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The Extent and Floristic Composition of the Rice Lake Plains Based on Remnants

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A study of the floristic composition and extent of the Rice Lake Plains in central southern Ontario was undertaken to provide a basis for protection and management and to contribute to a better understanding of pre-settlement vegetation. During field reconnaissance 42 remnant sites were discovered. Complete species lists were generated for 24 of these sites and a total of 260 native species was recorded of which 61 were present at more than half of the sites. Less than 10% of the native flora of dry, open ground is believed to be extirpated. The most frequent species and those dominating many of the remnants included *Andropogon gerardii*, *Carex siccata*, *Ceanothus americanus*, *Pteridium aquilinum*, *Sorghastrum nutans*, and *Toxicodendron rydbergii*, all of which are characteristic dominants of tallgrass prairie and related habitats in the midwest. It is believed that both composition and frequency are much the same, but not exactly the same, as existed in pre-settlement times. A principal coordinate analysis based on Jaccard's coefficient derived from a matrix of presence/absence data for 84 regionally rare species in 24 sites revealed three major groupings: (1) open sand and characteristic sand barren flora, including *Dichanthelium sabulorum*, *Carex merritt-fernaldii*, *Cyperus lupulinus*, *Polygonum douglasii*, *Selaginella rupestris*, and *Sporobolus cryptandrus*; (2) prairie sites with *Desmodium canadense*, *Monarda fistulosa*, *Penstemon hirsutus*, *Ranunculus rhomboideus*, and *Schizachyrium scoparium*; (3) high-diversity sites with savannah vegetation, including species characteristic of both prairie and open woodland, including *Asclepias exaltata*, *Desmodium glutinosum*, *Erigeron pulchellus*, *Solidago arguta*, and *Taenidia integerrima*. Correspondance analysis suggested a succession from sand barren to woodland and ordered species along a successional axis. In addition to three major associations, there was some regional variation with closer sites sharing species such as *Lupinus perennis*, *Liatris cylindracea* and *Dichanthelium oligosanthes*. The probable extent of plains vegetation revealed by remnants was determined by overlaying remnant sites on the soil landscapes and soil types to determine the extent of the associated soil or landscape thus providing a clue to the extent of the plains vegetation. Results of both the soil landscape and soil data analyses were subjected to restrictions based on exposure, elevation and historical information so as to develop a concept of minimum area. The minimum area of plains vegetation including prairie, sand barren and savannah was estimated to be 263 km² on the basis of distribution of appropriate soils and 590 km² on the basis of soil landscapes. Thus the Rice Lake Plains included an area of prairie, savannah and sand barrens approximately 600 km² in extent and extending as an essentially continuous band 123 km long and up to 25 km wide along the top and north slope of the Oak Ridges Moraine from the Ganaraska Highland west of Rice Lake eastward to the Murray Hills and the Trent River and was one of the largest areas of plains vegetation in the eastern Great Lakes region.

Key Words: Prairie, tallgrass prairie, sand barrens, savannah, vegetation, phytogeography, protection, invasive aliens, Rice Lake, Great Lakes region, Ontario.

Once a vast area of open prairie and savannah, the Rice Lake Plains were largely destroyed during the period of early settlement between 1875 and 1885 (Catling et al. 1992). Over the past decade there has been extensive interest in the protection and restoration of the scattered remnants (Figure 1) since prairie, savannah and sand barren (these often subsequently referred to as "plains vegetation") are among the most threatened plant communities on the continent and in Ontario less than 1% of this habitat (originally at least 2000 km²) remains (e.g., Carbyn and Catling 1995; Rodger 1998; Varga 1999). Not only are these rem-

nants major refugia of plant biodiversity (Clarke 2005; Hendrickson 2006) but they also contain significant diversity of other organisms (Figure 2). From an agro-economic perspective, they are a source of genetic material for development and improvement of new crops including those providing (some examples from the Rice Lake region in brackets) biofuel (Switchgrass), food (Hazel Nuts, Juneberries), forage (various grasses and forbs), fibre (grasses), medicine (Seneca Snakeroot), essential oils (Bergamot) and cut flowers (Blazing Star and Butterfly Milkweed), etc. (Dougan & Associates 2001*). As a result of recent



FIGURE 1. Restoration of native prairie vegetation at the Burnley Carmel Natural Area managed by the Nature Conservancy of Canada and Ontario Parks. A, prairie area recently burned to control invasive alien species and promote native prairie vegetation. A dead and burned stump of an invasive alien Scots Pine (*Pinus sylvestris*) in the foreground. B, New Jersey Tea (*Ceanothus americanus*), one of many species that decline or are extirpated by increasing invasive alien plant cover, but quickly increase in response to the natural process of fire, which was widespread in presettlement times.

interest, much information has been compiled (e.g., White 2003*) but several questions remain. Restoration requires information on what to restore and where. The composition and extent of North American prairies, savannahs and sand barrens are still not well understood, especially in eastern North America. This study of the Rice Lake Plains was designed to contribute to an understanding of (1) the vascular plant composition of the open areas (i.e., the plains), (2) variation in floristic composition, and (3) the likely extent of the Rice Lake Plains based on the distribution of remnants dominated by native species of dry, open ground.

Methods

(1) Floristic composition and Species lists

Between 1988 and 2006, the general region of the Rice Lake Plains was searched for remnants of natural vegetation of open (unforested) ground. Forty-two remnant sites were discovered. Remnants (Figure 3, Table 1) were defined as more or less dry, open areas dominated by native vegetation (80% of the cover). The remnants were located by driving roads and looking for native vegetation, checking likely localities discovered on aerial photographs, and determining pos-

sible locations through talking with local residents. Sites discovered during reconnaissance of the Ganaraska section by W. Bakowsky, S. Varga and D. White (White 2003*) were included. The sites ranged from a roadside slope an acre (0.40 hectare) in extent to extensive areas of 30 acres (12.14 hectares) distant from roads. Species lists (Appendix) were developed for native species at each site. Complete species lists were generated for 24 of the remnants and these were dispersed throughout the region. Species present in the 24 sites were organized by the number of remnant sites in which they occurred so as to develop an idea of predominant species on the former plains. The scientific and common names used are mostly those of Kartesz and Meachum (1999*).

It is to be noted that reconstructing past floristic composition from remnants may have limitations including: (1) certain species may be lost because certain natural processes upon which they depend, such as fire, have ceased; (2) certain kinds of plant associations may be lost readily, such as mesic openings which would be subject to succession more rapidly than drier openings, leaving an incomplete record; (3) existing remnants may represent only certain associations in a landscape, such as those of slopes, so that

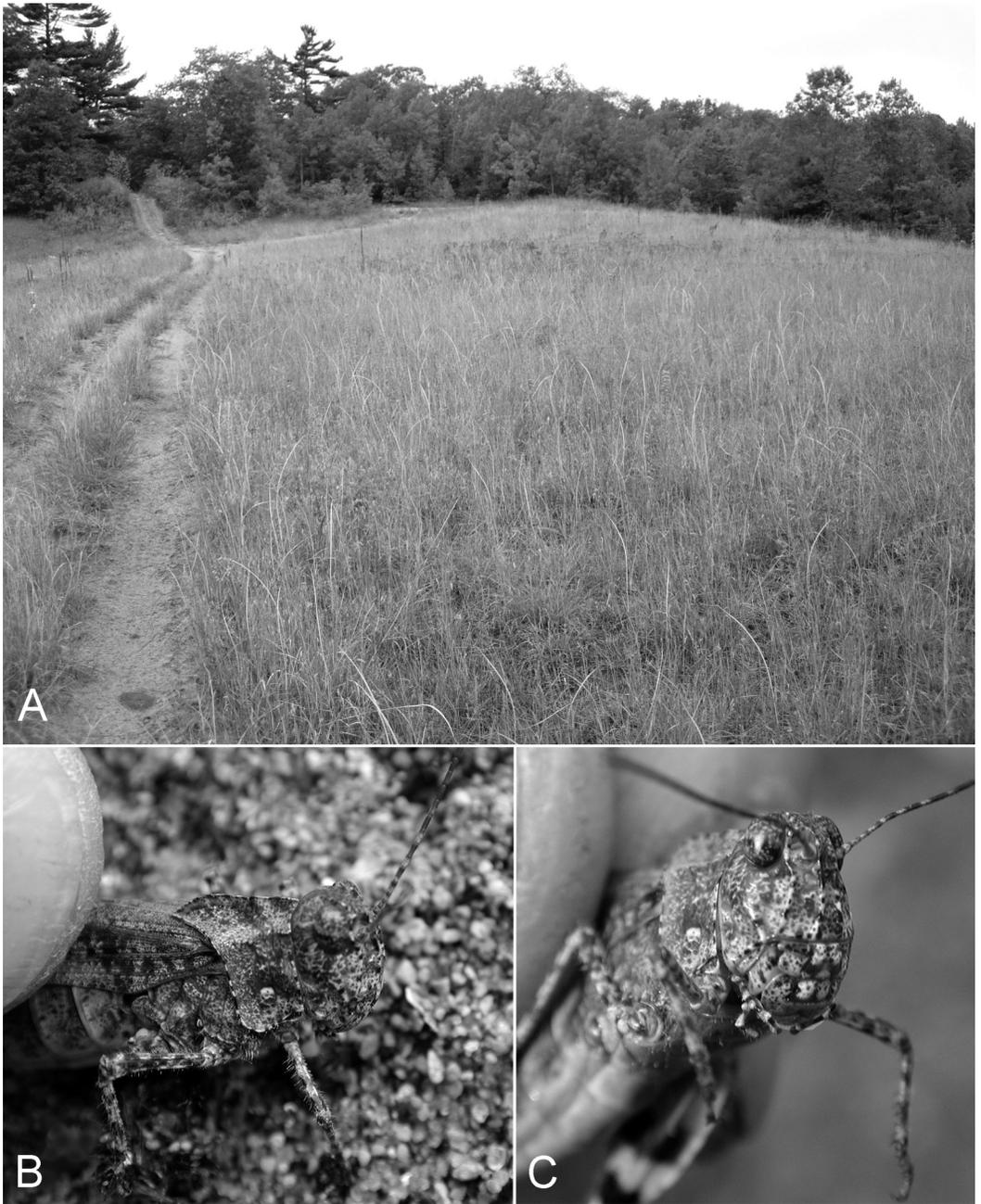


FIGURE 2. A, sandy meadow in open Black Oak (*Quercus velutina*) woods (site 32) dominated by Sand Dropseed Grass (*Sporobolus cryptandrus*), a typical habitat of the Mottled Sand Grasshopper, (*Spharagemon collare* (Scudder)), the Big Sand Tiger Beetle (*Cicindela formosa* Dejean) and many other increasingly localized insects. B, Mottled Sand Grasshopper inconspicuous on sandy substrate (thumbnail on left); C, Mottled Sand Grasshopper, frontal view.

the flora cannot be completely understood. As long as these limitations are acknowledged, floristic reconstruction on the basis of remnants can provide useful

information. In the present case, some limited historical data (Catling et al. 1992) are available for comparison allowing a degree of confirmation.

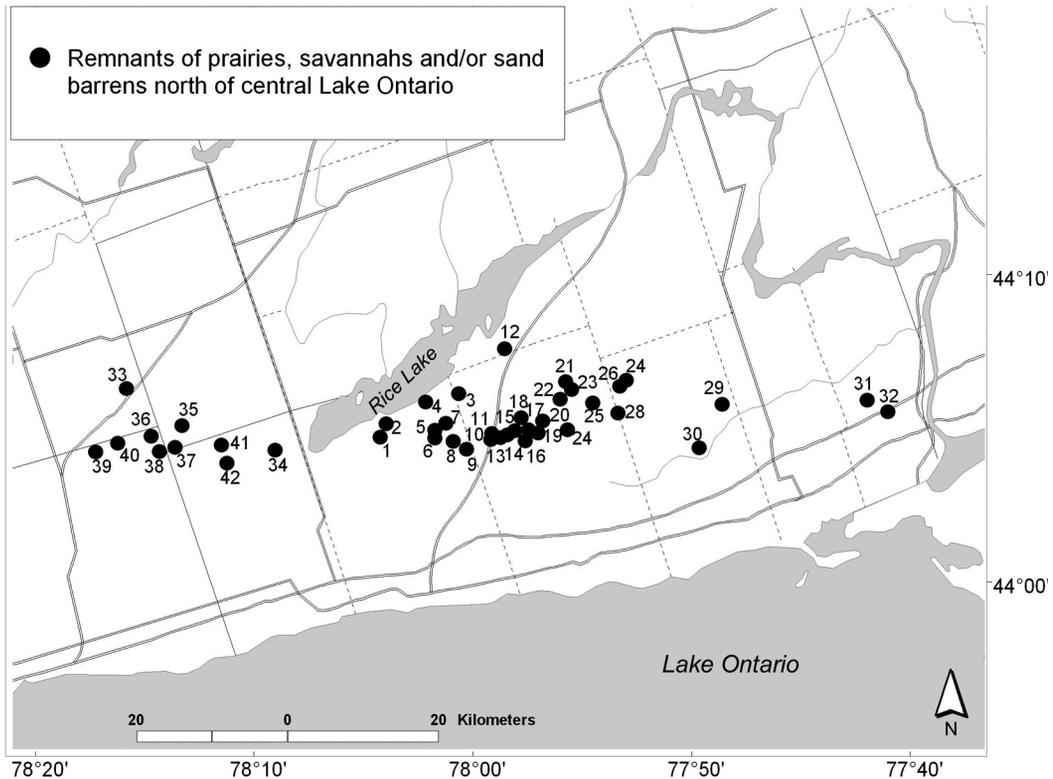


FIGURE 3. Rice Lake Plains region showing the locations of 42 remnant sites.

