FLORISTIC AND RARE PLANTS SURVEY

OF THE BLACKFOOT PROVINCIAL RECREATION AREA (1996)

by

Graham C.D. Griffiths, Deirdre E. Griffiths and Ross Priddle

January, 1997

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Prepared for:

Natural Resources Service/Parks, Parkland Region,

Alberta Environmental Protection,

Rimbey, Alberta

by

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January, 1997

ACKNOWLEDGEMENTS

The authors acknowledge their indebtedness to Ms. Chel Macdonald for kayak sampling and computerization of this report, to the park ranger, Mr. Ed Whitelock for facilitating access to our study area, to Ms. Joyce Gould for providing information on rare plants from the records of the Alberta Natural Heritage Information Centre, to Ms. Patsy J. Cotterill for information on her plant collections in the Edmonton Region, and to Mr. Bernard Goffinet for identification of lichens (especially *Peltigera* spp.). Mr. Ed Karpuk (Corporate Management Service, Parkland Region, Alberta Environmental Protection) administered our contract on behalf of Natural Resources Service/Parks, Parkland Region, Alberta Environmental Protection (Rimbey, Alberta).

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1.0. INTRODUCTION

1.1. Purpose of Study

The overall purpose of this study determined by the Natural Resources Service was "to conduct floristic surveys, identify and document the location of rare vascular and non-vascular native plants, and describe the site conditions where observed rare plants occur as information for the management of the natural resources of the Blackfoot Provincial Recreation Area; and to produce a report and a floristic survey site and rare native plant location map for selected, naturally vegetated areas of the Blackfoot Provincial Recreation Area". The seven fenced pastures inside the Recreation Area were excluded from consideration.

1.2. Location of the Blackfoot Provincial Recreation Area

The Blackfoot Provincial Recreation Area is located approximately 26 km east of Edmonton (at its western boundary) in the County of Beaver, immediately south and southeast of Elk Island National Park. Included are approximately 4,050 hectares (10,000 acres) of fenced cattle pastures (partially cleared) and 5,880 hectares (14,530 acres) of land managed for recreational use (naturally vegetated except for staging areas, roads and trails). The latter 5,880 hectares constituted our study area.

Presently there are five main public access points to Blackfoot: (1) the Waskahegan Staging Area and administrative offices on the west boundary (accessed from Range Road 210 in Strathcona County); (2) Wanisan Lake access point on the south boundary (at the end of Range Road 204 in Strathcona County); (3) Islet Lake Staging Area (with access road from the south signposted on the Wye Road); (4) the Central Staging Area (accessed from the same point on the Wye Road via the Central Road inside Blackfoot); and (5) the Blackfoot Lake Staging Area in the northeast (with access road from the north signposted on Highway 16).

1.3. Description of the Blackfoot Provincial Recreation Area

The Blackfoot Provincial Recreation Area is situated on the elongate (north-south) dead-ice moraine commonly called the Cooking Lake Moraine (or less frequently the Beaverhills) in the north and the Buffalo Lake Moraine further south. See Bayrock (1972) for mapping and general description of the northern part of this moraine. The topography is of the hummocky (knob-and-kettle) type produced by the melting of stagnant ("dead") ice sheets which are believed to have persisted in this area until about 9,050 years B. P. (Stefiszyn *et al.* 1983). The depressions ("kettles") are diverse in size and are mostly occupied by fens or water bodies (ranging in size from small ponds to relatively large lakes, the largest being Islet Lake traversing the south boundary).

There is a northwest-southeast ridge (with crestline in the range of 770-780 masl) running from west of the Blackfoot boundary (near Bennett Lake in Strathcona County) to north of Islet Lake. This is the highest land on the Cooking Lake Moraine north of Cooking and Hastings Lakes, and constitutes a divide (watershed) between water flowing south into Antler, Cooking, Wanisan, Hastings and Islet Lakes and water flowing north into Elk Island National Park. Towards the eastern boundary of Blackfoot the elevation declines to a low point of 704 masl (2,311 ft) at the southeast corner on the downslope towards Beaverhill Lake. This low point is about 35 m above the mean level of Beaverhill Lake, the ultimate recipient of most drainage from Blackfoot and those parts of the Cooking Lake Moraine immediately to the south (especially during wet years when there is outflow from the intervening lakes listed above).

