

Representation and Conservation of Rare Plants in Ontario's Carolinian Zone Provincial and National Parks

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Abstract

Using the Natural Heritage Information Centre's (NHIC) Element Occurrence (EODb) and Natural Areas (NADb) databases, we investigated the occurrence of provincially rare native vascular plants in provincial and national parks in Ontario's Carolinian Zone. Based on global and provincial species conservation priority ranks (G1, G2, S1, S2, etc.) and formal risk categories (Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Ontario Ministry of Natural Resources (OMNR) Vulnerable, Threatened, and Endangered (VTE) designations) we determined what proportion of the occurrences of provincially rare plants in this zone were in parks. In addition, we examined occurrences based on park class and park size. Results indicate that many provincially rare plants are afforded some protection in provincial and national parks. A few species are found in the Carolinian Zone only in parks, but many are not currently protected in any parks. Although some degree of protection is afforded to rare plants by virtue of occurrence in parks, some threats are actually greater in certain parks than elsewhere (e.g. trampling by humans, deer browsing). Our knowledge about the occurrence of rare plants in parks is often based on inventories done two or three decades ago, and for many species it is not known if the rare plant still persists in the park, exactly where it occurs, or the size of populations. Other recommendations are made to improve rare plant conservation in parks.

Background

Rare Plants in Ontario's Carolinian Zone

The few remaining natural areas in the Carolinian Zone of Ontario are predominately composed of vegetation more typical of the Carolinas of the United States; this is due, in part, to climatic factors such as long summers, mild winters, low snowfall, and moderate rainfall). Vascular plant diversity in this region is unparalleled in Canada. Although the Carolinian Zone accounts for only 2.2% of Ontario's land mass, 442 (60%) of Ontario's 732 provincially rare native vascular plant species (based on Oldham 1999) are present here, while 246 (34%) have their Ontario ranges completely restricted to the Carolinian Zone. Moreover, the majority of extremely rare (78% of S1 species), historic (88% of SH species) and extirpated (92% of SX species) vascular plant species in Ontario are restricted to the Carolinian Zone.

There are 21 provincial parks and one national park in the Carolinian Zone (Figure 1 and Table 1). For the purposes of this paper, the Carolinian Zone was defined as OMNR's Ecological Site Region 7E (as mapped in Riley et al. 1997). Parks are organized into different classes based on the types of activities (e.g. boating, fish-

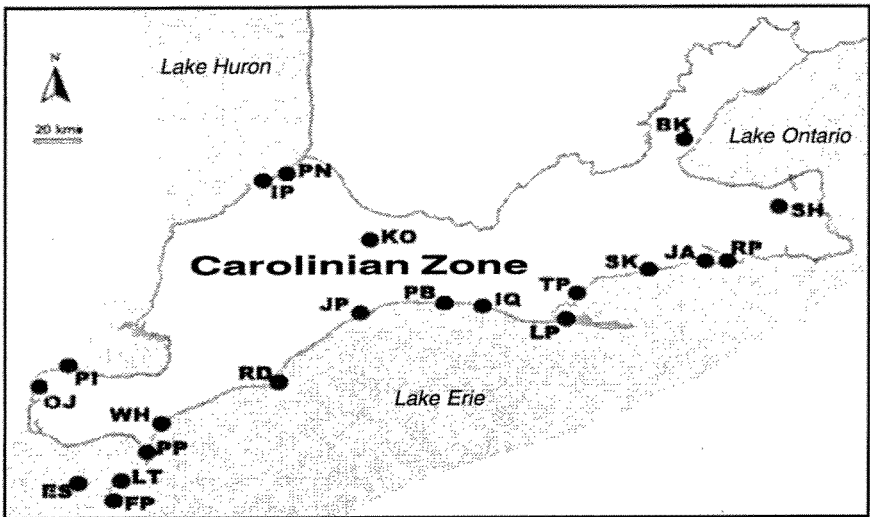


Figure 1: Ontario's Carolinian Zone, based on Ontario Ministry of Natural Resources Ecological Site Region 7E (Riley et al. 1997), and the 22 Provincial and National Parks examined in this study.

Code	Park	Park Class
BK	Bronte Creek Provincial Park	Recreation
ES	East Sister Island Provincial Nature Reserve	Nature Reserve
FP	Fish Point Provincial Nature Reserve	Nature Reserve
IP	Ipperwash Provincial Park	Recreation
IQ	Iroquois Beach (now Port Burwell P.P.)	Recreation
JA	James N. Allen Provincial Nature Reserve	Recreation
JP	John E. Pearce Provincial Nature Reserve	Nature Reserve
KO	Komoka Provincial Park	Recreation
LP	Long Point Provincial Park	Recreation
LT	Lighthouse Point Provincial Nature Reserve	Nature Reserve
OJ	Ojibway Prairie Provincial Nature Reserve	Nature Reserve
PI	Peche Island Provincial Park	Recreation
PN	The Pinery Provincial Park	Natural Environment
PP	Point Pelee National Park	National Park
RD	Rondeau Provincial Park	Natural Environment
RP	Rock Point Provincial Park	Recreation
SH	Short Hills Provincial Park	Natural Environment
SK	Selkirk Provincial Park	Recreation
TP	Turkey Point Provincial Park	Recreation
WH	Wheatley Provincial Park	Recreation

Table 1: Class of provincial and national parks in Carolinian Zone and park codes used in Figure 1.

ing, camping) permitted in each park. The three classes of provincial parks found in the Carolinian Zone, in order of decreasing human impact, are Recreation, Natural Environment and Nature Reserve. Together, these 22 parks comprise only 0.4% of the Carolinian Zone's land area (91 of 21,812 km²).

