripedium parviflorum*. We did find a caged area with several plants of Showy Lady's-slipper, *Cypripedium reginae,* too early for blooming. We also saw two parked vans with orchid license plates!

One of the best parts of the symposium is getting to know fellow orchid lovers. Each time I go to a gathering, I get to know a few more of the members. That's what makes it's so much fun to be a part of this organization. If you haven't been to one of our annual symposiums, try to fit it into your schedule next year!

RAM'S-HEAD LADY'S-SLIPPER ORCHIDS SEEN DURING THE NOC 2019 CONFERENCE FIELD TRIPS

Text and photos by Tom Sampliner, tomsam2651@hotmail.com

During the June 2019 symposium field trips on the Bruce Peninsula of Ontario, Canada, members got a good look at Rams-head Lady's-slipper Orchids, *Cypripedium arietinum*, in some of their typical natural settings. We saw them in sandy openings along the shoreline of Lake Huron, amidst Jack Pine clusters, and a few at an alvar site. The species is ranked as globally vulnerable according to the North American Orchid Conservation Center (2019).

Many of the symposium participants had never seen the species. For others, because the species is so rare, only a specimen or two had been previously encountered. What we saw on the Bruce was a peak bloom with enough singles, doubles and tight clusters to make an educational and aesthetically pleasing display. The orchids presented themselves among some companion flowers that are illustrated herein. I hope that showing the companion plants will promote better understanding of the orchids' habitat and aid in the spotting of additional possible sites of the orchid throughout its limited range.

For those unfamiliar with the species, I offer this brief description: a rhizome produces the flowering plant stem on which normally only one flower occurs. Health, age and vigor of the rhizome helps explain why some doubles and clusters occur. The conical slipper, or pouch, is basically white with liberal blotches,

lines and dots of what I will call a dark maroon. Having said this, I must also point out that elsewhere this orchid does have a white pouch color form with the other five flower parts being green. I'll leave it for the experts to debate whether this is merely a color form or qualifies as an albino. Speaking to the regular color form which is all we did see, the pouch rim is well-endowed with white hairs. The lateral petals and sepals are free all the way to their base and are colored brown to greenish. The pouch is tiny and may well be the tiniest of the slippers of North America. In the Great Lakes region, flowering time is early June. I have attached images I took during the conference to depict single-flowered specimens, a double, and a most handsome tightly packed cluster. I also provide an image of the all white one.

The genus *Cypripedium* is one of five within the subfamily Cypripedioideae, with some 50 recognized species of which 12 occur in the U.S. and Canada (Coleman 2018). Coleman and many other authors observed Rams-head Lady's-slipper orchids occurring in forests with tree associates such as cedar, juniper shrubs and some other mixed species. On the Bruce, we saw them in open galleries of two types. One was beneath dense junipers upon sandy, sparsely vegetated old dunes with companion plants Gaywings, *Polygala paucifolia*; Starry Solomon's Seal, *Maianthemum stellatum*; Dwarf Lake Crested Iris, *Iris lacustris*; and Bearberry, *Arctostaphylos uva-ursi*. Although we are primarily an orchid group, I take the liberty of attaching images of these other wildflowers to show what they look like.

Another slightly different site was inland from these ancient vegetated dunes, upon flat openings within coniferous forest and surface limestone exposure. Here, nearby companion plants were: Indian Paintbrush, *Castilleja coccinea*; Yellow Lady's-slipper Orchids, *Cypripedium parviflorum* var. *pubescens*; and assorted grasses and sedges. The latter habitat was certainly the less challenging when photographers attempt to lie down to take a photograph. The former had sharp Juniper needles to contend with and also the unfortunate consequence that any prostrate posture by the photographer was sure to do damage to other vegetation. If extreme care was not taken, the same result happened to the orchids.

It is interesting to note that we could observe that many of the orchids had been visited by their pollinator and that this had caused the dorsal sepal to collapse downward onto the pouch, closing off the opening (Brackley 1985). This could be seen on singles, doubles and in those tight clusters.

There are places within the species range where white forms are present alongside the normal color form. The most dependable and prolific such site to see both color forms is at Grand Sable Dunes in Upper Michigan.