(2) Variation in floristic composition among sites

The relationship between sites was explored using Jaccard's coefficient, which emphasizes positive matches, with principal coordinate analysis (PCO). The Jaccard matrix was double centered, and the eigenvalues were extracted and plotted to illustrate major patterns of variation. To help compensate for distortion in this principal coordinate analysis and better reflect relationships between sites, a minimum spanning tree, connecting the most closely related locations based on the Jaccard matrix, was superimposed on the PCO.

Correspondence analysis (CA) was used to further explore major trends in site relationships and to determine how species related to these trends. In particular, the analogous plot of species and sites, based on Chi-square distances in each case and on the same eigenvectors, allows the species to be associated with site related trends in analogous multivariate space.

Only 24 of the 42 sites were used in PCO and CA analyses (Table 1), these selected on the basis of reliable and complete species lists. Since common species present at all sites, rare species present at a single site, and non-native species are all of limited value in classifying sites, only regionally rare native species pres-

ent at more than one site were used (84 species, Table 3). Regionally rare species are those known from less than 30 locations in the Oak Ridges moraine region where a location is defined as an occurrence removed at least 1 km from another. The analyses were done using NTSYS-pc version 2.11X (Rolfe 2000*). Additional information on interpretation is available in Legendre and Legendre (1983) and Pielou (1984).

(3) Extent of the plains

Soil landscapes and soil types were overlaid with the locations of remnant sites to determine on which soils and landscapes the remnants occurred. Both the soil, relating to features such as drought, and the landscapes, relating directly to ecological factors such as fire, are considered important in this context. The extent of the associated soil or landscape provided a clue to the extent of prairie, savannah and sand barren. This assumes that the occurrence of these open habitats is a consequence of soil and landscape attributes and that climate does not vary appreciably over the area of concern. This assumption is reasonable except to the extent that the slope toward Lake Ontario may have received more orographic precipitation and early observations suggest that this slope was forested (Traill

TABLE 1. List of sites with prairie, savannah and sand barren vegetation with their latitude and longitude and soil type. For sites the coordinates are approximate to protect landowners. Br = Brighton-Colbourne Sandy Loam, B = Bondhead Sandy Loam, Du = Dundonald Sandy Loam, Pg (P) = Pontypool Gravelly Sand (P, Pg), Pl = Pontypool Sandy Loam, Ps = Pontypool Sand. Asterisks (*) following a site name indicate those sites (with complete species lists) that were used in the statistical analyses.

Number	Soil	Name	Area (ha)	Latitude	Longitude
1	B,Du	Plainville Roadside Prairie *	0.2	44.0973	-78.2382
2	B,Du	Gore landing Hydro Line Prairies *	0.6	44.109	-78.2312
3	Pg,Ps	Harwood Plains ANSI Prairies *	4	44.1343	-78.1448
4	Du	Harwood South Prairie *	0.1	44.1274	-78.1843
5	Du,Ps	Oak Valley Prairie *	1	44.1032	-78.1630
6	Ps	Mill Valley West Sandhills *	5.6	44.0967	-78.1733
7	Ps	Harwood Prairie *	0.1	44.1091	-78.1602
8	Ps	Mill Valley Central Sandhills *	0.45	44.094	-78.1514
9	Ps	Mill Valley Central Prairies	5.79	44.0873	-78.1356
10	Ps	Mill Valley West Prairies *	2.11	44.0956	-78.1068
11	Ps	Mill Valley North Prairie Roadside *	0.38	44.1006	-78.1056
12	Pl	Alderville Prairies and Savannah *	8.82	44.1274	-78.09
13	Ps	Scout Camp Prairie *	0.31	44.0969	-78.0951
14	Ps	Northumberland Forest West Sand Barren	0.15	44.0994	-78.0871
15	Ps	Northumberland Forest Central Prairie	0.3	44.1028	-78.0783
16	Ps	Northumberland Forest South Prairies	0.49	44.0943	-78.0657
17	Ps	Northumberland Forest East Prairies	1.35	44.1038	-78.0616
18	Ps	Northumberland Forest North Prairies	2.68	44.1139	-78.0704
19	Ps	North Centreton Roadside Prairie *	0.48	44.101	-78.0505
20	Ps	South Peters Woods Prairie *	0.27	44.1112	-78.0448
21	Ps	Burnley Creek ANSI North – NCC North	0.16	44.1445	-78.0173
22	Ps	Burnley Creek ANSI North – NCC South *	1.4	44.1298	-78.0239
23	Ps	Burnley Creek ANSI North Roadside *	0.5	44.1379	-78.0102
24	Ps	Burnley Creek ANSI South	0.5	44.1039	-78.0153
25	Ps	Salt Creek – Russ Creek Prairies *	8.17	44.1266	-77.9851
26	Br,Ps	Salt Creek – East Prairies *	6.8	44.1405	-77.9531
27	Br,Ps	Red Cloud Cemetery Prairies *	0.25	44.1459	-77.9454
28	Ps	North Castleton Roadside Prairie *	0.44	44.1178	-77.955
29	Ps	Cold Creek (Goodrich–Loomis) *	1.64	44.1254	-77.8312
30	Ps	Cold Creek – Shiloh	0.6	44.0886	-77.8584
31	Br,Ps	Murray Hill North Prairie *	1.47	44.1288	-77.6585
32	Br,Ps	Murray Hill Sand Barrens *	0.66	44.1192	-77.6339
33	Ps	Cavan Creek Headquarters GF *	16.69	44.1386	-78.5406
34	Ps	Ganaraska Forest East ANSI GF	5.54	44.0864	-78.3632
35	Ps	Ganaraska Forest West ANSI – NE GF	2.76	44.1073	-78.474
36	P	Ganaraska Forest West ANSI – W GF	8.79	44.0983	-78.511
37	Ps	Ganaraska Forest West ANSI – Central	0.21	44.089	-78.4822
38	Ps	Ganaraska Forest West ANSI – SW	0.04	44.0852	-78.5009
39	Ps	Manvers West	0.02	44.0849	-78.577
40	Ps	Manvers East	1.16	44.0923	-78.5506
41	Ps	Robb's Hill North	4.97	44.0907	-78.4272
42	Ps	Robb's Hill South	0.24	44.0755	-78.4205

1885). Consequently, prairie was assumed not to be present on those parts of the open-habitat-associated landscapes and soils on the Lake Ontario side of the height of land between Lake Ontario and Rice Lake. The lack of remnants in this region supports this assumption. This methodology also assumes that soils, landscape and climate are the important attributes and that fire, a major factor, is mediated through these attributes. Nevertheless the extent is based on the landscape and soil where species of dry, open habitat survived, whereas they may have been present on more

mesic sites but not able to survive there due to competition and succession (in the absence of fire) or more intensive use of the landscape by humans. Consequently these methods very likely underestimate the amount of open habitat but provide a reliable minimum estimate.

Soil landscape coverages and soil type polygons based on the Northumberland (Hoffman and Acton 1974) and Durham (Webber et al. 1946) soil surveys were downloaded from the CANSIS website (<http://sis2.agr.gc.ca/cansis>) and plotted with site location data

TABLE 2. List of 84 species in ascending order of dimension 1 row factor values from correspondence analysis (Figure 6) indicating those species associated primarily with sand barrens (at the top of the list), those primarily associated with prairie and mixed associations (middle of the list) and those primarily associated with savannah (bottom of the list). Authorities for scientific names for species listed here are provided in the appendix.

Species	Factor
<i>Grindelia squarrosa</i> var. <i>squarrosa</i>	-1.6456
<i>Polygonum douglasii</i> ssp. <i>douglasii</i>	-1.6456
<i>Panicum virgatum</i> var. <i>virgatum</i>	-1.3525
<i>Arabis holboellii</i> var. <i>retrofracta</i>	-1.0794
<i>Selaginella rupestris</i>	-1.0561
<i>Dichanthelium linearifolium</i>	-1.0372
<i>Cyperus lupulinus</i> ssp. <i>lupulinus</i>	-0.8935
<i>Arabis hirsuta</i> var. <i>pyncocarpa</i>	-0.8821
<i>Sporobolus cryptandrus</i>	-0.8764
<i>Dichanthelium sabulorum</i> var. <i>thinium</i> (<i>D. columbianum</i>)	-0.8243
<i>Arabis divaricarpa</i>	-0.6198
<i>Linum sulcatum</i> var. <i>sulcatum</i>	-0.5672
<i>Carex merritt-fernaldii</i>	-0.5452
<i>Comptonia peregrina</i>	-0.4719
<i>Verbena stricta</i>	-0.4630
<i>Liatris cylindracea</i>	-0.4346
<i>Artemisia campestris</i> ssp. <i>borealis</i> var. <i>scouleriana</i>	-0.3506
<i>Dichanthelium depauperatum</i>	-0.3133
<i>Shepherdia canadensis</i>	-0.3129
<i>Arabis glabra</i>	-0.2685
<i>Helianthemum canadense</i>	-0.2514
<i>Carex muehlenbergii</i> var. <i>muehlenbergii</i>	-0.2371
<i>Calystegia spithamea</i> ssp. <i>spithamea</i>	-0.2176
<i>Lechea intermedia</i> var. <i>intermedia</i>	-0.2077
<i>Polygala polygama</i>	-0.1976
<i>Helianthemum bicknellii</i>	-0.1891
<i>Ceanothus americanus</i>	-0.1508
<i>Juniperus communis</i>	-0.1207
<i>Ranunculus rhomboideus</i>	-0.1188
<i>Asclepias tuberosa</i> ssp. <i>tuberosa</i>	-0.1124
<i>Carex tonsa</i> var. <i>rugosperma</i>	-0.1038
<i>Rosa acicularis</i> ssp. <i>acicularis</i>	-0.1037
<i>Quercus velutina</i>	-0.0982
<i>Carex siccata</i>	-0.0872
<i>Amelanchier stolonifera</i>	-0.0571
<i>Monarda fistulosa</i> ssp. <i>fistulosa</i> var. <i>fistulosa</i>	-0.0194
<i>Sorghastrum nutans</i>	0.0194
<i>Penstemon hirsutus</i>	0.0233
<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i> (includes <i>unilaterale</i>)	0.0346
<i>Prunus pumila</i> var. <i>susquehanae</i>	0.0403
<i>Viola sagittata</i> var. <i>ovata</i>	0.0422
<i>Bromus kalmii</i>	0.0521
<i>Comandra umbellata</i>	0.0601
<i>Rosa blanda</i> var. <i>blanda</i>	0.0842
<i>Andropogon gerardii</i>	0.0863
<i>Rhus aromatica</i> var. <i>aromatica</i>	0.0883
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	0.0934
<i>Potentilla arguta</i> ssp. <i>arguta</i>	0.0983
<i>Viola adunca</i> var. <i>adunca</i>	0.1063
<i>Arctostaphylos uva-ursi</i>	0.1225
<i>Dichanthelium acuminatum</i> var. <i>acuminatum</i> (<i>D. implicatum</i>)	0.1269
<i>Helianthus divaricatus</i>	0.1311
<i>Vaccinium angustifolium</i>	0.1859
<i>Pinus resinosa</i>	0.1867
<i>Lilium philadelphicum</i> var. <i>philadelphicum</i>	0.1898
<i>Juniperus virginiana</i> var. <i>virginiana</i>	0.1903
<i>Potentilla simplex</i>	0.1923
<i>Dichanthelium xanthophysum</i>	0.2202

TABLE 2. (continued)

Species	Factor
<i>Carex backii</i>	0.2303
<i>Campanula rotundifolia</i>	0.2556
<i>Desmodium canadense</i>	0.2619
<i>Helianthus strumosus</i>	0.2658
<i>Dichanthelium perlongum</i>	0.3389
<i>Dichanthelium villosissimum</i>	0.3724
<i>Carex richardsonii</i>	0.3955
<i>Lupinus perennis</i> ssp. <i>perennis</i> var. <i>perennis</i>	0.4113
<i>Saxifraga virginensis</i>	0.4799
<i>Lespedeza capitata</i>	0.4908
<i>Botrychium multifidum</i>	0.5059
<i>Polygala senega</i>	0.6403
<i>Ceanothus herbaceus</i>	0.6574
<i>Asclepias exaltata</i>	0.6995
<i>Solidago arguta</i> var. <i>arguta</i>	0.7490
<i>Taenidia integerrima</i>	0.7630
<i>Oryzopsis asperifolia</i>	0.7945
<i>Dichanthelium latifolium</i>	0.8177
<i>Solidago bicolor</i>	0.9095
<i>Corylus americana</i>	1.0091
<i>Muhlenbergia glomerata</i>	1.0543
<i>Cirsium discolor</i>	1.2539
<i>Luzula acuminata</i>	1.2578
<i>Desmodium glutinosum</i>	1.3285
<i>Desmodium paniculatum</i> var. <i>paniculatum</i>	1.3992
<i>Ranunculus hispidus</i> var. <i>hispidus</i>	1.6825

using ARCVIEW 3.2 which also allowed for the calculation of areas within polygons. Soil landscapes are areas of soil and land with similar attributes on a broad scale, these attributes including characteristics related to plant growth (Agriculture Canada 1989).