The uplands in Blackfoot (where not cleared for pasture) are almost entirely forested, with natural shrubbery and grassland restricted to small refugia on south-facing slopes. Beaver are abundant and strongly influence the environment by damming and deepening ponds and by removing mature poplar trees from lower slopes. In general, the activities of beaver are beneficial through increasing the habitat available for waterfowl and other plants and animals requiring stable water levels; but their flooding of trails conflicts with recreational uses at some locations.

The Cooking Lake Moraine is recognized as the largest continuous tract of waterfowl breeding habitat in Alberta, with the exception of the far northern Peace-Athabasca Delta and Hay-Zama Lakes area (Kemper 1976).

Upland soils in most of the Blackfoot (including our entire study area) are classified as Orthic Gray Luvisols (mainly fine loam of the Cooking Lake Series, see Bowser *et al.* 1962 and Howitt *et al.* 1988). These Luvisols are considered to have severely limited agricultural capability (unsuited for arable farming). More fertile black soils (Chernozems) of the Angus Ridge Series marginally penetrate the southeast corner of Blackfoot, but lie within the pasture area excluded from our study. Wetlands may contain organic (peaty) deposits.

1.4. Climate

There are no long-term climate records for any site on the Cooking Lake Moraine. Griffiths (1992) compared some recent precipitation data for Cooking Lake Airport and Elk Island National Park with corresponding data for Edmonton International Airport, but did not find significant consistent differences. Until more data is available, it can only be assumed that climatic parameters for Blackfoot are close to those for Edmonton International Airport, as follows:

Canadian climate normals for Edmonton International Airport, 1961-1990
(Source: Environment Canada, Atmospheric Environment Service)

Annual Precip.(mm)	May-August Precip. (mm)	Degree Days Above 5°C	Mean Annual Temp. (°C)	Mean Daily May-Aug Temp.(°C)
465.8	289.4	1352	2.1	13.9

1.5. History of the Blackfoot Provincial Recreation Area

The book *Land Among the Lakes* (Stefiszyn *et al.* 1983) is the prime historical source for the northern part of the Cooking Lake Moraine, including the Blackfoot Provincial Recreation Area. The present boundaries of Blackfoot date from 1947, when the portion of Elk Island National Park south of Highway 16 was transferred from the Cooking Lake Forest Reserve to the park. The remaining portion of the Forest Reserve is what is today officially called the Cooking Lake-Blackfoot Grazing, Wildlife and Provincial Recreation Area. The name "Blackfoot" seems to have been originated by the Blackfoot Stock Association (founded in 1922), now replaced by the Blackfoot Grazing Association. Nowadays the designation "Cooking Lake" is frequently dropped, and the land simply called the "Blackfoot Provincial Recreation Area".

There were widespread fires in Blackfoot in the early part of this century (especially in 1924 and 1929) despite government efforts to prevent fires and preserve the area for timber supply. After the Second World War, use of the area as a source of timber declined (since most of the mature white spruce had been cut), and the last timber cutting permit was issued in 1967. The Provincial Government came to view the area primarily as a cattle pasture, and efforts were made to improve grazing by clearing poplar forest starting in the fifties. Subsequently, recreational use increased, and the government decided to reduce conflicts between grazing and recreational uses by confining cattle to (partly cleared) pastures occupying just over 40% of the land area. These pastures were cleared and fenced in 1987.

2.0. METHODS

2.1. Survey Methods

A preliminary map was prepared by Deirdre Griffiths by tracing from aerial photographs (series AS 4646, May 25 1996, scale 1:15,000) prior to commencement of field work. The photographs were searched (with a stereoscopic viewer) for features to be investigated as possibly supporting unusual vegetation, and the outlines of such features drawn as polygons on the map. These features included: (1) relict stands of mature white spruce forest (on north-facing slopes and islands in lakes), (2) large black spruce bogs, (3) minerotrophic larch-black spruce swamp, (4) naturally open areas on south-facing slopes (not cleared by beaver), and (5) permanent water bodies. A preliminary program for each day's field work was then drawn up. Naturally this program was sometimes modified in the field; some sites proved upon inspection not to be so interesting as expected, and some unusual sites not recognized as such in aerial photographs were discovered. Field work was commenced on July 22 and ended on September 3, 1996.

It should be noted that there is a conflict in site selection between the conduct of a floristic survey and a rare plants survey. In floristic surveys sites are normally selected on the basis of their representativeness of plant community types, with emphasis on more extensive (mappable) stands and avoidance of edge effects and smaller patches of vegetation. In a rare plants survey the emphasis is on documenting unusual stands (irrespective of extent), and some very extensive community types (such as aspen forest) may be of low priority because they do not contain rare species. In the present study we were asked to provide both floristic and rare plants data, so a compromise was necessary. While our first priority was the discovery of rare species, we included a few plots of extensive community types lacking rare species (aspen forest, dry bog forest, submersed aquatic communities of eutrophic lakes). The inclusion of these plots completes the floristic data, and allows us to present a comprehensive plant list.