For those interested, a fascinating set of observations regarding pollinators for this species has been previously set forth by Catling & Kostiuk (2013).

As I hope the reader can conclude from my images, the Rams-head Lady's-slipper Orchid is a handsome species which, due to its globally vulnerable status, should be further studied and protected as a valuable member of our flora.

REFERENCES

Brackley, F.E. 1985. The Orchids of New Hampshire. Rhodora 87: 1-117.

Catling, P.M. and B. Kostiuk. 2013. Pollination of Ram's-Head Lady's-Slipper (*Cypripedium arietinum*) in eastern Ontario and notes on the pollination system. Native Orchid Conference Journal 10(4): 20-28.

Coleman, R.A. 2018. The Genus *Cypripedium* of the U.S. and Canada part I. Native Orchid Conference Journal 15(1): 5-7.

North American Orchid Conservation Center, [accessed August 2019] http://goorchids.northamericanorchidcenter.org/species/cypripedium/arietinum/

THE YELLOW SLIPPERS OF EASTERN NORTH AMERICA AS A CONTINUUM RATHER THAN THREE VARIETIES OF ONE SPECIES, OR WHO DEY?

Text and photos by Tom Sampliner, tomsam2651@hotmail.com

Yellow Lady's-slipper Orchids (*Cypripedium parviflorum*) are a charismatic, highly sought-after group of orchids found in North America and Europe. Despite long-standing popularity, their taxonomic treatment has been varied. In my lifetime, the classification has run a course from treating them all as one widely varying worldwide species, to separating European yellows from their North American counterparts, to further dividing the North American yellows in various ways. These divisions have included a single species for the New World to an assortment of the numbers and names for varieties within one named North American species. Current taxonomy for the three named Eastern North American Yellow Lady's-slipper Orchids consists of a Large Yellow Lady's-slipper, *Cypripedium parviflorum* var. *pubescens*; a Southern Small Yellow Lady's-slipper, *Cypripedium parviflorum* var. *parviflorum*; and a Northern Small Yellow Lady's-slipper, *Cypripedium parviflorum* var. *makasin* (Go Orchids, 2019).

Taxonomic studies using DNA groupings, plus carefully defined visual traits, can establish a separation among the three taxa that may not be verifiable out in the field. This scenario has long bothered me; therefore, I have engaged in an extended discussion on this topic with other orchid aficionados, both laymen and professionals. It is true that specimens can be found that exhibit a perfect expression of all the traits attributed to each of the described taxa. However, it is also true that one may encounter specimens that do not. It certainly seems to me and to many others who have observed thousands of these orchids in the field over many years, that more times than not, the Yellow Lady's-slippers seem to represent a continuum rather than a neat division into identifiable taxa. Others, including professionals, have made similar comments.

First, let's examine what has been set forth as the traits composing a pure example for each variety of Yellow Lady's-slipper in North America. This will increase the total number of taxa up to four, though the latest addition, *exiliens*, is limited in its distribution to the Pacific Northwest (Sheviak, 2010).

The most recent key appears to be that in Coleman (2018) wherein the varieties of *Cypripedium parviflorum* are separated as follows:

1a. Uppermost entirely tubular bract glabrous or with very few hairs; scent intense, sweet … 2

2a. flowers small; pouch 15–29 mm; sepals and petals usually suffused with dark reddish brown or madder, or spotted and blotched — var. *makasin*

2b. flowers small; pouch 16–26 mm; sepals and petals dull green tan with small clusters of rust colored spots — var. *exiliens*

1b. Uppermost entirely tubular bract densely to conspicuously silvery-pubescent; scent moderate to faint, rose or musty … 3

3a. flowers large to small, pouch 20–54 mm; sepals unmarked to commonly spotted, striped, and reticulately marked with reddish brown or madder, rarely extensively blotched — var. *pubescens*

3b. flowers small, pouch 22–34 mm; sepals and petals densely and minutely spotted with dark reddish brown or madder and appearing uniformly dark, (rarely coarsely spotted and blotched); scent moderate to faint, rose or musty — var. *parviflorum*