Results and Discussion

(1) Floristic composition

Forty-two remnants were found within an area of approximately 1000 km². These remnants accounted for an area of approximately 250 acres (101.17 hectares, 1.01 km²) and thus represent approximately 0.15-0.33% of the plains area (300-600 km²) previously suggested (Catling et al. 1992); i.e., a fraction of one percent. These had escaped cultivation, excessive grazing, displacement by alien species and destruction by extensive tree planting during the mid-1900s, at which time these sandy areas were considered serious locations of erosion rather than special and restricted natural habitats. The tallgrass and savannah areas evidently were destroyed by nearly complete conversion of the landscape to contiguous small farms with both livestock and crops leaving very little natural habitat. Except on the drier sites, those that escaped agriculture were subject to natural succession to woodland which occurred due to the absence of fire. The remnants are thus probably lacking the more mesic example of prairie. Although native species moved into some abandoned marginal cropland, this recoloniza-

tion was often limited due to the simultaneous invasion of alien species such as Scots Pine and Smooth Brome (Catling and King 2008).

The remnants discovered occurred on steep slopes, roadsides, hydro lines and within two pioneer cemeteries where the soil had not been turned except within local areas, where non-native species had not been introduced, where livestock had been excluded, and where extensive manicuring had not occurred as a result of early abandonment. Because trees were excluded to a large extent, these pioneer cemeteries evidently remained as they were since used by the pioneers and represented pristine examples of the natural vegetation. Another significant remnant occurred on the Alderville Reserve where native people have protected the natural landscape and maintained natural processes such as fire. The persistence of prairie relicts in pioneer graveyards and on lands managed by native people is a widespread phenomenon in North America and in many instances it has enabled successful protection of vegetation that would otherwise be gone.

A total of 260 native species was recorded in the remnants but many of these occurred at only one or two of the sites (Figure 2). Sixty-one native species occurred in at least half of the remnants. The most frequent species and those dominating many of the remnants included **Andropogon gerardii*, **Anemone cylindrica*, **Asclepias syriaca*, **Asclepias tuberosa* ssp. *tuberosa*, **Carex pensylvanica*, **Carex siccata*, **Cean-*

othus americanus, *Fragaria virginiana* ssp. *virginiana*, *Maianthemum stellatum*, **Monarda fistulosa* ssp. *fistulosa* var. *fistulosa*, *Poa pratensis* ssp. *pratensis*, *Prunus virginiana* var. *virginiana*, *Pteridium aquilinum* var. *latiusculum*, **Quercus velutina*, *Rhus typhina*, *Solidago juncea*, *Solidago nemoralis* var. *nemoralis*, **Sorghastrum nutans*, *Symphyotrichum oolentangiense* var. *oolentangiense*, *Symphyotrichum urophyllum*, *Symphyotrichum ericoides* var. *ericoides*, and *Toxicodendron rydbergii* (Appendix). Many of these are characteristic dominants of tallgrass prairie and related habitats in the midwest (e.g., Curtis 1959). Eight of them (marked with an asterisk) were recorded from the plains in presettlement times (Catling et al. 1992).

Although the most reliable indication of floristic composition is likely to be that obtained from the early historical records (Catling et al. 1992), these are incomplete and supplementation with additional information from remnants is appropriate provided that the limitations (see also under Methods) are taken into account. A major limitation is the differential response to changing conditions. Some of the species of the plains probably were able to withstand a degree of settlement pressure such as intense grazing and competition with alien plants. *Asclepias syriaca*, for example was very likely a common plant on the plains, and now occurs along roadsides throughout southern Ontario. *Andropogon gerardii* has some capability to spread along roads and railways, especially in the past prior to saturation of the landscape with alien Smooth Brome Grass (*Bromus inermis*). For some other species the situation may have been very different due to increased dependence on stochastic events and biological interactions relating to pollination and dispersal etc. *Lupinus perennis*, known from three remnants (none with more than a few dozen plants), appears to fall into this category and its scarcity today is a contrast to Traill's (1885) observation that "the extensive grassy flats were brilliant with the azure hues of lupine." In most cases, but clearly not all, low frequency in Table 1 probably does reflect low frequency on the former plains landscape.

Of 56 species reported from the plains prior to 1900 (Catling et al. 1992), only 10 were not found in the recent survey. Of these, the Wavy-leaf American Aster (*Symphyotrichum undulatum* (L.) Nesom.) and Running Buffalo Clover (*Trifolium stoloniferum* Muhl. ex Eat.) may have been misidentified since they are far beyond their main native range in the Rice Lake area. Great St. John's-wort (*Hypericum ascyron* L. = *pyramidatum*) is still found in the region, but only in wetland habitats. Thus of 56 species reported prior to 1900, seven species may be extirpated, including the following: Cut-Leaf Grape Fern (*Botrychium dissectum* Spreng. = *obliquum*), Scarlet Indian-Paintbrush (*Castilleja coccinea* (L.) Spreng.), Agueweed (*Gentiana quinquefolia* (L.) Small), Hairy Lettuce (*Lactuca hirsuta* Muhl. ex Nutt.), Virginia Mountain Mint

(*Pycnanthemum virginianum* (L.) T. Dur. & B.D. Jackson ex B.L. Robins. & Fern.), American Wintergreen (*Pyrola americana* Sweet, = *rotundifolia*), and Highbush Blueberry (*Vaccinium corymbosum* L.). Some of these (notably the last two) probably occurred in lower, moist and acid places in savannah. A few small habitats of this kind, dominated by Lowbush Blueberry (*Vaccinium angustifolium*), persist at Alderville (site 12), but none of these species have been found there. As for the others, some of them were characteristic of plains vegetation and occurred elsewhere in Ontario where plains occurred (e.g., *Castilleja coccinea*, *Gentiana quinquefolia*, *Pycnanthemum virginianum*), including the Humber Plains and the Norfolk Plains. Given the loss of the historically recorded species of dry ground, 9.8% (5 of 51) may be extirpated. Extrapolating this percentage to the total dry ground native flora, 28 native species (9.8% of 288 since 260 is 90.2%) of dry ground may be extirpated. However this is to be considered a maximum number since it is difficult to conceive of 28 additional native species of dry ground that likely occurred in the region based on occurrence in areas nearby such as the Trent Valley (Catling and Catling 1993) or former Humber Plains (Varga 1999). Certainly some species are extirpated and frequencies in remnants may not reflect frequency on the original plains. Nevertheless, comparison with original composition and a general knowledge of the usual dominants of these associations suggest that both composition and frequency are much the same, but not exactly the same, as existed in pre-settlement times.

(2) Variation in floristic composition among sites

The PCO analysis explained almost 25% of the variation on the first two axes (Figure 4) which is not unreasonable for ecological data of this kind (Pielou 1984). Variation explained on subsequent axes decreased gradually, with the third axis accounting for 7.2%. The minimum spanning tree helped to resolve three major groupings (Figure 4): (1) sites with open sand on high-elevation neutral sand and characteristic sand barren flora, including *Dichanthelium sabulorum*, *Carex merritt-fernaldii*, *Cyperus lupulinus*, *Polygonum douglasii*, *Selaginella rupestris*, and *Sporobolus cryptandrus* and other species with an ability to grow in either sand or dry grassland such as *Artemisia campestris*, *Liatris cylindracea*, *Linum sulcatum*, and *Ceanothus herbaceus*; (2) prairie sites on neutral to slightly acid pure sand with *Desmodium canadense*, *Monarda fistulosa*, *Penstemon hirsutus*, *Ranunculus rhomboideus*, and *Schizachyrium scoparium* and other species associated mostly with grassland; (3) high-diversity sites with savannah vegetation often on calcareous or neutral gravel, including species characteristic of both prairie and open woodland, including *Asclepias exaltata*, *Desmodium glutinosum*, *Erigeron pulchellus*, *Solidago arguta*, and *Taenidia integerrima* as well as certain rare species such as *Anemone*

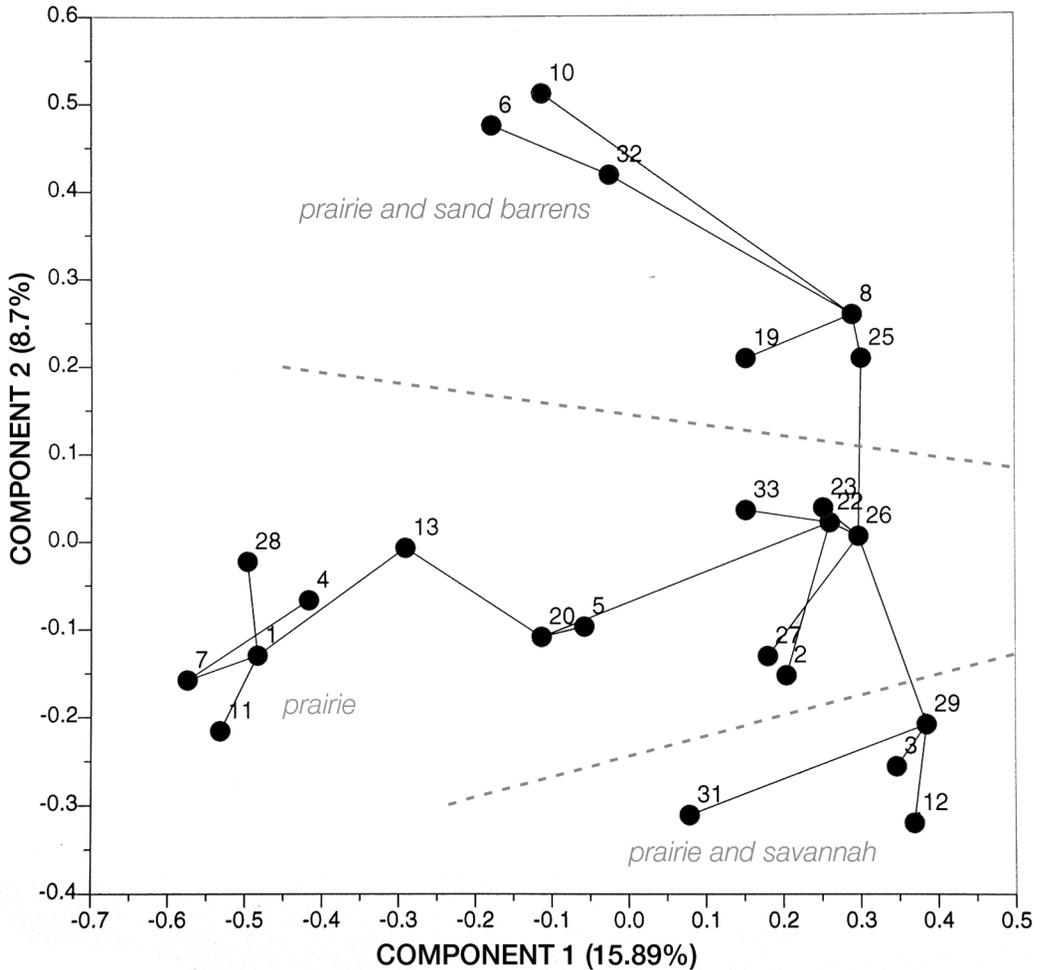


FIGURE 4. Relationships among 24 remnants of Rice Lake Plains vegetation portrayed by Principal Coordinate Analysis based on a matrix of Jaccard's coefficients from species presence/absence data with a superimposed minimum spanning tree. Three groups are suggested, the upper including sand barrens, the middle including prairie and mixed sites and the lower including savannah.

quinquefolia and *Vitis aestivalis*. While a small number of species occur only or predominantly in sand barrens and an equally small number occur only in savannah (Table 3), many species (including those present in the majority of sites (Appendix), are present in all three associations; e.g., *Carex siccata*, *Ceanothus americanus*, and *Andropogon gerardii*. A classification of associations based on sites has limitations because many sites contain more than one association and disturbance and succession may lead to intermediate associations. For example a particular site may have open sand with some characteristic sand barren flora grading into both prairie and savannah. Despite the limitations, the PCO analysis clearly suggests that sites

differ with respect to three major association types (Figure 5).