In total 42 plots were documented with Site Description and Vegetation Description Forms, and 35 Rare Native Plant Survey Forms were completed. (Plot 43 refers to a *Wolffia* site for which Element Occurrence Form PMLEMO3060024AB was completed prior to this study).

Most vegetation plots were rectangular in shape (in most cases square, but oblong in the case of a few narrow features). Plot size was 100 square metres (10 m x 10 m if square) for all categories except trees (in the latter case 400 square metres, i.e. 20 m x 20 m). Offshore plots in lakes sampled from a kayak or canoe were circular (radius 5.64 m, plot area 100 square metres); the centre of the plot was marked with a line anchored to a concrete block with floats attached at half-metre intervals (to provide a depth reading); vegetation within the radial distance was observed and sampled while moving the boat in a circle around the marker.

Plants were identified by Graham Griffiths (vasculars) and Ross Priddle (bryophytes and lichens), as far as possible in the field. Samples were collected in cases where the identification was considered to require confirmation and to document the occurrence of rare species present in numbers; rare species represented by rather few individuals were

documented only by photographs. All collected material was identified in the laboratory by use of special literature and by comparison with specimens in the University of Alberta Herbarium. Specimens of 51 species of vascular plants were deposited in the Alberta Environmental Protection Herbarium on September 19, mostly dry-mounted on standard herbarium sheets (but in vials of preserving fluid in the case of Lemnaceae). All but a few of the most common species of bryophytes and lichens are supported by specimens deposited in the Cryptogamic Herbarium at the University of Alberta. The marginal annotations in Appendix 1 indicate for which species specimens and/or photographs are available.

Nomenclature for vascular plants generally follows that in the second edition of the *Flora of Alberta* (Moss and Packer 1983), but with the following additions or changes in the light of subsequent work. The two *Wolffia* species (Lemnaceae) were added to the Alberta list after publication of the *Flora* (see Griffiths 1988, Griffiths and Griffiths 1990). The common duckweed in Alberta is here called *Lemna turionifera* (LEMN TUR) following recent literature, not "*L. minor*". Awned and slender wheatgrass (*Agropyron subsecundum* and *A. trachycaulum*) are distinguished (AGRO SUB, AGRO TRA), not lumped together as in the second (but not the first!) edition of the *Flora of Alberta*. Greater beaked sedge (*Carex utriculata*) is distinguished from *C. rostrata* following Griffiths (1989); the true *C. rostrata* occurs in Elk Island National Park, but has not so far been found in Blackfoot. Tall myrtle-leaved willow is distinguished (as *Salix novae-angliae*, SALI NOV) from the low shrub *S. myrtillifolia* (the latter not reliably recorded for the Cooking Lake Moraine) following Argus (1973). The name *Betula* X *uliginosa* Dugle (1966) (BETU XUL) is used for a hybrid birch. The name *Rumex orbiculatus* Gray (RUME ORB) for water dock is preferred to "*R. britannica* L.".

English names for vascular plants mainly follow the *Alberta Vegetation Species List* (1990), but in some cases other sources have been used since the names in the list are ambiguous (applied to more than one species) or subject to conflicting usage. Currently, the use of English common names for plants is unsatisfactory since there is no standard North American list; in cases of doubt the identity of plant species should always be inferred from their Latin names.

Nomenclature for mosses follows Anderson *et al.* (1990), with the exception of *Sphagnum* spp. for which we follow Anderson (1990). Liverwort nomenclature follows Stotler and Crandall-Stotler (1977), with the exception of *Calypogeia* sp. and *Jungermannia lanceolata* after Schuster (1969). Lichen nomenclature follows Esslinger and Egan (1995).

The abbreviations used for bryophytes and lichens on the Vegetation Description Forms follow the Alberta Vegetation Species List (1990), but it should be noted that in a few cases the generic names here used following recent revisions differ from those used in that list (e.g., the abbreviation for *Hamatocaulis vernicosus* is DREP VER, that for *Sanionia uncinata* is DREP UNC, that for *Bryohaplocladium microphyllum* is HAPL MIC, and that for *Vulpicida pinastri* is CETR PIN). The abbreviation RICC FLU refers to the liverwort *Riccia fluitans* L. omitted from the above list.