Having set forth a starting point, it does not take much searching to find difficulties in identifying what one is seeing. Sheviak (1995) wrote that variation in observable traits may depend upon soil and exposure to sun. Sheviak (1993, 1994, 1995, and 2010) has also set forth the current taxonomic view as modified by Coleman (2018), that includes the most recently recognized taxon, *exiliens.*

While I have no quarrel with the authors setting forth descriptive frameworks for each of the four varieties to fit into, clearly for the layman, it is not sufficient for field determination. Within a given population, one can readily find variations that calls into question the classification of a given specimen. One can also find populations that show such variation that even experts would be hard-pressed to attribute clear membership by all specimens within that population into one of the four varieties. For example, Homoya (1993) writes, "Part of the reason for the single species concept is the relatively high frequency of integration between the two varieties. I have seen populations where it is impossible to determine an individual's varietal status."

Specimens can have variation in one, many, or all of the following traits, whether they be a single, double or clump from the same rhizome: configuration/shape of the pouch, size, color, including blotching, lines, dots, or complete lack thereof, twisting of lateral parts, posture of the lateral parts, and of course, odor or lack thereof.

Having described this observational quagmire, perhaps DNA could explain that no matter what the outwardly visible traits are, there is a clear and uniform category into which you can place any specimen or entire clump. Color change/ fading due to flower aging has been noted by Sheviak (2013). In a revealing experiment, he grew *Cypripedium parviflorum* from the same rhizome, showing how pouch color can shift from a dark, rich yellow to a creamy white in just one or two days following the initial unfurling of the orchid flower.

No images or explanation is tendered for any difference in the shape of the pouch or for clearly visible differences in flower dimensions. One would be hard-pressed to argue these traits could change with flower age.

In my images, in the same clump arising from one rhizome, we clearly observe that there are differences in the size and configuration of pouches among cluster members. Color shifting can be attributed to flower aging, but nowhere is there any evidence that a smaller, rounder, more squat pouch results over time. Could this be a manifestation of a peloric trait? Could we be witnessing radiation within the species with either a hybrid or perhaps even something new at the species level, developing right before our eyes? Can the different appearance of several of the classic traits assigned to each of the taxa be otherwise explained? Is there an adaptive benefit to some members of the same orchid rhizome showing different colors upon opening or even as they age? One could theorize there is a benefit in relationship to would-be pollinators by increasing the breadth of the color variation within the same rhizome.

Based upon what we all saw during the Native Orchid Conference symposium field trips this June on the Bruce peninsula, our eyes confirmed what various authors have spoken to in the past.

Fred Case (1987, p. 75) wrote, "… owing to hybridization, tremendous variation occurs in the Great Lakes Region, where race ranges overlap. Besides a hybrid complex, two rather distinctive varieties can occasionally be found growing in pure populations."

In my group image, above, you can notice a distinctive color difference between the specimen on the extreme left side of this possibly clonal group as well as a difference in both the size and configuration from other members of the group.

More research and observations noting all possible variables must be undertaken long-term and in many geographical areas to gain a better understanding variation. Until further and better information comes along, I conclude that the Yellow Lady's-slipper Orchids of North America are really spread along a continuum rather than fitting neatly into separate taxa labeled at the varietal level. So for now, I would string them along a continuum on a sliding scale rather than trying to fit them into neatly defined varieties. Or perhaps we can borrow from the sporting world the colloquial phrase for a group not well known or understood yet, "Who Dey?"

REFERENCES

Case, F.W. 1987. Orchids of the Western Great Lakes Region. Cranbrook Institute of Science Bulletin 48. 251 pp.

Coleman, R.A. 2018. The genus *Cypripedium* of the United States and Canada, part 1. Native Orchid Conference Journal 15(1): 21.

Go Orchids, North American Orchid Conservation Center, [accessed August 2019]
http://goorchids.northamericanorchidcenter.org/species/cypripedium/parviflorum/

Homoya, M.A. 1993. Orchids of Indiana. Indiana University Press. 276 pp.