Two previous studies that documented the status of rare plants within the Carolinian Zone are of particular relevance to our paper. Lindsay (1982) summarized the number of provincially rare plants in 12 provincial parks (Rondeau, Pinery, Bronte Creek, Short Hills, Turkey Point, Wheatley, Long Point, Ojibway Prairie, Fish Point, Lighthouse Point, Ipperwash, and East Sister Island). She noted that the 203 rare plants known at that time from these parks constituted 33% of the rare flora of Ontario (based on Argus and White 1977) and 56% of the rare plants of the Deciduous Forest Region (or Carolinian Zone). More than half of the rare plants in the 12 parks (118 taxa or 58%) had ranges that were confined to the Deciduous Forest Region. Our study is not directly comparable to Lindsay (1982) because we looked at all provincial and national parks in the Carolinian Zone, we used different boundaries to delineate the Carolinian Zone, and the list of provincially rare species has been modified. Despite differences in the number and composition of species lists used by Lindsay (1982) and this study, the calculated percentages of rare taxa present in the Carolinian Zone (60%) and restricted to the Carolinian Zone (34%) are the same. Later, Oldham (1990) provided a detailed list of the then 215 provincially rare vascular plants restricted to the Carolinian Zone and recommended conservation strategies for these plants. At that time, Oldham (1990) found that 65% of the 542 provincially rare plants of Ontario occurred in the Carolinian Zone while 40% of the plants were restricted to the Carolinian Zone.

Conservation Data Centres, Species Ranking and Status Designations

The Ontario Natural Heritage Information Centre (NHIC) compiles and organizes data on all known locations of provincially rare species and natural communities in the province. The NHIC is one of about 80 Conservation Data Centres (CDCs) in the western hemisphere tracking rare species as part of a network developed by The Nature Conservancy.

CDCs assign conservation priority ranks to species at a subnational (S-ranks) and global (G-ranks) scale to set protection priorities for plant and animal species and vegetation communities. S-ranks are determined primarily by the number of extant occurrences ("populations") in a jurisdiction, but other factors such as population size, population trend, population health, threats, number of protected occurrences, and population sustainability are also used to assign ranks. S-ranks range from S1 (extremely rare, typically 5 or fewer occurrences) to S5 (very common and widespread, typically more than 1000 occurrences). S1, S2 and S3 ranked species, those with fewer than 100 occurrences in the province, are tracked by the NHIC. The same criteria are used to assign G-ranks for the entire range of the species (Oldham 1999).

Some species have also been designated as Vulnerable, Threatened, or Endangered at a national level, by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and at a provincial level by the Ontario Ministry of Natural Resources, based on the recommendations of the Committee on the Status of Species at Risk in Ontario (COSSARO).

NHIC Databases

Several databases have been established at the NHIC and are maintained and updated on a regular basis by staff. The Natural Areas database (NADb) contains

information on natural areas in the province, including national and provincial parks, Areas of Natural and Scientific Interest (ANSIs), International Biological Programme (IBP) sites, and OMNR evaluated wetlands. Rare species, together with any available information on biodiversity, vegetation, soils, topography, size, land use history, management, disturbances or threats, and ownership are documented for each natural area.

The Element Occurrence database (EODb) is a compilation of existing data on "element occurrences" or distinct localities of rare plants, animals and vegetation communities in Ontario that are tracked by the NHIC. The EODb contains information, where known, on the following: status designations, all known observations of the species at each locality, population size, quality of the occurrence, date of first and last observation, habitat information, land use and ownership information and, where relevant, links to a natural area in the NADb.

Objectives

Our main objective was to prepare a list of the rare vascular plant species found in the 22 provincial and national parks in the Carolinian Zone. We then examined the proportions of rare Carolinian Zone plant species inside and outside of these parks based on the various ranks and status designations. Special emphasis was placed on those species entirely restricted to the Carolinian Zone.

Methods

Data Compilation

The Natural Areas and Element Occurrence databases were linked and searched to compile a list of S1 to S3 plant species found in provincial and national parks in the Carolinian Zone. Other key references were checked for additional records of rare species in parks to ensure the list was as comprehensive as possible. These additional data sources included, but were not limited to, plant checklists (e.g. Jellicoe 1984, Crabe 1996, Woodliffe 1997), life science inventories and similar documents (e.g. Lindsay 1979, Klinkenberg and Edwards 1980, Klinkenberg 1985, Gartshore et al. 1987, House and Carleton 1988, Kamstra et al. 1995, Webber 1982, Varga 1995), and inventories of specific habitats (e.g. Bakowsky 1993).