184 35 mm colour slides were taken by Deirdre Griffiths and deposited in the Alberta Environmental Protection (Parks) slide collection. These are listed in Appendix 2. They include both habitat shots and close-ups showing diagnostic features of particular plant species. Prints of 18 of these slides are included in Appendix 3.

2.2. Ranking Criteria

The development of Provincial Tracking Lists for rare plants and animals was initiated by the Alberta Natural Heritage Information Centre in 1995, and such lists are still in a draft state and subject to continuing revision. The provisional state of these tracking lists has caused some difficulty with respect to the choice of species to be recorded as "rare". We were asked to record all species with Provincial ranks S1 and S2, the definitions of these ranks being as follows:

S1: ≤5 occurrences in the province or only a few remaining individuals or may be imperiled because some factor of its biology makes it especially vulnerable to extirpation;
S2: 6-20 occurrences or with many individuals in fewer occurrences; or may be susceptible to extirpation because of some factor of its biology.

We have completed Rare Native Plant Survey Forms for all species ranked S1 or S2 in the draft tracking lists available in July 1996, with the exception of *Anemone riparia* (tall anemone) and *Spirodela polyrhiza* (larger duckweed). These species are common throughout the Edmonton Region and will surely be downgraded in the next revision of the tracking lists. Their listing as S2 was due to underrecording.

There is a possibility that four further species ranked as S2 in the July 1996 list will in future be downgraded, namely *Wolffia borealis* (northern ducksmeal), *Eriophorum chamissonis* (russet cottongrass), *Rumex orbiculatus* (water dock) and *Cicuta virosa* (narrow-leaved water hemlock), but we have for the present included these in the list of rare species to be tracked. [Note: in the revised tracking list issued in November 1996, while the present report was in process of finalization, *Wolffia borealis* was placed on the "S3 Watch List", *Rumex orbiculatus* downgraded to S3, and *Eriophorum chamissonis* and *Cicuta virosa* omitted from the tracking list.]

Provincial rarity ratings are to some extent an artefact of provincial boundaries, so we consider that more local studies of rare biota should also include species which are regionally or locally rare. Such species do not qualify for high Provincial rank because they are common in some other region of the Province, but may provide important information for identifying significant sites at a local level. These "locally rare" species have been found at fewer sites on the Cooking Lake Moraine than some of the species ranked S2. We include eight such locally rare species of vascular plants in the list of rare species discussed in Section 3.2. The ranking criterion is as follows:

Locally Rare: ≤5 occurrences in the regional ecological unit (in this case the Cooking Lake Moraine or Beaverhills).

2.3. Mapping Methods

The locations of the 43 sample plots have been indicated on the enclosed map (scale 1:15,000), and those plots containing rare species enclosed in a polygon representing a feature or plant community (ecoelement). These polygons were drawn by Deirdre Griffiths by tracing from aerial photographs (series AS 4646, May 25, 1996). The map legend summarizes data relevant to each plot, with special reference to any rare plants.

3.0. RESULTS

3.1. Floristic Overview

The main plant communities occurring in Blackfoot have already been defined in studies of adjacent areas, especially Elk Island National Park (several studies), North Cooking Lake Natural Area (Griffiths and Griffiths 1989) and the Lister Lake portion of Beaverhill Natural Area (Griffiths, Griffiths and Taylor 1996). The existence of these previous studies allowed the definition of communities unlikely to contain rare plants, such as aspen forest, to be assumed without the need for documenting large numbers of plots.

3.1.1. Aspen Poplar Forest

This is the prevalent upland vegetation blanketing most of the higher ground throughout Blackfoot. In the classification of the deciduous forests of the prairie provinces proposed by Looman (1987a), the poplar forest on the Cooking Lake Moraine and elsewhere in the Edmonton Region falls within the alliance Populion tremuloidis (forests dominated by trembling aspen, *Populus tremuloides*) and the association Corylo-Populetum (i.e., aspen poplar forest with beaked hazel, *Corylus cornuta*, prominent in the shrub layer). Plots 5, 13 and 27 are representative of this community.

The presence of white spruce saplings in some areas indicates that succession to mixedwood and (eventually) white spruce forest will occur in the absence of fire. However, in other areas the shrub layer is too dense for establishment of white spruce seedlings, and aspen forest may persist indefinitely. In some areas mature aspen trees are sparse, probably as a result of mortality during recent tent caterpillar outbreaks; but denser, more vigorous stands can also be found. Defoliation of aspen by tent caterpillars did not occur during 1996.