The first and second dimensions of the CA analysis account for 13.36% and 11.94% (total 25.3%) of the variation, respectively, with a gradual decline thereafter. The three major site groups revealed by the principal coordinate analysis form a gradation on the first axis with the sand barren group on the left, the prairie in the centre, and the savannah on the right (Figure 6). The fact that the sites are not discrete but form a continuum on this axis, which accounts for most of the variation, suggests that they intergrade. Field observations over a decade suggest that this intergradation may be a result of a succession from sand barren to

TABLE 3. Exemplary indicator species for group 1 (sand barrens and prairie) and group 3 (savannah and prairie) associations (see Figure 4) with percentages of their overall occurrence within particular associations.

Species	Group 1 Sand Barren (6)	Group 2 Prairie/Mixed (14)	Group 3 Savannah (4)
GROUP 1 INDICATORS			
<i>Artemisia campestris</i> (10)	50.0	50.0	–
<i>Carex merritt-feraldii</i> (10)	100.0	38.1	25.0
<i>Cyperus lupulinus</i> (10)	100.0	38.1	–
<i>Dichanthelium sabulorum</i> (5)	50	14.3	–
<i>Linum sulcatum</i> (7)	50.0	28.6	–
<i>Polygonum douglasii</i> (2)	33.3	–	–
<i>Selaginella rupestris</i> (4)	50.0	7.1	–
<i>Sporobolus cryptandrus</i> (7)	50.0	28.6	–
GROUP 2 INDICATORS			
<i>Asclepias exaltata</i> (5)	–	14.2	75.0
<i>Cirsium discolor</i> (3)	–	7.1	50.0
<i>Corylus americana</i> (5)	–	7.1	100.0
<i>Desmodium glutinosum</i> (4)	–	7.1	75.0
<i>Erigeron pulchellus</i> (5)	–	14.2	75.0
<i>Saxifraga virginiensis</i> (3)	–	–	75.0
<i>Solidago arguta</i> (4)	–	7.1	75.0
<i>Taenidia integerrima</i> (4)	–	–	100.0

prairie to savannah to woodland with increasing organic matter accumulation and increasing tree colonization. The rate of succession almost certainly depends upon soil moisture and would have been mediated by fire in pre-settlement times. Natural fires burned on parts of the plains every summer (Roche 1845*). Fires burning in different areas at different frequencies and in different sites ranging from mesic to very dry would have led to associations in different stages of succession. In some cases, succession was likely arrested by fire; i.e., prairie with oak “grubs” which would rapidly become savannah with the cessation of fire. Wide-

spread topographic variation likely would have led to a mosaic of associations. Thus, it seems likely that substantial variation in associations often existed within smaller areas of 1 km² but at the same time. Sand barrens would likely have been most prevalent at higher elevations on coarse sand, whereas savannah would have prevailed at lower elevations on gravelly soils. Since some of the hills and slopes are gravelly and partly protected from heat exposure (north slopes) it seems most likely that savannah and open woodland developed on hills with sand barrens and prairie on the land between.

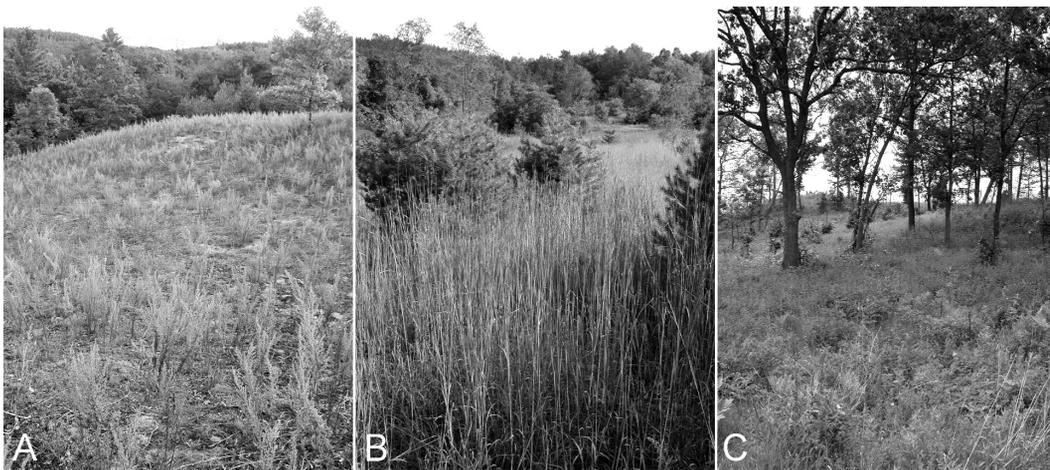


FIGURE 5. Examples of major associations represented by remnants of the Rice Lake Plains. A, sand barren, this one dominated by *Artemisia campestris* ssp. *borealis* (site 10); B, prairie dominated by Big Bluestem (*Andropogon gerardii*) (site 10); C, savannah with Black Oaks (*Quercus velutina*) at Alderville (site 12).

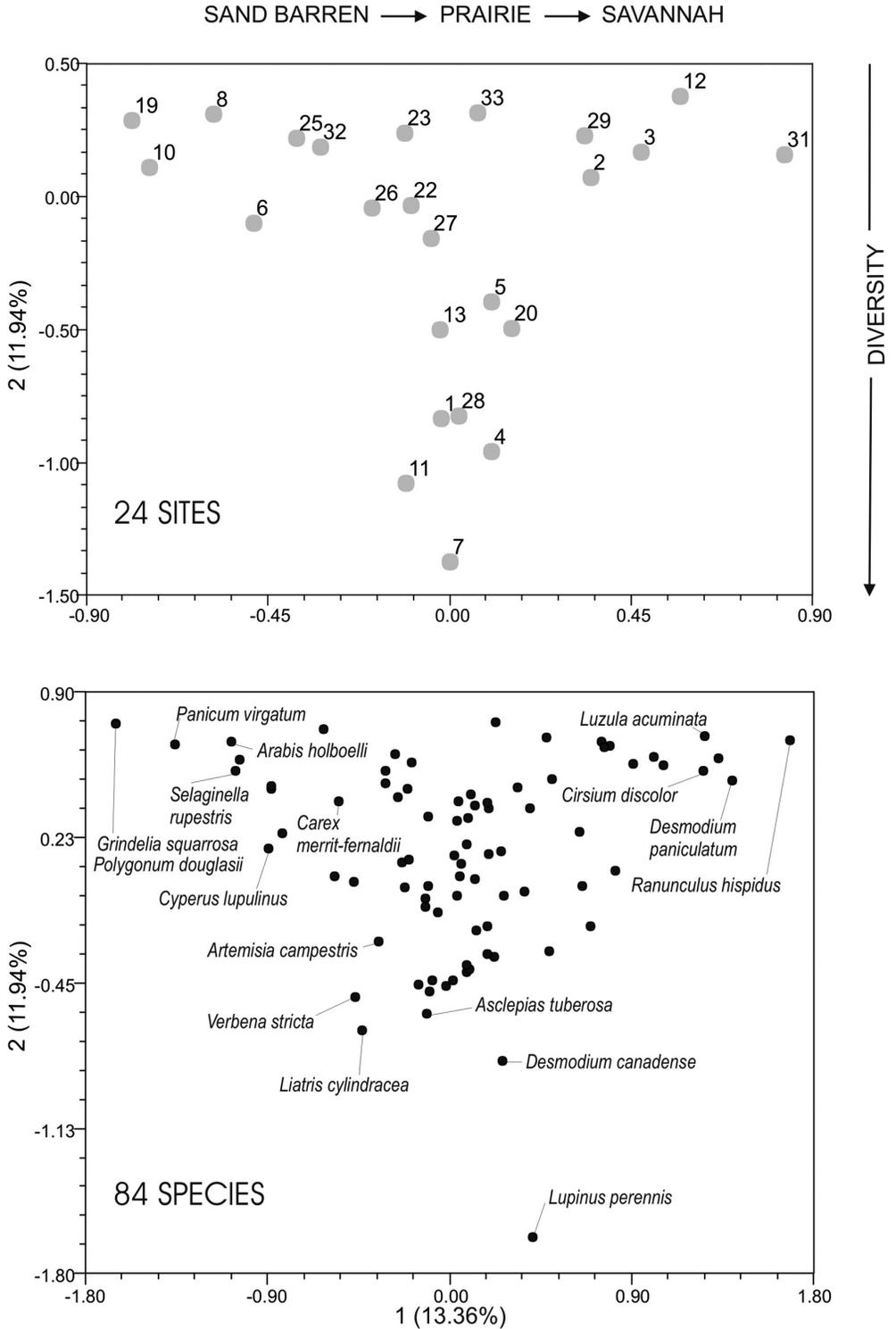


FIGURE 6. Correspondance analysis with a plot of dimensions 1 and 2 by site (above) and by species (below).

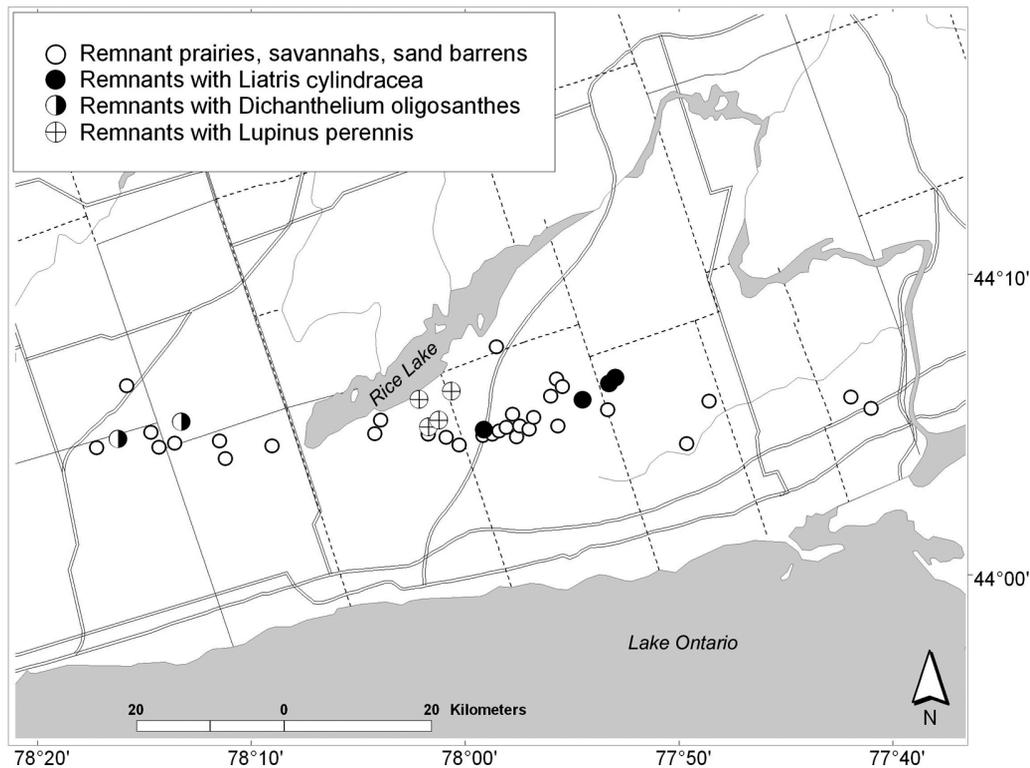


FIGURE 7. Rice Lake Plains region showing the locations of 42 remnant sites (circles) with the locations for certain regional rare species shown. Regional floristic variation within the plains is suggested by the occurrences of *Dichanthelium oligosanthes* (half-dots), *Liatris cylindracea* (filled dots), and *Lupinus perennis* (circles with crosses).