Only records based on valid herbarium specimens or reliably reported by botanists, and known to occur within the boundaries of the parks, were included in the plant list. Historic records with inadequate locality information (e.g., records which just noted Point Pelee or Turkey Point as the collection site and which could have been from outside the current park boundary) were omitted. This list was then reviewed by NHIC biologists and individuals familiar with particular parks.

A table with the final list of rare (S1-S3, SH, SX) plant species recorded in each Carolinian Zone park was compiled. This table included the following information for each species: scientific name, Rank, COSEWIC and OMNR status (i.e., Vulnerable, Threatened or Endangered), park name, park area (ha), park classification and the last observation date. This table was used as the basis for our evaluation of rare flora in Carolinian Zone provincial and national parks.

Results

Appendix Table 1 provides a list of all provincial and national parks in the Carolinian Zone along with their class and the number of provincially rare vascular plant species per park. Appendix Table 2 lists the species present in Carolinian Zone parks, along with their S-ranks, COSEWIC and OMNR VTE status designations, and approximate last observation dates. It also identifies which species are restricted to the Carolinian Zone.

Ginseng (*Panax quinquefolius*) has not been included in Appendix Table 2 due to risks of illegal harvesting in its remaining locations. Of the four Carolinian Zone parks from which Ginseng is historically known, it is now presumed extirpated in two and has not been recorded since the 1980s in the other two. Given that a known population from an eastern Ontario provincial park was decimated by illegal harvesting in recent years, the fate of this species in Carolinian parks is precarious.

There are records of 227 rare vascular plant species from the provincial and national parks in the Carolinian Zone which equates to 31% of the rare vascular plants in the province. Of these 227 species, 124 or 55% are restricted to the Carolinian Zone. More than half of the rare plant species which are restricted to the Carolinian Zone are found within these parks (124 of 246 taxa). The majority of the parks have a representation of each rare species ranking level: S1, S2 and S3 species (Figure 2).

Ojibway Prairie contains the largest number of rare plant species (68) of the 22 Carolinian parks. Four of the parks, Ojibway Prairie, Rondeau, Fish Point and Pinery, contain 50% of the rare species found in all of the parks combined. This illustrates that much of the diversity is found in the prairies, savannahs, dunes and wetlands which characterize these four parks and not in the deciduous forests.

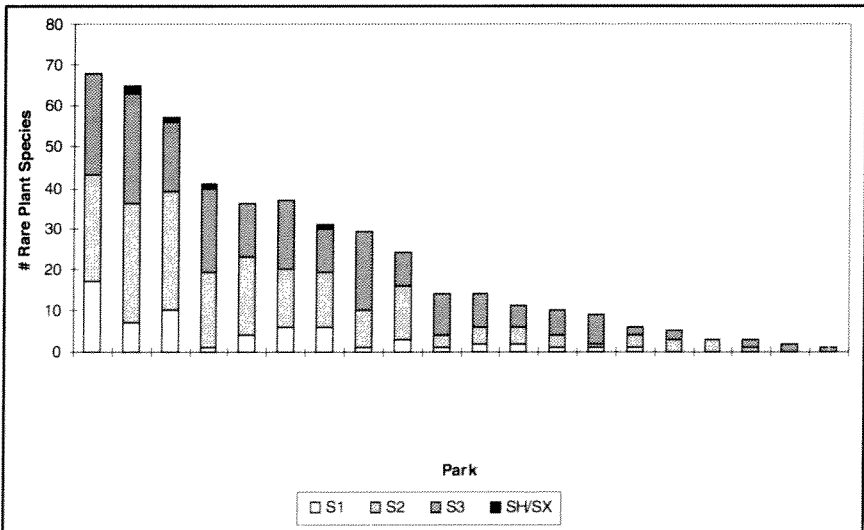


Figure 2: Number of species and S-ranks of rare plants in Carolinian Zone parks.

Ojibway Prairie, Fish Point, East Sister Island and Lighthouse Point, in descending order, have the highest numbers of rare plant species per hectare (Figure 3). Provincial parks designated as 'Recreation' class have, on average, far fewer provincially rare plant species than 'Natural Environment' or 'Nature Reserve' class parks.

Of the 120 rare plant species restricted to the Carolinian Zone and missing from all parks, 18 have a COSEWIC VTE status. Four vulnerable species (*Scirpus verecundus*, *Isopyrum biternatum*, *Arisaema dracontium*, *Aster prenanthoides*), two threatened species (*Smilax rotundifolia*, *Carex lupuliformis*), and ten endangered species (*Agalinis skinneriana*, *Isotria medeoloides*, *Isotria verticillata*, *Magnolia acuminata*, *Plantago cordata*, *Lespedeza virginica*, *Trillium flexipes*, *Pycnanthemum incanum*, *Solidago speciosa*, *Stylophorum diphyllum*) are all missing from parks. Seven of these species also have an OMNR VTE status. Fourteen globally rare (G1 to G3) rare plant species are missing from parks. These include *Crataegus perjudunda*, *Crataegus nitidula*, *Sida hermaphrodita*, *Isotria medeoloides*, and *Crataegus formosa*.