Balsam poplar (*Populus balsamifera*) occurs in varying degrees of admixture with aspen, especially on moister sites, but may be entirely absent on drier sites.

Besides the normal understory dominant, beaked hazel (*Corylus cornuta*), other shrub species regularly occurring in aspen forest on the Cooking Lake Moraine include: *Rosa acicularis* (prickly rose), *Amelanchier alnifolia* (saskatoon), *Rubus idaeus* (raspberry), *Rubus pubescens* (dewberry), *Viburnum edule* (low-bush cranberry), *Cornus stolonifera* (red-osier dogwood), *Symphoricarpos albus* (snowberry) and *Linnaea borealis* (twinflower). Common herbs include *Aralia nudicaulis* (wild sarsaparilla), *Cornus canadensis* (bunchberry), *Pyrola asarifolia* (common pink wintergreen), *Lathyrus ochroleucus* (white peavine) and *Aster ciliolatus* (Lindley's aster). The moss *Pylaisiella polyantha* forms stockings around the bases of aspen trees. This characterization agrees with Achuff's (1992) characterization of upland aspen forests in the Dry Mixedwood Subregion (in which he included the Cooking Lake Moraine as a disjunct portion), except that true paper birch (*Betula papyrifera* s.s.) is very local on the moraine. In Blackfoot we found true paper birch only on the island in Islet Lake. Another stand is reported east of Islet Lake on the Moose Link Trail.

Mature aspen are frequently absent from lower slopes along waterbodies due to cutting by beaver. But otherwise the vegetation here has substantially the same species composition as aspen forest, since beaver do not remove the dominant shrubs, such as hazel and rose, to any great extent. For purposes of vegetation analysis, such beaver-cleared slopes are classified as an early seral stage of aspen forest. Close inspection normally reveals an abundance of aspen suckers growing from the roots of felled trees.

3.1.2. Mixedwood and White Spruce Forest

This is the climax upland vegetation on the Cooking Lake Moraine, classified in the association Piceo-Populetum within the alliance Populion tremuloidis by Looman (1987a). Presently stands of mature white spruce (growing mixed with aspen or as small pure stands) are rare in Blackfoot due to past fires and logging (up to about the middle of this century) and suppression of regeneration by the issuance of permits for Christmas tree cutting (up to the sixties).

We documented two stands of upland white spruce or mixed forest. Plot 3 represents a small relict stand on a north-facing slope south of Neon Lake. The shrub layer is less dense than in neighbouring aspen forest, without rose or hazel. But otherwise the species composition is not significantly different from aspen forest. Plot 16 is more interesting. This represents open mixed forest on the summit of the large island in Islet Lake. Because of its island location, this forest has been protected from fires and logging. This is the only site in Blackfoot where we found true paper birch (*Betula papyrifera*), a much larger tree than the common Alaska birch (*B. neoalaskana*). The shrub and herb layers in this plot were highly diverse, and the moss layer more extensive and diverse than in aspen forest. The rare lichen *Peltigera evansiana* was found only in this plot. [The large size (up to 55 cm dbh) of the white spruce in Plot 16 suggests an age of at least 100 years. More precise age estimates (through coring) are expected to be available shortly.]

3.1.3. White Spruce Swamp

Plot 28 represents a relict stand of old white spruce growing on a swampy lower slope above a fen. This stand is quite different in species composition from upland mixed forest, with *Cornus stolonifera* (red-osier dogwood) dominant in the low shrub layer and *Climacium dendroides* (tree moss) carpeting much of the ground. Similar stands have not been documented locally, so it is unclear whether this swamp represents a recurring community type. The locally rare *Moneses uniflora* (one-flowered wintergreen) occurs in this stand. The presence of pools of water and abundance of *Climacium* (a moss typical of saturated soil) suggest that this site may be classified as a swamp (treed fen).

3.1.4. Black Spruce Bog Forest

Typical black spruce bogs (or "poor fens") with little or no admixture of larch are rather numerous in perched depressions on higher ground in Blackfoot, especially in the western half. Absence of larch is indicative of ombrotrophic conditions, i.e. that the water in the surface layers of the soil is rainwater deficient in minerals. Plots 1, 8, 9 and 35 document this plant community, classified by Looman (1987b) as the association Ledo-Piceetum marianae of the alliance Piceo marianae-Laricion laricinae. Black spruce (*Picea mariana*)

is the dominant tree, and Labrador tea (*Ledum groenlandicum*) the dominant low shrub. Common herbs are cloudberry (*Rubus chamaemorus*) and cranberry (*Vaccinium vitis-idaea*). Herb coverage is often sparse, but the ground is extensively (often totally) blanketed with mosses, especially the feathermosses *Pleurozium schreberi, Hylocomium splendens* and *Ptilium crista-castrensis* with several *Sphagnum* spp. on wetter ground.