Species are associated with different parts of the gradation on the first dimension (Figure 6 lower). For example a number of species unique to sand barrens appear on the left-hand side and other species unique to savannah appear on the extreme right. An indication of the association of species with either sand barren, prairie/mixed, or savannah associations can be obtained by a listing of species in ascending order of row factors on dimension 1 (Table 2). The species at the top of the list are exclusively or primarily associated with sand barren whereas those at the bottom of the list are primarily or exclusively associated with savannah. Species associated mainly with prairie and mixed associations are in the middle of the list.

The second axis in the CA plot is related to diversity, with the lower diversity sites at the bottom of the plot (Figure 6 upper). Some of these lower diversity sites are disturbed edges of roads and fields, and the species associated with the lower diversity sites, including *Asclepias tuberosa*, *Desmodium canadense*, *Liatris cylindracea*, *Lupinus perennis* and *Verbena stricta*, are species that may benefit from disturbance to the soil.

Most of the variation in floristic composition between sites is related to a succession from open sand to woodland with at least three species groups, and secondarily, to diversity possibly related to soil disturbance history. However, there is some regional variation that was not revealed in these analyses. For example *Dichanthelium oligosanthes*, *Liatris cylindracea* and *Lupinus perennis* all are restricted to a portion of the plains area (Figure 7).

(3) Extent of occurrence

Prairies, savannahs and sand barrens occurred throughout a huge area of western North America in pre-settlement times but the presence of these habitats further east is less well known. Judging by the distribution of relict vegetation, they extended narrowly eastward in the southern Great Lakes (Catling and McKay 1974; Roberts et al. 1977; Bakowsky and Riley 1994; Faber-Langendoen and Maycock 1994; Goodban et al. 1996; Rodger 1998; Varga 1999, 2001*). On the north side of Lake Ontario the eastern limit was evidently the Trent River (Catling and Catling 1993; Catling and Brownell 1999), although sandy open habitats with some unusual species occur in eastern

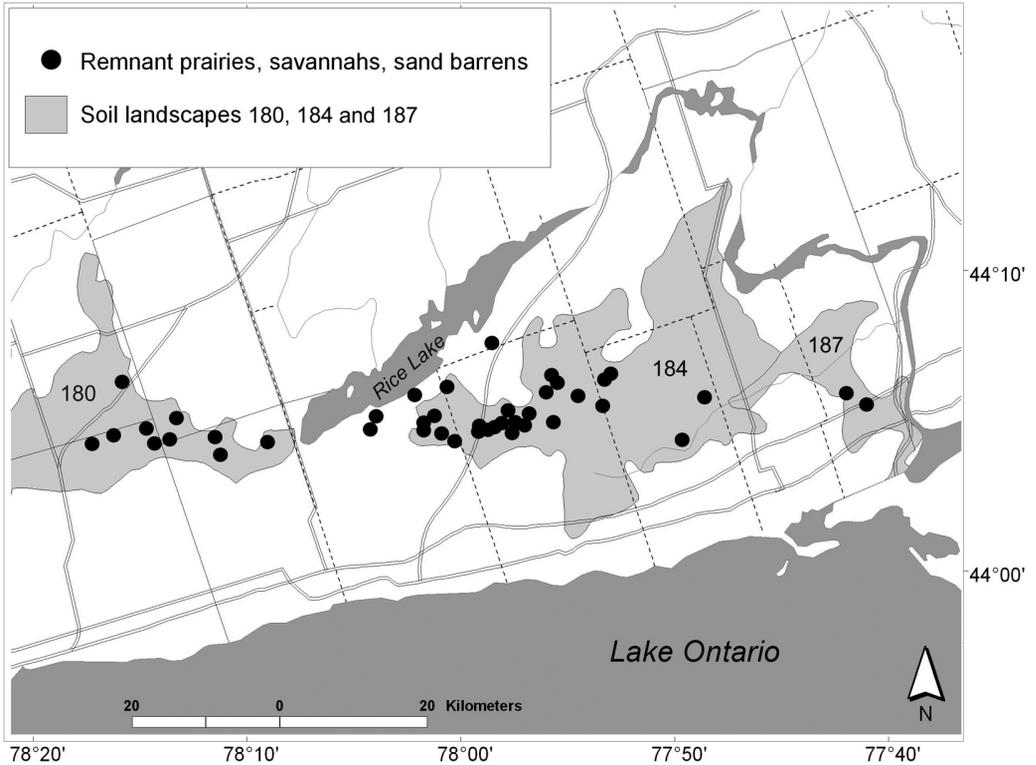


FIGURE 8. Rice Lake Plains region showing the locations of 42 remnant sites with soil landscapes superimposed. Soil landscape data from Agriculture Canada (1989).

Ontario; however, these are sand barrens rather than savannah or prairie (Carbyn and Catling 1995). On the south side of Lake Ontario the prairies, savannahs and sand barrens may have existed more or less continuously east to the Mohawk and Hudson valleys (e.g., Day 1953; Marks et al. 1992). The continuity of these habitats may have been substantial during the warmer and drier hypsithermal (xerothermic) interval (Deevey and Flint 1957) 5000 years ago, but subsequent forest expansion left these habitats as more or less disconnected islands. Many species with largely western distributions apparently moved narrowly eastward along this more or less continuous corridor, resulting in a characteristic distribution pattern, but some did not reach as far as the coastal plain while others radiated onto its northern section. The Rice Lake Plains and smaller areas in the valley of the Trent River on its eastern border (Catling and Catling 1993) appear to represent the northeastern limit of prairie and sand barren in North America.

In the Rice Lake area, dry open habitats with native vegetation exist primarily within three soil landscapes (units 180, 184 and 187, Agriculture Canada 1989) and are widely distributed within these landscapes. All of these landscapes have relict Black Oaks (*Quercus*

velutina) along field edges and tree lines, and these oaks are extensively distributed throughout. Since these oaks often are associated with savannah and prairie vegetation, their occurrence supports the idea that these kinds of vegetation were predominant throughout the region. Only four of 42 sites are not within these landscapes (Figure 8). Three are in 182 (to the west of 184) and the northernmost is in 185. Both of these landscapes are extensive and have only localized relict Black Oak, which makes it seem unlikely that they contained extensive dry, open habitats. Consequently, these landscapes are excluded from the calculation of the plains area. Since remnants are known only from the eastern half of the Ganaraska Highland (in 180), only this eastern half, approximately 150 km², is considered likely to have been plains. All but the southern lobe of landscape 184 (the central landscape—see also Methods) seems likely to have been plains, although the remaining area includes some wetlands. Removing the wetlands and the southern lobe leaves approximately 360 km². The upper portion of landscape 187 (the part shown in Figure 8) is approximately 80 km². Therefore, collectively based on the landscape analysis the plains likely occupied a band from the Ganaraska Highland east to the Trent River, including approxi-

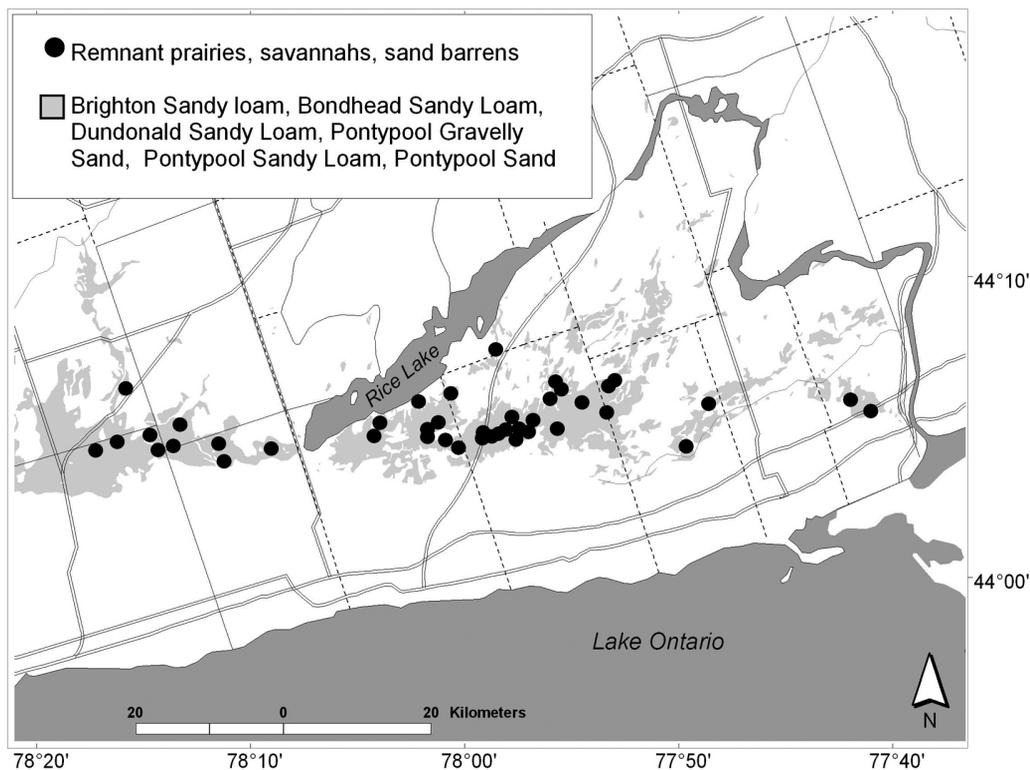


FIGURE 9. Rice Lake Plains region showing the locations of 42 remnant sites with the extent of coarse sandy soil types delineated. Soil landscape data from Webber et al. (1946) and Hoffman and Acton (1974).

mately 590 km² (approximately 59 000 hectares, approximately 145 792 acres, Figure 8).

With respect to soils, most of the remnants occur principally on the extensive Pontypool Sand (Table 1). The eastern area of Pontypool Sand in Durham (much of the Ganaraska Highland where remnants occur on the west side of Rice Lake) includes approximately 101 km² (Webber et al. 1946). The area of this soil type south and east of Rice Lake and north of the height of land between Rice Lake and Lake Ontario is also approximately 101 km². To this can be added approximately 61 km² of other sandy soil types, north of the height of land, which are represented by remnants. All of this area (Figure 9), representing the soil types conducive to prairie, savannah and sand barren development, existed over an approximate area of 263 km² on the east, south, and west sides of Rice Lake. The extensive occurrence of remnants throughout this region suggests that all of these soils may have been occupied by plains vegetation including prairie, savannah and sand barren. This area of open habitat, 263 km² approx. (65 000 acres, approximately 26 305 hectares), is considered very conservative since frequent fire may have allowed open habitat on adjacent soils and at lower elevations where prairie remnants

were less likely to survive due to less extreme conditions (such as the southwest corner of Rice Lake where the early explorers reported plains (Hambly 1795*; Fothergill 1817*; Catling et al. 1992).

The area of 263–590 km² is a more extensive area of prairie, savannah and sand barren than that suggested earlier (Catling et al. 1992) based on: (1) early surveys which were incomplete but nevertheless indicated a definite area of 172.2 km²; and (2) on a general consideration of soil and elevation which resulted in an estimate of 250–300 km². This earlier estimate did not take into account the area west of Rice Lake because, apart from Roche's (1845*) reference to plains in the 9th and 10th concessions of Hope Township, the plains area in that region was thought to be small and isolated. The distribution of remnants in relation to soil and landscape was not used in the earlier analysis. Based on current information, including that presented here, the Rice Lake Plains included an area of prairie, savannah and sand barrens approximately 600 km² in extent and extending as an essentially continuous band 123 km long and up to 25 km wide along the top and north slope of the Oak Ridges Moraine from the Ganaraska Highland west of Rice Lake eastward to the Murray Hills and the Trent River.

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APPENDIX. Species of vascular plants found in 24 remnants of Rice Lake plains vegetation arranged in descending order of frequency (number of 24 potential sites where present). Within frequency categories the species are arranged alphabetically by scientific name. Species marked with an asterisk (*) are regionally rare based on personal observations and Varga (2001*). Of the 42 remnants known, the 24 included here have reasonably complete species lists. Three species at the end of the list are not known from the well-inventoried sites, but occur in the western Ganaraska section (White 2003*). Scientific and common names are taken largely from Kartesz and Meachum (1999).