Sheviak, C.J. 2010. *Cypripedium parviflorum* in the Northwest, with the description of a new variety. Native Orchid Conference Journal 7(2): 1-9, 13-15.

Sheviak, C.J. 2013. Developmentally variable lip color in *Cypripedium parviflorum* Salisb.: more than a form? Native Orchid Conference Journal, 10 (1):26-30.

THE NATIVE ORCHIDS OF MT. HOOD

Text and photos by Rick Burian, bur.rick@att.net

It is with great disappointment that the 2020 annual symposium had to be canceled due to the big pandemic. We are all looking forward to the rescheduled conference on June 25-28, 2021 which will be held in the same venue and with most of the same speakers. Even though we don't get to meet this June I thought that perhaps featuring some of the orchids of another area of the Pacific Northwest might keep everyone excited about our planned gathering and maybe encourage many of you to head west next year to enjoy the beauty of Oregon and Washington.

Mt. Hood is practically in my back yard (OK, views of it are within walking distance but as the Steller's Jay flies it is about 45 miles east of Portland). At 11,249 feet tall it is the highest peak in Oregon and is part of the Cascade Range of mountains which extend from British Columbia through Washington, Oregon and into California. The Cascades are part of the Pacific Ocean's Ring of Fire, the ring of volcanoes and associated mountains around the Pacific Ocean. All of the eruptions in the contiguous United States over the last 200 years have been from Cascade volcanoes. The tallest in the range is Mt. Rainier (14,410') in Washington with Mt. Adams (12,281'), Glacier Peak (10,541'), Mt. Baker (10,781), Mt. Shuksan (9131') and Mt. St. Helens (8,365') nearby. In Oregon we also have Mt. Jefferson (10,495'), Mt. Bachelor (9068'), Three Sisters (Faith, Hope and Charity; 10,363'), Mt. McLaughlin (9495') and Mt. Thielsen (9183'). California is known for Mt. Shasta (14,179') and Lassen Peak (10, 462'). The Columbia River Gorge is the only major break of the range in the United States. It is north of Mt. Hood by about 25 miles.

The climate around Mt. Hood varies quite a bit depending on the elevation and position. While we get 43" of rain annually in Portland, the rainfall varies from just 15" less than 20 miles east of the mountain (The Dalles) to 75" about 20 miles west (Cascade Locks). At Mt. Hood Village (1,247') rainfall is about 57" each year, mostly from September to August. Yes, it can rain any time of year but June to August has the least. Temperatures average 34/46°F in January and 57/84°F in August. At Timberline Lodge (5,960') it snows 540" each year (that is equivalent to about 54" of rain) with a snow base of 180". The longest ski and snowboard season in North America is at Mt. Hood's Timberline. For orchids around the mountain it is all about location, location, location.

The state of Oregon claims to have 4,560 vascular plant species. As for orchids, there are indications that 28 species have been recorded over the years but my estimate is closer to 26. Here are some of the species that I have found regularly while taking hikes around Mt. Hood. Generally the best time to see orchids is in June through August but of course elevation stretches the season out. For our symposium in the Olympic National Park we expect to see many of these same plants. Mt. Hood is about 225 miles (278 road miles, 5 hours driving) from Port Angeles. There the average rainfall is about 56" though some areas can get as much as 220" annually (Mt. Olympus) and less than 17" in the rain shadow (Sequim, pronounced "Skwim").

I hope that this piques your interest in joining us in June of 2021.

Corallorhiza maculata
(Spotted Coralroot)

Corallorhiza mertensiana
(Western Coralroot)

Corallorhiza striata
(Striped Coralroot)

Goodyera oblongifolia
(Menzie's Rattlesnake Plantain)

Neottia banksiana
(Northwest Twayblade)

Neottia cordata
(Heart-leaved Twayblade)

Platanthera stricta
(Slender Bog Orchid)

Platanthera (*Piperia) transversa*
(Flat-spurred Piperia)

Platanthera (*Piperia) unalascensis*
(Alaska Piperia)

Platanthera dilatata
var. *leucostachys*
(Northern White Bog Orchid)

Spiranthes romanzoffiana
(Hooded Ladies' Tresses)

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