Large bogs may provide refugia for rare northern plant species. Thus, plot 35 contains creeping snowberry (*Gaultheria hispidula*) and the very wet bog inclusive of plot 9 contains *Carex trisperma* (three-seeded sedge) and *Andromeda polifolia* (bog rosemary). Past logging and grazing seem to have had little impact on bog vegetation, but some of the drier bogs were probably burnt during the widespread fires in the first half of this century. Plot 8 represents such a bog in which most black spruce are still saplings. Burnt-over bogs may be initially colonized by Alaska birch (*Betula neoalaskana*), particularly if there is no immediate seed source for black spruce.

3.1.5. Larch-Black Spruce Swamp

In previous reports (especially that on Coyote Lake, Griffiths and Griffiths 1987), we have drawn a distinction between black spruce bog forest (ombrotrophic) and larch-black spruce swamp (with mineralized water in depressions). Such swamps have a much higher biological diversity than bog forest. The ground surface is hummocky, with bog plants (especially Ericaceae) colonizing raised mossy mounds where conditions are ombrotrophic, while fen plants requiring minerotrophic conditions occupy water-filled hollows. Species of sedges, especially *Carex disperma* (two-seeded sedge), are usually prominent and *Sphagnum warnstorfii* is usually dominant in the extensive (often total) moss coverage.

An outstanding stand of this type (containing plot 20) was found close to the NW end of West Sawmill Lake. This is a "hot spot" for rare plants, including five species of northern vascular plants and one calciphile moss.

3.1.6. Alder Swamp

Alder swamp dominated by river alder (*Alnus tenuifolia*) of tree size develops on the Cooking Lake Moraine under very wet intermittently flooded conditions, especially on bog margins and along stream channels. Plot 37 represents a typical stand of this type along a stream channel. The dominant alder is often accompanied by *Salix discolor* (pussy willow), also of tree size. Common shrubs include *Lonicera involucrata* (bracted honeysuckle), *Cornus stolonifera* (red-osier dogwood) and *Ribes hudsonianum* (northern blackcurrant); herbs are diverse, including *Caltha palustris* (marsh marigold), *Viola palustris* (marsh violet) and *Calamagrostis canadensis* (bluejoint). Moss coverage is extensive, the dominant in the plot being *Plagiomnium cuspidatum*.

3.1.7. Mixed Willow Swamp

Mixed willow swamp (with willows reaching tree size) is found in intermittently flooded perched wet depressions on the Cooking Lake Moraine, and intergrades with alder swamp at some sites. Plot 6 represents a stand of this type. Seven species of willows

(*Salix petiolaris, S. planifolia, S. pseudomonticola, S. novae-angliae, S. discolor, S. maccalliana and S. bebbiana*) formed a continuous canopy 4-7 m high. This stand contained virtually no herbs as a result of deep flooding due to recent beaver activity. A diverse herb layer similar to that of alder swamp may be expected in more shallowly flooded stands.

3.1.8. Balsam Willow Carr

The term carr is here used for fens with extensive shrub coverage (but with few or no trees). Balsam willow carr dominated by balsam willow (*Salix pyrifolia*) with varying admixture of Alaska birch (*Betula neoalaskana*) has been reported from several sites in the Edmonton Region, including the North Cooking Lake Natural Area (Griffiths and Griffiths 1989). This community is found in perched morainal depressions and on bog margins, and may intergrade with taller swamp (treed fen) vegetation at some sites. Dominance of balsam willow indicates relatively oligotrophic conditions in comparison with stands dominated by other species of willow.

Plot 23 represents a stand of this community situated on a bog margin; *Salix pyrifolia* (balsam willow) and *Betula neoalaskana* (Alaska birch) are the dominant taller species (reaching tall shrub to small tree size), with high understory coverage by *Ledum groenlandicum* (Labrador tea) and *Calamagrostis canadensis* (bluejoint); there is an extensive moss layer dominated by *Sphagnum warnstorfii*.