Sites	Scientific/Common Name
24	<i>Asclepias syriaca</i> L. / COMMON MILKWEED / 1,2,3,4,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,31,32,33
"	* <i>Carex siccata</i> Dewey / DRY-SPIKE SEDGE / 1,2,3,4,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,31,32,33
23	<i>Anemone cylindrica</i> Gray / LONG-HEAD THIMBLEWEED / 1,2,3,4,5,6,7,8,10,11,12,13,20,22,23,25,26,27,28,29,31,32,33
"	<i>Fragaria virginiana</i> Duchesne ssp. <i>virginiana</i> / VIRGINIA STRAWBERRY / 1,2,3,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,31,32,33
"	<i>Maianthemum stellatum</i> (L.) Link (<i>Smilacina stellata</i>) / STARRY FALSE SOLOMON'S-SEAL / 1,2,3,4,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,31,32
"	<i>Pteridium aquilinum</i> L. Kuhn var. <i>latiusculum</i> (Desv.) Underwood ex Heller / NORTHERN BRACKEN FERN / 1,2,3,4,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,29,31,32,33
"	* <i>Quercus velutina</i> Lam. / BLACK OAK / 1,2,3,4,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,31,32
"	<i>Solidago nemoralis</i> Ait. var. <i>nemoralis</i> / GRAY GOLDENROD / 1,2,3,4,5,6,7,8,11,12,13,19,20,22,23,25,26,27,28,29,31,32,33
"	<i>Symphotrichum oolentangiense</i> (Riddell) Nesom var. <i>oolentangiense</i> / SKY-BLUE AMERICAN-ASTER / 1,2,3,4,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,32,33
22	<i>Poa pratensis</i> L. ssp. <i>pratensis</i> / KENTUCKY BLUE GRASS / 1,2,3,4,5,6,7,8,10,11,13,19,20,22,23,25,26,28,29,31,32,33
"	<i>Prunus virginiana</i> L. var. <i>virginiana</i> / CHOKE CHERRY / 1,2,3,4,6,7,10,11,12,13,19,20,22,23,25,26,27,28,29,31,32,33
"	<i>Toxicodendron rydbergii</i> (Small ex Rydb.) Greene / POISON IVY / 1,2,3,4,5,6,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,32
21	* <i>Asclepias tuberosa</i> L. ssp. <i>tuberosa</i> / BUTTERFLY MILKWEED / 1,2,3,4,5,6,7,8,10,11,12,13,20,22,23,25,26,27,28,29,32
"	* <i>Ceanothus americanus</i> L. / NEW JERSEY-TEA / 1,2,3,4,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,32,33
"	* <i>Monarda fistulosa</i> L. ssp. <i>fistulosa</i> var. <i>fistulosa</i> / OSWEGO / 1,2,3,4,7,8,10,11,12,13,19,20,22,23,25,26,27,28,29,31,33
"	* <i>Sorghastrum nutans</i> (L.) Nash / YELLOW INDIAN GRASS / 1,2,3,4,5,6,7,8,11,12,13,19,20,22,23,25,26,27,29,31,33
20	* <i>Andropogon gerardii</i> Vitman / BIG BLUESTEM / 1,2,3,4,5,8,10,11,12,13,20,22,23,25,26,27,28,29,31,33
"	<i>Carex pensylvanica</i> Lam. / PENNSYLVANIA SEDGE / 1,2,3,4,5,6,7,8,10,12,13,19,20,22,23,25,28,29,31,32
"	<i>Rhus typhina</i> L. / STAG-HORN SUMAC / 1,2,3,4,5,6,7,10,12,13,19,20,22,23,25,26,29,31,32,33
"	<i>Solidago juncea</i> Ait. / EARLY GOLDENROD / 1,2,3,5,6,7,8,11,12,13,19,20,22,23,25,26,27,29,31,32
"	<i>Symphotrichum ericoides</i> var. <i>ericoides</i> / WHITE HEALTH AMERICAN-ASTER / 1,2,3,5,6,7,8,12,19,20,22,23,25,26,27,28,29,31,32,33
"	<i>Symphotrichum urophyllum</i> (Lindl.) Nesom / WHITE ARROW AMERICAN-ASTER / 1,2,3,5,6,7,8,12,13,19,20,22,23,25,26,27,29,31,32,33
19	* <i>Amanchier stolonifera</i> Wieg. / RUNNING SERVICE-BERRY / 1,2,3,5,8,10,12,13,19,20,22,23,25,26,27,28,29,31,32
"	* <i>Calystegia spithamea</i> (L.) Pursh ssp. <i>spithamea</i> / LOW FALSE BINDWEED / 1,2,3,5,6,8,10,12,13,19,20,22,23,25,26,27,29,32,33
"	<i>Pinus strobus</i> L. / EASTERN WHITE PINE / 1,2,3,4,5,10,11,12,13,19,20,22,23,25,26,29,31,32,33
"	<i>Vitis riparia</i> Michx. / RIVER-BANK GRAPE / 1,2,3,4,5,7,8,10,11,12,13,20,22,23,25,26,28,29,32
18	<i>Apocynum androsaemifolium</i> L. / SPREADING DOGBANE / 1,2,3,5,6,8,12,19,20,22,23,25,26,27,28,29,31,32
"	<i>Danthonia spicata</i> (L.) Beauv. ex Roemer & J.A. Schultes / POVERTY WILD OAT GRASS / 1,2,5,6,8,10,12,13,19,22,23,25,26,27,29,31,32,33
"	* <i>Elymus trachycaulus</i> (Link) Gould ex Shinners ssp. <i>subsecundus</i> (Link) A. & D. Löve (includes unilaterale) / SLENDER WILD RYE / 1,2,3,8,12,13,19,20,22,23,25,26,27,28,29,31,32,33
18	* <i>Potentilla arguta</i> Pursh ssp. <i>arguta</i> / TALL CINQUEFOIL / 2,3,4,5,7,8,12,13,19,20,22,23,25,26,27,28,29,31
"	<i>Quercus rubra</i> L. var. <i>rubra</i> / NORTHERN RED OAK / 2,3,4,5,7,8,10,11,12,13,19,20,22,23,25,29,31,32

APPENDIX. (continued)

Sites	Scientific/Common Name
18	<i>Solidago canadensis</i> L. var. <i>canadensis</i> / CANADIAN GOLDENROD / 2,3,4,5,7,8,11,12,13,19,20,22,23,25,28,29,31,32
17	* <i>Carex muehlenbergii</i> Schkuhr ex Willd. var. <i>muehlenbergii</i> / MUHLENBERG'S SEDGE / 2,3,4,6,8,10,12,19,20,22,23,25,26,27,29,32,33
"	* <i>Helianthus divaricatus</i> L. / WOODLAND SUNFLOWER / 1,2,3,5,8,11,12,13,19,20,22,23,26,27,29,31,33
"	<i>Salix humilis</i> Marsh. var. <i>humilis</i> / PRAIRIE WILLOW / 2,3,8,10,11,12,19,20,22,23,25,26,27,28,29,31,33
16	<i>Aquilegia canadensis</i> L. / RED COLUMBINE / 2,3,5,7,11,12,13,19,20,22,23,25,27,29,31,32
"	* <i>Juniperus communis</i> L. var. <i>depressa</i> Pursh / COMMON JUNIPER / 1,2,3,5,6,7,8,19,22,23,25,26,29,31,32,33
"	<i>Populus tremuloides</i> Michx. / QUAKING ASPEN / 1,2,3,4,7,8,10,12,19,22,23,25,26,29,31,32
"	* <i>Rosa acicularis</i> Lindl. ssp. <i>acicularis</i> / PRICKLY ROSE / 2,3,6,8,10,13,20,22,23,25,26,28,29,31,32,33
"	* <i>Rosa blanda</i> Ait. var. <i>blanda</i> / SMOOTH ROSE / 1,2,6,7,11,12,20,22,23,25,26,27,29,31,32,33
"	<i>Rubus allegheniensis</i> Porter var. <i>allegheniensis</i> / ALLEGHENY BLACKBERRY / 2,3,6,7,8,10,12,19,20,22,23,26,27,29,31,32
15	* <i>Comandra umbellata</i> (L.) Nutt ssp. <i>umbellata</i> / BASTARD-TOADFLAX / 2,3,5,8,10,12,13,20,22,23,25,26,29,31,32
"	* <i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark var. <i>acuminatum</i> (<i>D. implicatum</i>) / TAPERED ROSETTE GRASS / 1,2,3,5,8,12,19,20,22,25,26,27,29,31,33
"	* <i>Penstemon hirsutus</i> (L.) Willd. / HAIRY BEARDTONGUE / 2,3,5,6,8,12,19,20,22,23,25,26,27,29,31
"	<i>Quercus alba</i> L. / NORTHERN WHITE OAK / 2,3,5,7,8,12,13,19,20,22,23,25,29,31,32
14	* <i>Carex tonsa</i> (Fern.) Bickn. var. <i>rugosperma</i> (Mackenzie) Crins / SHAVED SEDGE / 2,3,5,8,12,19,22,23,25,26,27,29,32,33
"	* <i>Comptonia peregrina</i> (L.) Coult. / SWEET-FERN / 3,6,8,10,19,20,22,23,25,26,27,28,29,32
"	<i>Cornus racemosa</i> Lam. / GRAY DOGWOOD / 2,5,6,7,13,19,20,22,23,25,26,28,29,31
"	* <i>Desmodium canadense</i> (L.) DC. / SHOWY TICK-TREFOIL / 1,3,5,7,8,11,12,13,20,26,27,28,29,31
"	* <i>Lilium philadelphicum</i> L. var. <i>philadelphicum</i> / WOOD LILY / 2,3,4,11,12,19,20,22,23,25,26,27,29,31
"	<i>Maianthemum canadense</i> Desf. / FALSE LILY-OF-THE-VALLEY / 2,3,5,7,8,11,12,13,20,22,25,29,31,32
"	<i>Maianthemum racemosum</i> (L.) Link ssp. <i>racemosum</i> (<i>Smilacina racemosa</i>) / FALSE SOLOMAN'S SEAL / 2,3,5,7,11,12,13,19,20,22,25,28,29,31
"	* <i>Ranunculus rhomboideus</i> Goldie / LABRADOR BUTTERCUP / 2,3,4,5,6,8,12,19,20,25,26,27,29,32
"	* <i>Schizachyrium scoparium</i> (Michx.) Nash var. <i>scoparium</i> / LITTLE FALSE BLUESTEM / 2,3,5,8,12,19,22,23,25,26,27,29,31,33
13	* <i>Bromus kalmii</i> Gray / KALM'S BROME / 3,5,8,12,13,20,22,23,25,26,27,29,33
"	<i>Rudbeckia hirta</i> L. var. <i>hirta</i> / BLACK-EYED-SUSAN / 2,3,5,8,12,19,20,25,27,29,31,32,33
12	<i>Cornus rugosa</i> Lam. / ROUND-LEAF DOGWOOD / 1,2,5,7,12,13,20,22,23,26,29,31
"	* <i>Lechea intermedia</i> Leggett ex Britt. var. <i>intermedia</i> / ROUND-FRUIT PINWEED / 2,3,8,10,12,19,23,25,26,27,29,33
"	* <i>Polygala polygama</i> Walt. / RACEMED MILKWORT / 2,3,4,8,10,12,19,22,25,26,27,29
"	* <i>Potentilla simplex</i> Michx. / OLDFIELD CINQUEFOIL / 2,3,5,6,8,12,20,22,25,29,31,32
"	<i>Symphoricarpos albus</i> (L.) Blake var. <i>albus</i> / COMMON SNOWBERRY / 3,5,6,8,12,13,19,23,29,31,32,33
11	<i>Antennaria howellii</i> Greene ssp. <i>petaloidea</i> (Fern.) Bayer / SMALL PUSSYTOES / 2,3,5,8,12,19,22,23,25,27,31
"	* <i>Campanula rotundifolia</i> L. / BLUEBELL-OF-SCOTLAND / 3,5,8,12,20,22,23,26,29,31,32
"	* <i>Carex merritt-fernaldii</i> Mackenzie / MERRITT FERNALD'S SEDGE / 3,6,8,10,19,22,23,25,26,29,33
"	* <i>Carex richardsonii</i> R. Br. / RICHARDSON'S SEDGE / 2,3,12,22,23,25,26,27,29,31,33
"	* <i>Vaccinium angustifolium</i> Ait. / LATE LOWBUSH BLUEBERRY / 2,3,8,10,12,13,23,29,31,32,33
"	* <i>Viola adunca</i> Sm. var. <i>adunca</i> / HOOK-SPUR VIOLET / 2,3,5,8,12,19,23,25,29,31,32
10	* <i>Arctostaphylos uva-ursi</i> (L.) Spreng. / RED BEARBERRY / 2,3,8,12,22,25,26,27,29,33
"	* <i>Artemisia campestris</i> L. ssp. <i>borealis</i> (Pallas) Hall & Clements var. <i>scouleriana</i> (Hook.) Cronq. / PACIFIC WORMWOOD / 8,10,11,12,13,19,20,23,25,26,27
"	* <i>Cyperus lupulinus</i> (Spreng.) Marcks. ssp. <i>lupulinus</i> / GREAT PLAINS FLAT SEDGE / 6,8,10,13,19,22,23,25,26,32
"	* <i>Helianthus strumosus</i> L. / PALE-LEAF WOODLAND SUNFLOWER / 3,11,12,19,23,26,28,29,31,33
"	* <i>Lespedeza capitata</i> Michx. / ROUND-HEAD BUSH-CLOVER / 2,3,4,6,12,20,28,29,31,32
"	* <i>Prunus pumila</i> L. var. <i>susquehanae</i> (hort. ex Willd.) Jaeger / SUSQUEHANA SAND CHERRY / 2,3,10,12,22,23,25,26,27,29
"	* <i>Rhus aromatica</i> Ait. var. <i>aromatica</i> / FRAGRANT SUMAC / 8,12,13,22,26,27,29,31,32
9	<i>Crataegus douglasii</i> Lindl. / BLACK HAWTHORN / 2,3,6,7,8,19,25,28,29
"	* <i>Dichanthelium villosissimum</i> (Nash) Freckmann var. <i>praecocius</i> (A.S. Hitchc. & Chase) Freckmann / WHITE-HAIR ROSETTE ROCK / 2,3,4,12,22,23,26,27,29
"	* <i>Juniperus virginiana</i> L. var. <i>virginiana</i> / EASTERN RED-CEDAR / 3,8,12,22,26,27,31,32,33
"	* <i>Pinus resinosa</i> Ait. / RED PINE / 3,5,7,12,19,20,23,27,29
"	<i>Rubus idaeus</i> L. ssp. <i>idaeus</i> / COMMON RED RASPBERRY / 2,3,12,22,25,27,29,31,33
"	* <i>Shepherdia canadensis</i> (L.) Nutt. / RUSSET BUFFALO-BERRY / 8,12,19,22,23,25,26,29,33
"	* <i>Viola sagitta</i> Ait. var. <i>ovata</i> (Nutt.) Torr. & Gray / ARROW-LEAF VIOLET / 3,8,12,22,25,26,27,29,33
8	<i>Achillea millefolium</i> L. var. <i>occidentalis</i> DC. (<i>A. lanulosa</i>) / SMALL PUSSYTOES / 2,3,5,8,12,19,20,33
"	<i>Anaphalis margaritacea</i> (L.) Benth. / PEARLY-EVERLASTING / 2,3,6,8,10,12,19,32