Current information on rare plants in Carolinian Zone provincial and national parks is limited. Fifty-two percent of the occurrences listed in Appendix Table 2 were observed or recorded over 10 years and we have no data on the last observation date of approximately 11% of the occurrences (Figure 4).

Discussion and Recommendations

Parks provide some of the most representative and unusual habitats left in Ontario and, as a result, provide habitat for many rare plants. The data on rare plants in Carolinian Zone parks, however, is often from studies conducted decades ago and there is virtually no information on the current size and health of plant populations. The lack of information on the status of rare plants within parks impedes the conservation of these species.

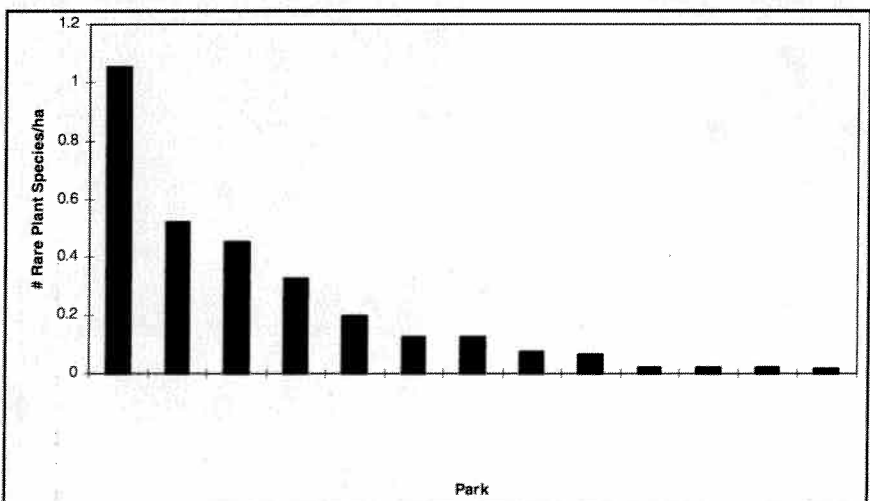


Figure 3: Number of rare species per hectare for some Carolinian Zone parks.

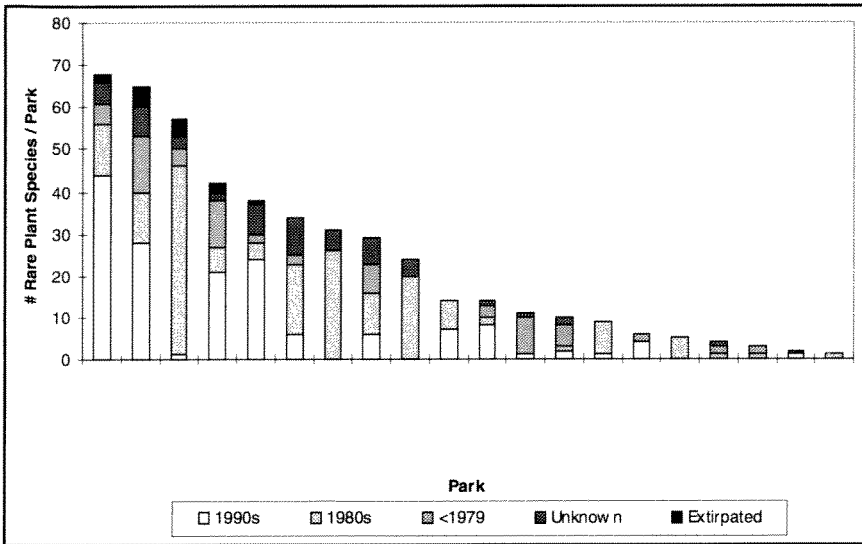


Figure 4: Last observation date for rare plants in Carolinian Zone parks.

Although many rare plants (e.g., 50% of the plants restricted to the Carolinian Zone) are found within the boundaries of parks and are offered some degree of protection under provincial and federal parks legislation, they are still vulnerable to human activities. Some of the threats already identified include: over-browsing by deer (e.g. Rondeau, Pinery, Long Point); trampling and disturbance of plants and habitats (e.g. dunes); development and maintenance of roads, trails and buildings; illegal collection (e.g. Ginseng); exotic species invasion (e.g. Garlic Mustard); fire suppression; and habitat succession.

In order to better protect rare plants within parks we recommend the following: annual monitoring of rare flora and fauna species, including size and health of populations; detailed mapping of locations of rare species within each park; production and distribution of brochures/fact sheets outlining rare species or communities present for each park dependent upon the degree of sensitivity of each species; monitoring of exotic species and habitat succession; and encouraging research on species of conservation concern.

Improved monitoring of rare species in parks, together with information sharing between organizations and submission of rare plant information to an appropriate agency such as the NHIC, will aid in conservation efforts, both within parks and across Ontario.