3.1.9. Flat-leaved Willow Carr

This term was introduced in our report on the North Cooking Lake Natural Area (Griffiths and Griffiths 1989) for stands of willow-sedge fen in more or less permanent shallow water, especially around the shores of lakes. The dominant species are *Salix planifolia* (flat-leaved willow), the sedges *Carex aquatilis* and *C. utriculata*, and the moss *Drepanocladus aduncus*. This vegetation may intergrade with water sedge fen (lacking willows) or other types of shoreline marsh. The extensive marshes around Neon Lake (plots 2 and 4) approximate the description of flat-leaved willow carr to varying degree, but show an unusual abundance of bluejoint (*Calamagrostis canadensis*). Two herbs currently listed as rare, *Rumex orbiculatus* (water dock) and *Cicuta virosa* (narrow-leaved water hemlock), are frequent in these marshes. Plot 21 represents the transition between flat-leaved willow carr and water sedge fen (with sparse willows).

Plot 38 represents a willow-sedge fen transitional between flat-leaved willow carr and certain types of carr found in calcareous marshes; it contains the calciphilous *Salix pedicellaris* (bog willow) and a complete moss carpet dominated by *Sphagnum angustifolium*, in addition to the dominant *Salix planifolia* and *Carex aquatilis*. The presence of a band of tamarack larch on the edge of the depression in which this fen is situated also indicates minerotrophic conditions. The locally rare sundew *Drosera rotundifolia* was found only here in Blackfoot (on a sphagnum mound).

3.1.10. Water Sedge Fen

Fens dominated by *Carex aquatilis* (water sedge) and *C. utriculata* (greater beaked sedge) in varying proportions are very common in Alberta. *Drepanocladus aduncus* is normally dominant in the moss layer. Such open fens (without willows) occur in wet morainal depressions and along the shores of lakes and ponds in Blackfoot. Plots 14, 24, 25 and 36 represent shoreline plots containing the interface between water sedge fen and open water with duckweed mats. The rare *Carex vulpinoidea* (fox sedge) was associated with *C. aquatilis* in Plot 36. Plot 21 represents a stand without open water transitional to flat-leaved willow carr (with sparse willows).

3.1.11. Awned Sedge Fen

Awned Sedge (*Carex atherodes*) becomes dominant in the Cooking Lake Moraine on eutrophic sites subject to intermittent flooding. Plots 11 and 33 represent sites of this type, situated on outlets of drainage channels. The former plot (on a lakeshore) is more diverse, containing numerous herbs and pools with duckweed mats; the latter (receiving bog drainage) is uniform with *Scolochloa festucacea* (spangletop) codominant.

3.1.12. Sedge-Reedgrass Fen

Quaking fens with *Calamagrostis stricta* (narrow reedgrass) codominant with the sedges *Carex aquatilis* and/or *C. utriculata* are found in depressions in the northeast sector of Blackfoot (plots 26, 31). These sites are both in the centre of boggy depressions (with black spruce bog forest around their peripherae); both have extensive moss layers, dominated by *Drepanocladus aduncus* in the first plot, by *Sphagnum squarrosum* in the second. Plants currently listed as rare found at these sites were *Rumex orbiculatus* (water dock), *Cicuta virosa* (narrow-leaved water-hemlock) and *Eriophorum chamissonis* (russet cottongrass) (the last only in plot 26).

3.1.13. Other Shoreline Communities

Beds of cattails (*Typha latifolia*), bulrushes (*Scirpus acutus/validus*) or giant burreed (*Sparganium eurycarpum*) occur commonly in Blackfoot, especially in bands along the shores of lakes and ponds. Plot 7 (shoreline marsh of Arrowhead Lake) documents a marsh dominated by the burreed, with associated duckweed mat (predominantly *Spirodela polyrhiza*). Plot 15 documents a quaking (partly floating) shoreline with mixture of cattails, burreed and diverse mud plants, especially the annual *Bidens cernua* (nodding beggarticks); the rare moss *Drepanocladus crassicostatus* was discovered at this site (in deeper water beyond extensive floating mats of the common *D. aduncus*).

3.1.14. Duckweed Mats

Because of the presence on the Cooking Lake Moraine of two *Wolffia* (ducksmeal) species only recently discovered in Alberta, special attention was paid to duckweed mats, whether growing interspersed with shoreline emergents or on open water (either alone or above submersed aquatics). *Wolffia borealis* (northern ducksmeal) was found on several waterbodies (mainly beaver ponds) and was always abundant (often dominant or

codominant with *Lemna turionifera)* where it occurred. An association containing this species clearly needs to be added to Looman's (1986) classification of duckweed communities (Lemnetea minoris). Plots 10, 14, 25, 36, 42 and 43 (in whole or part) represent such an association. The rarer *Wolffia columbiana* (Columbian ducksmeal) was only found as a minor component in plot 36.