APPENDIX. (continued)

Sites	Scientific/Common Name
8	<i>Antennaria parlinii</i> Fern. ssp. <i>fallax</i> (Greene) Bayer & Stebbins / PARLIN'S PUSSYTOES / 2,3,12,22,23,25,31,33
"	* <i>Dichanthelium depauperatum</i> (Muhl.) Gould / STARVED ROSETTE GRASS / 2,8,12,19,22,25,26,33
"	* <i>Helianthemum canadense</i> (L.) Michx. / LONG-BRANCH FROSTWEED / 3,8,10,19,27,29,31,32
7	<i>Amelanchier arborea</i> (Michx. f.) Fern. var. <i>arborea</i> / DOWNY SERVICE-BERRY / 3,5,12,20,25,29,31
"	<i>Corylus cornuta</i> Marsh. var. <i>cornuta</i> / BEAKED HAZELNUT / 2,3,12,22,23,29,31
"	<i>Eurybia macrophylla</i> (L.) Cass. (<i>Aster macrophyllus</i>) / LARGE-LEAF WOOD-ASTER / 2,3,12,20,22,29,31
"	<i>Euthamia graminifolia</i> (L.) Greene var. <i>graminifolia</i> / FLAT-TOP GOLDENTOP / 2,5,11,12,22,28,31
"	* <i>Linum sulcatum</i> Riddell var. <i>sulcatum</i> / GROOVED YELLOW FLAX / 5,6,8,19,26,27,29
"	<i>Populus grandidentata</i> Michx. / BIG-TOOTH ASPEN / 2,3,8,12,29,31,32
"	<i>Symphytotrichum novae-angliae</i> (L.) Nesom / NEW ENGLAND AMERICAN-ASTER / 2,3,5,12,25,29,31
"	* <i>Verbena stricta</i> Vent. / HOARY VERVAIN / 7,8,11,19,22,23,29
"	* <i>Sporobolus cryptandrus</i> (Torr.) Gray / SAND DROPSSEED / 6,8,10,23,25,32,33
6	* <i>Dichanthelium perlongum</i> (Nash) Freckmann / ELONGATE PANIC GRASS / 3,12,23,25,27,29
"	<i>Diervilla lonicera</i> P. Mill. / NORTHERN BUSH HONEYSUCKLE / 2,8,12,19,23,29
"	* <i>Helianthemum bicknellii</i> Fern. / HOARY FROSTWEED / 6,8,12,25,29,33
"	* <i>Muhlenbergia glomerata</i> (Willd.) Trin. / SPIKED MUHLY / 2,3,12,29,31,33
"	* <i>Polygala senega</i> L. / SENECA-SNAKEROOT / 2,3,12,13,23,29
"	<i>Smilax herbacea</i> L. / SMOOTH CARRION-FLOWER / 3,10,12,29,31,33
"	<i>Solidago gigantea</i> Ait. / LATE GOLDENROD / 8,11,12,19,25,29
"	<i>Thalictrum dioicum</i> L. / EARLY MEADOW-RUE / 2,3,5,12,29,31
"	<i>Amelanchier laevis</i> Wieg. / ALLEGHENY SERVICE-BERRY / 2,3,23,25,29,31
"	<i>Physalis heterophylla</i> Nees / CLAMMY GROUND-CHERRY / 5,6,8,10,23,25
5	<i>Acer saccharum</i> Marsh. var. <i>saccharum</i> / SUGAR MAPLE / 2,3,12,29,31
"	<i>Ambrosia artemisiifolia</i> L. var. <i>artemisiifolia</i> / ANNUAL RAGWEED / 3,12,19,27,32
"	* <i>Arabis divaricarpa</i> A. Nels. (pro sp.) / HYBRID ROCK CRESS / 8,12,19,23,25
"	<i>Bromus pubescens</i> Muhl. ex Willd. / HAIRY WOODLAND BROME / 3,12,13,20,29
"	* <i>Corylus americana</i> Walt. / AMERICAN HAZELNUT / 3,12,23,29,31
"	* <i>Dichanthelium latifolium</i> (L.) Gould & C.A. Clark / BROAD-LEAF ROSETTE GRASS / 2,3,20,23,31
"	* <i>Dichanthelium linearifolium</i> (Scribn. ex Nash) Gould / SLIM-LEAF ROSETTE GRASS / 8,10,19,25,29
"	* <i>Dichanthelium sabulorum</i> (Lam.) Gould & C.A. Clark var. <i>thinium</i> (A.S. Hitchc. & Chase) Gould & C.A. Clark (<i>D. columbianum</i>) / HEMLOCK ROSETTE GRASS / 5,8,10,23,25
"	* <i>Dichanthelium xanthophyllum</i> (Gray) Freckmann / SLENDER ROSETTE GRASS / 2,13,20,22,33
"	* <i>Erigeron pulchellus</i> Michx. var. <i>pulchellus</i> / ROBIN'S-PLANTAIN / 3,12,22,23,29
"	<i>Galium circaezans</i> Michx. / LICORICE BEDSTEAW / 2,3,12,29,31
"	<i>Prunella vulgaris</i> L. ssp. <i>vulgaris</i> / COMMON SELFHEAL / 1,2,3,12,29
"	<i>Schizachne purpurascens</i> (Torr.) Swallen / FALSE MELIC GRASS / 1,3,12,29,31
"	<i>Silene antirrhina</i> L. / SLEEPY CATCHFLY / 10,12,19,29,32
"	* <i>Solidago bicolor</i> L. / WHITE GOLDENROD / 3,12,29,31,32
"	<i>Prunus serotina</i> Ehrh. / BLACK CHERRY / 3,12,19,25,29
"	<i>Sisyrinchium montanum</i> Greene var. <i>montanum</i> / STRICT BLUE-EYED-GRASS / 2,3,12,27,29
4	<i>Agrimonia gryposepala</i> Wallr. / TALL HAIRY GROOVEBURR / 3,12,29,31
"	<i>Amelanchier sanguinea</i> (Pursh) DC. var. <i>sanguinea</i> / ROUND-LEAF SERVICE-BERRY / 3,12,13,29
"	<i>Amphicarpa bracteata</i> L. (Fern.) var. <i>bracteata</i> / AMERICAN HOG-PEANUT / 3,12,29,31
"	* <i>Arabis hirsuta</i> (L.) Scop. var. <i>pyncocarpa</i> (M. Hopkins) Rollins / HAIRY ROCKCRESS / 19,23,25,26
"	<i>Aralia nudicaulis</i> L. / WILD SARSAPARILLA / 2,3,12,31
"	* <i>Asclepias exaltata</i> L. / POKE MILKWEED / 5,12,20,29
"	* <i>Cirsium discolor</i> (Muhl. ex Willd.) Spreng. / FIELD THISTLE / 2,12,29,31
"	* <i>Desmodium glutinosum</i> (Muhl. ex Willd.) Wood / POINTED-LEAF TICK-TREFOIL / 3,12,29,31
"	<i>Erigeron hyemale</i> L. var. <i>affine</i> (Engelm.) A.A. Eat. / TALL SCOURING RUSH / 8,10,19,23
"	<i>Erigeron strigosus</i> Muhl. ex Willd. / PRAIRIE FLEABANE / 12,22,23,31
"	* <i>Liatris cylindracea</i> Michx. / ONTARIO GAYFEATHER / 11,25,26,27
"	<i>Lonicera dioica</i> L. / LIMBER HONEYSUCKLE / 2,3,12,29
"	* <i>Lupinus perennis</i> L. ssp. <i>perennis</i> var. <i>perennis</i> / SUNDIAL LUPINE / 3,4,5,7
"	<i>Melampyrum lineare</i> Desr. var. <i>lineare</i> / AMERICAN COW-WHEAT / 2,12,31,32
"	<i>Muhlenbergia mexicana</i> (L.) Trin. / MEXICAN MUHLY / 2,3,12,31
"	<i>Prunus nigra</i> Ait. / CANADIAN PLUM / 3,7,19,29
"	* <i>Saxifraga virginiana</i> Michx. / EARLY SAXIFRAGE / 3,8,12,29
"	* <i>Selaginella rupestris</i> (L.) Spring / LEDGE SPIKE-MOSS / 8,10,23,32
"	* <i>Taenidia integerrima</i> (L.) Drude / YELLOW-PIMPERNEL / 3,12,23,29
"	<i>Thuja occidentalis</i> L. / EASTERN ARBORVITAE / 5,12,13,22
"	<i>Trillium grandiflorum</i> (Michx.) Salisb. / WHITE TRILLIUM / 2,3,12,29
"	<i>Viburnum acerifolium</i> L. / MAPLE-LEAF ARROW-WOOD / 2,3,12,29

APPENDIX. (continued)