Based upon this analysis, half of the rare plants restricted to the Carolinian Zone are not found within parks. Many of these species may be protected to some degree on other public lands (e.g., conservation authority properties, National Wildlife Areas), naturalist club sanctuaries, or other undisturbed private lands. The next step in this process is to identify other key public and private sites for rare plants restricted to the Carolinian Zone. With this information, we can work towards pro-

tecting representative sites containing other rare Carolinian Zone species and habitat corridors between these sites. This information will be an asset to co-operative projects such as "The Big Picture: Cores and Connections in Canada's Carolinian Zone", a project currently being developed (J. Jalava, NHIC, pers. comm.).

Note

The NHIC always is interested in obtaining additional information on tracked flora and fauna. Lists of species tracked by the Centre and an electronic copy of our 'Rare Species Reporting Form' can be found at our web site (<http://www.mnr.gov.on.ca/MNR/nhic/nhic.html>). Paper copies of the form are also available upon request from the NHIC.

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Appendix: Provincially Rare Plants in Carolinian Zone Provincial and National Parks

Code	Park	Park Class	Number of Rare Plants
BK	Bronte Creek Provincial Park	Recreation	3
ES	East Sister Island Provincial Nature Reserve	Nature Reserve	24
FP	Fish Point Provincial Nature Reserve	Nature Reserve	57
IP	Ipperwash Provincial Park	Recreation	11
IQ	Iroquois Beach (now Port Burwell P.P.)	Recreation	14
JA	James N. Allen Provincial Nature Reserve	Recreation	1
JP	John E. Pearce Provincial Nature Reserve	Nature Reserve	5
KO	Komoka Provincial Park	Recreation	9
LP	Long Point Provincial Park	Recreation	10
LT	Lighthouse Point Provincial Nature Reserve	Nature Reserve	30
OJ	Ojibway Prairie Provincial Nature Reserve	Nature Reserve	68
PI	Peche Island Provincial Park	Recreation	3
PN	The Pinery Provincial Park	Natural Environment	41
PP	Point Pelee National Park	National Park	34
RD	Rondeau Provincial Park	Natural Environment	65
RP	Rock Point Provincial Park	Recreation	2
SH	Short Hills Provincial Park	Natural Environment	14
SK	Selkirk Provincial Park	Recreation	6
TP	Turkey Point Provincial Park	Recreation	37
WH	Wheatley Provincial Park	Recreation	29

Appendix Table 1: Park codes used in Figure 1 and appendix table along with park class and number of provincially rare vascular plant species per park.

Notes on Appendix Table 2 (following)

1. Plant common names have been omitted to save space; these can be found in Oldham (1999) or on the NHIC web page.
2. Codes in brackets beside scientific names: V (Vulnerable), T (Threatened) or E (Endangered) for (COSEWIC/ OMNR) designations.
3. An asterisk (*) beside the S-ranks indicates a provincially rare plant species that is restricted in Ontario to the Carolinian Zone.

Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	PI	LP	JA	FP	LT	SK	JP	OJ	IP	ES
<i>Agalinis purpurea</i>	S1*																			U	
<i>Agastache scrophulariifol</i>	SX*	H																			
<i>Agrimonia parviflora</i>	S3 S4*	H						A												A	
<i>Aletris farinosa (T/T)</i>	S2*																			A	
<i>Allium cernuum</i>	S2														B	B					
<i>Ammannia robusta (E/-)</i>	S1*															B					
<i>Ammophila breviligulata</i>	S3	A							A				H								
<i>Amorpha fruticosa</i>	S1*														B						
<i>Aplectrum hyemale</i>	S2	A																		H	
<i>Arabis hirsuta var. adpre</i>	S1															B					
<i>Arabis shortii</i>	S2*			B											B						B
<i>Arisaema dracontium</i>	S3		X																		
<i>Aristida longespica var. g</i>	S2*						A						B								
<i>Aristida purpurascens</i>	S1*																			A	
<i>Asclepias hirtella</i>	S1*																			B	
<i>Asclepias purpurascens</i>	S2*	X								B										A	
<i>Asclepias sullivantii</i>	S2*																			A	
<i>Asclepias verticillata</i>	S2	X					A													U	
<i>Asclepias viridiflora</i>	S2	A	A	U											X					X	
<i>Asimina triloba</i>	S3*				H		A														
<i>Aster divaricatus (T/-)</i>	S1*				B																
<i>Aster dumosus</i>	S2	B	A				A						H								H
<i>Aster praealtus (V/-)</i>	S2	B																		A	
<i>Aster shortii</i>	S2*			A											B	B					B
<i>Astragalus neglectus</i>	S3																A				
<i>Aureolaria flava</i>	S3*																			A	
<i>Aureolaria pedicularia</i>	S3*		H				A														
<i>Baptisia tinctoria</i>	S2*																			A	
<i>Bidens coronata</i>	S2*	A		B																	
<i>Blephilia ciliata</i>	S1*									B											

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Appendix Table 2: Provincially Rare Plants in Carolinian Zone Parks. See Appendix Table 1 for park codes. Last Observation Codes: A= 1990s; B= 1980s; H= >20 years ago; X= extirpated; U= unknown.

Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	Pi	LP	JA	FP	LT	SK	JP	CJ	IP	ES	
<i>Botrychium oneidense</i>	S3						U	U														
<i>Bouteloua curtipendula</i>	S2						A															
<i>Buchnera americana (E/-)</i>	S1*		A																		A	
<i>Calamovilla longifolia va</i>	S3	B	A																		H	
<i>Camassia scilloides (V/-)</i>	S2*														B						B	
<i>Campsis radicans</i>	S2*			U											B							
<i>Carex albicans var. alhic</i>	S2							B							X							
<i>Carex amphibola</i>	S2*	A																				
<i>Carex annectens</i>	S2*																				A	
<i>Carex appalachica</i>	S2S3								A												B	
<i>Carex bicknellii</i>	S2																				B	
<i>Carex conoidea</i>	S3		U																		U	
<i>Carex emoryi</i>	S3									B												
<i>Carex formosa</i>	S3S4		B																			
<i>Carex frankii</i>	S2*														B							
<i>Carex gracilescens</i>	S3							A														
<i>Carex hirsutella</i>	S3*				A		A															
<i>Carex jamesii</i>	S3														B						B	
<i>Carex meadii</i>	S2*																				A	
<i>Carex muskingumensis</i>	S2*														B							
<i>Carex oligocarpa</i>	S2			B											B	B						
<i>Carex schweinitzii</i>	S3									B												
<i>Carex squarrosa</i>	S2*							A														
<i>Carex suberecta</i>	S2*											B										
<i>Carex swanii</i>	S3							A	A													
<i>Carex tetanica</i>	S3	A	A										U								H	
<i>Carex trichocarpa</i>	S3*									B												
<i>Carex virescens</i>	S3				A			A														
<i>Carya glabra</i>	S3*				B																A	B
<i>Carya laciniosa</i>	S3*														B						B	U

continued...

Appendix Table 2 (continued): Provincially Rare Plants in Carolinian Zone Parks. See Appendix Table 1 for park codes. Last Observation Codes: A= 1990s; B= 1980s; H= >20 years ago; X= extirpated; U= unknown.

Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	PI	LP	JA	FP	LT	SK	JP	QJ	IP	ES
<i>Castanea dentata</i> (T/-)	S3*				A		A	H													
<i>Celtis tenuifolia</i> (V/-)	S2		A	B											B						
<i>Cerastium velutinum</i>	S2*														H	B					
<i>Ceratophyllum echinatum</i>	S3														H						
<i>Cercis canadensis</i>	SX*														X						
<i>Chaerophyllum procumbe</i>	S2*														B	B					B
<i>Chenopodium foggii</i>	S2		H	U				H							B	U					
<i>Chenopodium leptophyllum</i>	S1			U																	
<i>Chenopodium standleyanum</i>	S2*			H				H							B						B
<i>Cirsium pitcheri</i> (T/-)	S2		A																		
<i>Coralorrhiza odontorrhiza</i>	S2	A	B				A														H
<i>Coreopsis tripteris</i>	S2*																				A
<i>Corispermum pallasi</i>	S1S3	A																			
<i>Corydalis flavula</i>	S2*			B				H							B	B					
<i>Crataegus conspicua</i>	S1*				A																
<i>Cuscuta campestris</i>	S2	U													B						B
<i>Cuscuta caphalanthi</i>	S2																				A
<i>Cuscuta coryli</i>	S1*																				U
<i>Cyperus erythrorhizos</i>	S3	B		B					B						B	B	A				B
<i>Cyperus flavescens</i>	S2*	B					A	A				A									
<i>Cyperus schweinitzii</i>	S3															B					
<i>Cypripedium arietinum</i>	S3		H				H														H
<i>Cypripedium candidum</i>	S1						A														
<i>Cystopteris prolifera</i>	S2*					A															
<i>Desmodium canescens</i>	S2*	H		B											B	B					
<i>Desmodium rotundifolium</i>	S2		H																		
<i>Digitaria cognata</i>	S1						B														
<i>Draba reptans</i>	S2	A	H	B											B						
<i>Echinochloa walteri</i>	S3	A		B			B	U													
<i>Eclipta prostrata</i>	S2*														U	B					U

continued...

Appendix Table 2 (continued): Provincially Rare Plants in Carolinian Zone Parks. See Appendix Table 1 for park codes. Last Observation Codes: A= 1990s; B= 1980s; H= >20 years ago; X= extirpated; U= unknown.

Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	PI	LP	JA	FP	LT	SK	JP	OJ	IP	ES
<i>Eleocharis engelmannii</i>	S1														H						
<i>Eleocharis geniculata</i>	S1*	X																			
<i>Eleocharis quadrangulata</i>	S1*	H																			
<i>Eragrostis pilosa</i>	S1*														B						
<i>Eragrostis spectabilis</i>	S2							B													
<i>Erigeron bulbosa</i>	S3																				B
<i>Euonymus atropurpurea</i>	S3			U	H										U						B
<i>Eupatorium altissimum</i>	S1*															B					
<i>Eupatorium purpureum</i>	S3	H														U			H		
<i>Euphorbia obtusata</i>	S1															U					
<i>Euthamia gymnospermoides</i>	S1*																			A	
<i>Fraxina carolinensis (V/-)</i>	S2*				A												A				
<i>Fraxinus profunda</i>	S2*	A																			
<i>Fraxinus quadrangulata (T/V)</i>	S3*			B						B					B	B					
<i>Galium pilosum</i>	S3*	A	A	U			A													U	
<i>Geum biennis</i>	S2				U															A	
<i>Gentiana quinquefolia</i>	S2		B																B		
<i>Geum vernum</i>	S3*							B							B	B					
<i>Geum virginianum</i>	S1*																				B
<i>Gleditsia triacanthos</i>	S2*			A											B						
<i>Gymnocladus dioica (T/T)</i>	S2*																				B
<i>Hibiscus moscheutos(V/-)</i>	S3	A		B				B				U			B	B					B
<i>Hieracium venosum</i>	S2		A				U														
<i>Hybanthus concolor</i>	S2				H																
<i>Hydrophyllum appendiculatum</i>	S2*			A											B						B
<i>Hypericum gentianoides</i>	S1*																			A	
<i>Hypericum prolificum</i>	S2	U															H				
<i>Hypoxis hirsuta</i>	S3	A																		A	
<i>Ipomoea pandurata</i>	S1*			B											X						
<i>Iris brevicaulis</i>	S1*														B						

continued...

Appendix Table 2 (continued): Provincially Rare Plants in Carolinian Zone Parks. See Appendix Table 1 for park codes. Last Observation Codes: A= 1990s; B= 1980s; H= >20 years ago; X= extirpated; U= unknown.

Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	PI	LP	JA	FP	LT	SK	JP	CJ	IP	ES
<i>Juncus acuminatus</i>	S3																			B	
<i>Juncus biflorus</i>	S1*																			A	
<i>Juncus brachycarpus</i>	S1*																			B	
<i>Juncus greenei</i>	S3																			A	
<i>Juncus marginatus</i>	S2*							U													
<i>Juncus tenuis</i> var. <i>anthelatus</i>	S1*																			A	
<i>Justicia americana</i> (T/V)	S2*	B		B					B						B	B					
<i>Koeleria macrantha</i>	S2		A				B													X	
<i>Krigia biflora</i>	S2*																			A	
<i>Lactuca floridana</i>	S2*			A											B	B					B
<i>Lechea pulchella</i>	S1*																			B	
<i>Lechea villosa</i>	S3*	H	A				A													A	
<i>Leucospora multifida</i>	S1*														B	U					
<i>Liatris aspera</i>	S2*	A	A																	H	
<i>Liatris cylindracea</i>	S3	A	A				A														H
<i>Liatris spicata</i> (V/-)	S3*		A																	A	
<i>Linum medium</i> var. <i>medium</i>	S3	U																			
<i>Linum medium</i> var. <i>texanum</i>	S1*						H						H								
<i>Linum sulcatum</i>	S3						A														
<i>Linum virginianum</i>	S2*	H				H	U	H													
<i>Liparis liliifolia</i> (E/T)	S2																			A	
<i>Lithospermum carolinense</i>	S3		U	U			U														
<i>Lithospermum incisum</i>	S1*			H											A						
<i>Lithospermum latifolium</i>	S3	H																			
<i>Ludwigia alternifolia</i>	S1*																			B	
<i>Ludwigia polycarpa</i>	S2*														U					H	
<i>Lupinus perennis</i>	S3		A				X														
<i>Lycopus asper</i>	S2			B																	
<i>Lycopus rubellus</i>	S2*	H																			
<i>Lycopus virginicus</i>	S2*		H												B	B					B

continued...

Appendix Table 2 (continued): Provincially Rare Plants in Carolinian Zone Parks. See Appendix Table 1 for park codes. Last Observation Codes: A= 1990s; B= 1980s; H= >20 years ago; X= extirpated; U= unknown.

Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	PI	LP	JA	FP	LT	SK	JP	QJ	IP	ES
<i>Lythrum alatum</i>	S3							U							B					A	
<i>Mimulus alatus</i>	S2*																		B		
<i>Monarda didyma</i>	S3	B							B	B											
<i>Morus rubra (E/-)</i>	S2*	A		B											B	U					U
<i>Muhlenbergia sylvatica</i>	S2						U														
<i>Muhlenbergia tenuiflora</i>	S2	A				H															
<i>Myosotis macrosperma</i>	S1*														B						
<i>Myrica pennsylvanica</i>	S1*						A														
<i>Nelumbo lutea</i>	S2	X																			
<i>Nuphar advena</i>	S3*	B	H									H			B	B					
<i>Nyssa sylvatica</i>	S3*						A	B			U									B	
<i>Opuntia humifusa (EE)</i>	S1*			A											B						
<i>Oxypolis rigidior</i>	S2*																			A	
<i>Panicum dichotomum</i>	S2						A														
<i>Panicum gattingeri</i>	S3								B	A					B				B		
<i>Panicum sphaerocarpon</i>	S3							U												A	
<i>Panicum villosissimum</i>	S3		H																	B	
<i>Paspalum setaceum</i>	S2*	A																		B	
<i>Phacelia purshii</i>	S1*																				B
<i>Phegopteris hexagonoptera (V/-)</i>	S3	A																		B	
<i>Phlox subulata</i>	S1?*						A														
<i>Phyla lanceolata</i>	S2*														B						
<i>Piptochaetium avenaceum</i>	SH		A																		
<i>Platanthera leucophaea (V/-)</i>	S2																				B
<i>Platanthera macrophylla</i>	S2	U																			
<i>Poa angulata</i>	S3	A																			
<i>Poa sylvestris</i>	S2*	B																			B
<i>Polygala incarnata (E/-)</i>	S1*																				A
<i>Polygonum arifolium</i>	S3							H			A			B							
<i>Polygonum tenue</i>	S2*		A				B														