Sites	Scientific/Common Name
4	<i>Viburnum rafinesquianum</i> J.A. Schultes / DOWNY ARROW-WOOD / 3,8,12,13
3	<i>Agrostis scabra</i> Willd. / ROUGH BENT / 2,12,33
"	* <i>Ceanothus herbaceus</i> Raf. / PRAIRIE REDROOT / 5,23,31
"	<i>Celastrus scandens</i> L. / AMERICAN BITTERSWEET / 12,29,31
"	<i>Geranium maculatum</i> L. / SPOTTED CRANE'S-BILL / 5,12,19
"	* <i>Lathyrus ochroleucus</i> Hook. / CREAM VETCHLING / 3,12,20
"	<i>Lonicera hirsuta</i> Eat. / HAIRY HONEYSUCKLE / 2,12,29
"	* <i>Oryzopsis asperifolia</i> Michx. / WHITE-GRAIN MOUNTAIN-RICE GRASS / 2,12,33
"	* <i>Panicum virgatum</i> L. var. <i>virgatum</i> / WAND PANIC GRASS / 8,19,32
"	<i>Parthenocissus quinquefolia</i> (L.) Planch. (incl. <i>P. inserta</i>) / VIRGINIA-CREEPER / 2,12,29
"	<i>Podophyllum peltatum</i> L. / MAY-APPLE / 12,29,31
"	<i>Populus balsamifera</i> L. subsp. <i>balsamifera</i> / BALSAM POPLAR / 2,10,29
"	<i>Populus deltoides</i> Bartr. ex Marsh ssp. <i>deltoides</i> / EASTERN COTTONWOOD / 8,12,27
"	<i>Rubus flagellaris</i> Willd. / WHIPLASH DEWBERRY / 8,12,33
"	* <i>Solidago arguta</i> Ait. var. <i>arguta</i> / ATLANTIC GOLDENROD / 3,12,23
"	<i>Solidago rugosa</i> P. Mill. ssp. <i>rugosa</i> var. <i>rugosa</i> / WRINKLE-LEAF GOLDENROD / 3,12,29
"	<i>Symphotrichum puniceus</i> (L.) A. & D. Löve / PURPLE-STEM AMERICAN-ASTER / 2,12,31
2	<i>Acer rubrum</i> L. var. <i>rubrum</i> / RED MAPLE / 12,31
"	<i>Actaea pachypoda</i> Ell. / WHITE BANE BERRY / 3,12
"	* <i>Andropogon virginicus</i> L. var. <i>virginicus</i> / BROOM-SEDGE / 29,32
"	* <i>Anemone quinquefolia</i> L. var. <i>quinquefolia</i> / NIGHTCAPS / 3,12
"	* <i>Arabis holboellii</i> Hornem. var. <i>retrofracta</i> (Graham) Rydb. / HOLBOELL'S ROCKCRESS / 19,23
"	* <i>Botrychium multifidum</i> (Gmel.) Trev. / LEATHERY GRAPE FERN / 2,33
"	* <i>Carex backii</i> Boott / BACK'S SEDGE / 12,25
"	<i>Cornus canadensis</i> L. / CANADIAN BUNCHBERRY / 2,12
"	<i>Cypripedium parviflorum</i> Salisb. var. <i>pubescens</i> (Willd.) Knight / LESSER YELLOW LADY'S SLIPPER / 3,12
"	<i>Deschampsia flexuosa</i> (L.) Trin. var. <i>flexuosa</i> / WAVY HAIR GRASS / 8,32
"	* <i>Desmodium paniculatum</i> (L.) DC. var. <i>paniculatum</i> / PANICLED-LEAF TICK-TREFOIL / 29,31
"	<i>Eupatorium maculatum</i> L. var. <i>maculatum</i> / SPOTTED JOE-PYE-WEED / 12,31
"	* <i>Grindelia squarrosa</i> (Pursh) Dunal var. <i>squarrosa</i> / CURLY-CUP GUMWEED / 8,19
"	<i>Gnaphalium obtusifolium</i> L. / MARSH CUDWEED / 10,33
"	* <i>Hamamelis virginiana</i> L. / AMERICAN WITCH-HAZEL / 3,29
"	* <i>Luzula acuminata</i> Raf. var. <i>acuminata</i> / HAIRY WOOD-RUSH / 3,12
"	<i>Monotropa hypopithys</i> L. / MANY-FLOWER INDIAN-PIPE / 12,29
"	<i>Pedicularis canadensis</i> L. ssp. <i>canadensis</i> / CANADIAN LOUSEWORT / 12,29
"	<i>Polygala paucifolia</i> Willd. / GAYWINGS / 2,12
"	* <i>Polygonum douglasii</i> Greene ssp. <i>douglasii</i> / DOUGLAS' KNOTWEED / 8,19
"	<i>Pyrola elliptica</i> Nutt. / SHINLEAF / 3,12
"	* <i>Ranunculus hispidus</i> Michx. var. <i>hispidus</i> / BRISTLY BUTTERCUP / 12,31
"	<i>Rubus odoratus</i> L. var. <i>odoratus</i> / PURPLE-FLOWERING RASPBERRY / 12,19
"	<i>Sanicula marilandica</i> L. / MARYLAND BLACK-SNAKEROOT / 12,29
"	<i>Stellaria longipes</i> Goldie / LONG-STALK STARWORT / 12,29
"	<i>Symphotrichum lateriflorum</i> (L.) A. & D. Löve var. <i>lateriflorum</i> / FAREWELL-SUMMER / 2,12
"	<i>Tilia americana</i> L. var. <i>americana</i> / AMERICAN BASSWOOD / 3,12
"	<i>Verbena hastata</i> L. var. <i>hastata</i> / SIMPLER'S-SOY / 2,12
"	<i>Viburnum lentago</i> L. / NANNY-BERRY / 2,12
"	<i>Viola canadensis</i> L. var. <i>canadensis</i> / CANADIAN WHITE VIOLET / 29,31
"	<i>Viola pubescens</i> Ait. var. <i>pubescens</i> / DOWNY YELLOW VIOLET / 12,29
1	<i>Acer spicatum</i> Lam. / MOUNTAIN MAPLE / 12
"	<i>Actaea rubra</i> (Ait.) Willd. subsp. <i>rubra</i> / RED BANE BERRY / 12
"	<i>Anemone virginiana</i> L. var. <i>virginiana</i> / TALL THIMBLEWEED / 12
"	* <i>Arabis glabra</i> (L.) Bernh. / TOWER MUSTARD / 23
"	<i>Arenaria serpyllifolia</i> L. / THYME-LEAF SANDWORT / 19
"	<i>Betula papyrifera</i> Marsh var. <i>papyrifera</i> / PAPER BIRCH / 12
"	* <i>Carex tonsa</i> (Fern.) Bickn. var. <i>tonsa</i> / SHAVED SEDGE / 23
"	* <i>Cerastium arvense</i> L. ssp. <i>arvense</i> / FIELD MOUSE-EAR CHICKWEED / 29
"	<i>Cerastium fontanum</i> Baumg. ssp. <i>vulgare</i> (Hartman) Greuter & Burdet / COMMON MOUSE-EAR CHICKWEED / 12
"	<i>Circaea lutetiana</i> L. ssp. <i>lutetiana</i> / BROAD-LEAF ENCHANTER'S-NIGHTSHADE / 12
"	<i>Cornus alternifolia</i> L. f. / ALTERNATE-LEAF DOGWOOD / 12
"	<i>Cornus foemina</i> P. Mill. / STIFF DOGWOOD / 12
"	<i>Cornus sericea</i> L. (including <i>C. stolonifera</i>) / REDOSIER / 12
"	<i>Crataegus macrantha</i> / HAWTHORN / 12

APPENDIX. (continued)

Sites	Scientific/Common Name
1	* <i>Desmodium nudiflorum</i> (L.) DC. / NAKED-FLOWER TICK-TREFOIL / 31
"	<i>Doellingeria umbellata</i> (P. Mill.) Nees var. <i>umbellata</i> / PARASOL WHITE-TOP / 2
"	<i>Elymus canadensis</i> L. / NODDING WILD RYE / 19
"	<i>Epigaea repens</i> L. / TRAILING-ARBUTUS / 29
"	<i>Equisetum Xmackaii</i> (Newman) Brichan / (<i>hyemale</i> × <i>variegatum</i>) / 33
"	<i>Gaultheria procumbens</i> L. / EASTERN TEABERRY / 2
"	<i>Gentiana andrewsii</i> Griseb. var. <i>andrewsii</i> / CLOSED BOTTLE GENTIAN / 12
"	<i>Geum aleppicum</i> Jacq. / YELLOW AVENS / 12
"	<i>Geum canadense</i> Jacq. var. <i>canadense</i> / WHITE AVENS / 12
"	* <i>Geum triflorum</i> Pursh var. <i>triflorum</i> / OLD-MAN'S-WHISKERS / 29
"	* <i>Hierchloe odorata</i> (L.) Beauv. / VANILLA GRASS / 12
"	<i>Hieracium canadense</i> Michx. var. <i>divaricatum</i> Lepage / CANADIAN HAWKWEED / 25
"	<i>Lactuca canadensis</i> L. / FLORIDA BLUE LETTUCE / 12
"	<i>Lonicera canadensis</i> Bartr ex Marsh / AMERICAN FLY-HONEYSUCKLE / 12
"	<i>Lycopodium Xhabereri</i> House / (<i>digitatum</i> × <i>tristachyum</i>) / 33
"	<i>Lycopodium tristachyum</i> Pursh / DEEP-ROOT GROUND-PINE / 33
"	* <i>Lysimachia quadriflora</i> Sims / FOUR-FLOWER YELLOW-LOOSESTRIFE / 4
"	<i>Malaxis unifolia</i> Michx. / GREEN ADDER'S-MOUTH ORCHID / 2
"	<i>Monotropa uniflora</i> L. / ONE-FLOWER INDIAN-PIPE / 25
"	<i>Oenothera biennis</i> L. / KING'S CUREALL / 33
"	<i>Oenothera perennis</i> L. / SMALL EVENING-PROMROSE / 27
"	<i>Orobanche uniflora</i> L. / NAKED BROOM-RAPE / 12
"	<i>Orthilia secunda</i> (L.) House / SIDEBELLS / 12
"	<i>Packeria paupercula</i> (Michx.) A. & D. Löve / BALSAM GROUNDSEL / 29
"	* <i>Panicum philadelphicum</i> Bernh. ex Trin. / PHILADELPHIA PANIC GRASS / 8
"	* <i>Penstemon digitalis</i> Nutt. ex Sims / FOXGLOVE BEARDTONGUE / 19
"	<i>Polygonatum biflorum</i> (Walt.) Eil. / KING SOLOMON'S-SEAL / 25
"	<i>Prenanthes alba</i> L. / WHITE RATTLESNAKE-ROOT / 12
"	<i>Prenanthes altissima</i> L. / TALL RATTLESNAKE-ROOT / 12
"	<i>Prunus pensylvanica</i> L. f. var. <i>pensylvanica</i> / FIRE CHERRY / 20
"	<i>Pyrola americana</i> Sweet / AMERICAN WINTERGREEN / 12
"	* <i>Ranunculus fascicularis</i> Muhl. ex Bigelow / EARLY BUTTERCUP / 29
"	* <i>Rhus glabra</i> L. / SMOOTH SUMAC / 25
"	* <i>Rosa carolina</i> L. var. <i>carolina</i> / CAROLINA ROSE / 12
"	<i>Rubus occidentalis</i> L. / BLACK RASPBERRY / 33
"	<i>Salix petiolaris</i> Sm. / MEADOW WILLOW / 12
"	<i>Sambucus nigra</i> L. subsp. <i>canadensis</i> (L.) R. Bolli / BLACK ELDER / 12
"	* <i>Scrophularia lanceolata</i> Pursh / LANCE-LEAF FIGWORT / 26
"	<i>Solidago hispida</i> var. <i>hispida</i> / HAIRY GOLDENROD / 12
"	* <i>Spiranthes casei</i> Catling & Cruise var. <i>casei</i> / CASE'S LADIES'-TRESSES / 2
"	* <i>Spiranthes lacera</i> (Raf.) Raf. var. <i>lacera</i> / NORTHERN SLENDER LADIES'-TRESSES / 2
"	* <i>Symphotrichum amethystinum</i> (Nutt.) Nesom / AMETHYST ASTER / 12
"	<i>Trientalis borealis</i> Raf. / MAYSTAR / 12
"	<i>Triodanis perfoliata</i> (L.) Nieuwl. / CLASPING-LEAF VENUS'-LOOKING-GLASS / 25
"	<i>Triosteum perfoliatum</i> L. / FEVERWORT / 3
"	* <i>Viola affinis</i> Le Conte / SAND VIOLET / 3
"	* <i>Vitis aestivalis</i> Michx. / SUMMER GRAPE / 31
"	* <i>Zanthoxylum americanum</i> P. Mill. / PRICKLY ASH / 29
"	* <i>Zigadenus elegans</i> Pursh ssp. <i>glaucus</i> (Nutt.) Hultén / MOUNTAIN DEATHCAMAS / 29

Additional species at sites for which complete lists are not available:

- * *Lycopodium complanatum* L. / TRAILING GROUND-PINE
- * *Dichanthelium oligosanthes* (J.A. Schultes) Gould var. *scribnerianum* (Nash) Gould / HELLER'S ROSETTE GRASS
- * *Gaylussacia baccata* (Wangenh.) K. Koch / BLACK HUCKLEBERRY