continued...

Appendix Table 2 (continued): Provincially Rare Plants in Carolinian Zone Parks. See Appendix Table 1 for park codes. Last Observation Codes: A= 1990s; B= 1980s; H= >20 years ago; X= extirpated; U= unknown.

Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	PI	LP	JA	FP	LT	SK	JP	QJ	IP	ES
<i>Potamogeton pulcher</i>	SH*	X																			
<i>Potentilla paradoxa</i>	S3	A		B											B	B					
<i>Ptelea trifoliata</i> (V/-)	S3*	A		A					B						B	B					
<i>Pycnanthemum tenuifolium</i>	S3							B												H	
<i>Pycnanthemum verticillatum</i> var. <i>pilosum</i>	S1*	B																		A	
<i>Quercus palustris</i>	S3*							U												A	
<i>Quercus prinoides</i>	S2*		A																		H
<i>Quercus shumardii</i> (V/-)	S3*	U																			
<i>Ranunculus hispidus</i> var. <i>hispidus</i>	S3				A		U	A													
<i>Ranunculus rhomboideus</i>	S3	U	A				U														
<i>Ratibida pinnata</i>	S2S-3*																				A
<i>Rhus copallina</i> var. <i>latifolia</i>	S3S4																				A
<i>Rosa setigera</i> (V/-)	S3			U				B			H				B	B					A
<i>Saururus cernuus</i>	S3		H					H													
<i>Scirpus clintonii</i>	S2																				A
<i>Scirpus smithii</i>	S2?	B		B			A														
<i>Scleria triglomerata</i>	S1*																				A
<i>Scleria verticillata</i>	S3		A				A						A								H
<i>Senecio obovatus</i>	S3		B																		
<i>Senecio plattensis</i>	S2S3		B																		
<i>Silphium terebinthinaceum</i>	S1*																H				A
<i>Sisyrinchium albidum</i>	S1*																				A
<i>Smilax ecirrhata</i>	S3?														B						B
<i>Smilax illinoensis</i>	S2?														B						
<i>Solidago arguta</i>	S3				A					B											
<i>Solidago riddellii</i>	S3*	H																			A
<i>Solidago rigida</i> ssp. <i>rigida</i>	S3																				A
<i>Sphenopholis obtusata</i>	S1	H													B						U
<i>Spiranthes magnicamporum</i>	S3	A	H				A	A				H	H							A	H
<i>Sporobolus asper</i>	S1S2																				A

continued...

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Scientific Name	Rank	RD	PN	PP	SH	BK	TP	WH	IQ	KO	RP	PI	LP	JA	FP	LT	SK	JP	QJ	IP	ES
<i>Stachys pilosa</i> var. <i>arenicola</i>	S1*								B												
<i>Stipa spartea</i>	S3	B	A																		
<i>Strophostyles</i> <i>helvula</i>	S3	A		U				B	A				H		B	B				A	
<i>Tephrosia</i> <i>virginiana (T/-)</i>	S1*						U														
<i>Thalictrum</i> <i>revolutum</i>	S2*	H	H				A													U	
<i>Thalictrum</i> <i>thalictroides</i>	S3	U																			
<i>Thaspium</i> <i>barbinode</i>	S1*	H																			
<i>Thaspium</i> <i>trifoliatum</i> var. <i>aureum</i>	S2*							B													
<i>Tradescantia</i> <i>ohiensis</i>	S2*																			A	
<i>Triphora</i> <i>trianthophora (E/-)</i>	S1*	A																			
<i>Verbesina</i> <i>alternifolia</i>	S2S- 3*	A																			
<i>Vernonia</i> <i>missurica</i>	S3?*							B												A	
<i>Veronicastrum</i> <i>virginicum</i>	S2*																			A	
<i>Viola palmata</i>	S2*	A																		A	
<i>Viola pedata (V/-)</i>	S1*						A														
<i>Viola rafinesquii</i>	S1*															B					
<i>Vulpia octoflora</i>	S2		B				A														

Appendix Table 2 (continued): Provincially Rare Plants in Carolinian Zone Parks. See Appendix Table 1 for park codes. Last Observation Codes: A= 1990s; B= 1980s; H= >20 years ago; X= extirpated; U= unknown.