In plots 19 and 24 the duckweed mat was dominated by *Spirodela polyrhiza* (larger duckweed), and *Wolffia* was entirely absent. Both plots (one in a beaver pond, one on a lakeshore) contained abundant submersed plants, including *Ceratophyllum demersum* (hornwort). Looman (1986) refers vegetation dominated by *Spirodela* to an association Lemno-Spirodeletum polyrrhizae found by him mainly in water with circumneutral pH (6.6-7.5).

The floating liverworts *Riccia fluitans* and *Ricciocarpus natans* often occur as minor components of duckweed mats.

3.1.15. Submersed Aquatic Communities

The presence of rare pondweeds (*Potamogeton* spp.) on the Cooking Lake Moraine motivated us to pay special attention to aquatic plants. On the basis of our data we distinguish two vascular plant communities occurring in the lakes of Blackfoot: (1) a community in which the rare *Potamogeton obtusifolius* (blunt-leaved pondweed) is prominent and often dominant, and (2) a community in which *P. pectinatus* (sago pondweed) and/or *P. vaginatus* (large-sheath pondweed) are prominent or dominant. *Ceratophyllum demersum* (hornwort) and *Myriophyllum exalbescens* (spiked water-milfoil) may be present in either community, this showing a wider ecological amplitude than the pondweeds. The *Potamogeton obtusifolius* community is found in the lakes at higher elevation (here called watershed lakes), so presumably indicates relatively oligotrophic water. In Neon Lake (760 masl) *Potamogeton obtusifolius* is associated with the locally rare *P. zosteriformis* (grass-wrack), known on the Cooking Lake Moraine only from this lake (plot 18). Other lakes supporting the *P. obtusifolius* community are Arrowhead Lake (plot 7), Islet Lake (plots 12, 17), the south boundary lake on the Islet Lake Road (plot 15) and Long Lake (plot 41). These have an elevational range of 740-760 masl, except for Long Lake in the northeast (only 715 masl, but higher than other lakes in its vicinity). The community with *Potamogeton pectinatus/vaginatus* was found in Crooked and Blackfoot lakes (plots 39, 40), lakes at lower elevation (±710 masl) which are evidently eutrophic and receive saline seepage. We noted that Crooked Lake has become a regular feeding ground for trumpeter swans, apparently attracted to the extensive beds of *Potamogeton vaginatus* (large-sheath pondweed) available there. Plot 39 documents a site at which swans had been observed feeding.

Smaller waterbodies in Blackfoot may contain submersed communities dominated by one or other of the smaller pondweeds *Potamogeton foliosus* (leafy pondweed) or *P. pusillus* (small pondweed). The rare *P. foliosus* was found at two sites: as dominant in a small pond without duckweed mat beside the Whitetail Trail (plot 30), and subordinate to *Ceratophyllum demersum* (hornwort) in Detour Lake (plot 42). The two sites appear dissimilar in other respects, particularly since Detour Lake possesses an extensive duckweed mat (dominated by *Wolffia borealis*). *Potamogeton pusillus* was found to be

codominant with *Ceratophyllum* in the submersed layer of plot 19, an old beaver pond whose surface was almost completely covered by *Spirodela*.

3.1.16. Moist Saline Meadow

Saline meadows (entirely lacking shrubs) develop on sites receiving saline seepage. Such sites are found in the vicinity of Blackfoot Lake, and we have documented one (on the foreshore of that lake) as plot 29. The dominants are *Hordeum jubatum* (foxtail barley), *Juncus balticus* (wire rush) and *Aster falcatus* (creeping white prairie aster). The rare moss *Desmatodon heimii* was discovered at this site. This vegetation has much in common with the "foxtail barley/alkali grass zone" described for the foreshore of Beaverhill Lake (Griffiths, Griffiths and Taylor 1996).

3.1.17. Dryland Shrubbery

Dryland shrubbery dominated by *Prunus virginiana* (chokecherry) and *Amelanchier alnifolia* (saskatoon) is widespread in the parklands of the prairie provinces, but becomes restricted to south-facing slopes in the forest zone; Looman (1983) has classified such vegetation in the alliance Prunion melanocarpae. In Blackfoot such shrubbery persists only in small refugia on strong to steep south-facing slopes. Plot 22 represents such a stand situated below a headland west of Elk Push Lake. In this stand the low shrubs grow mixed with tall grasses, of which the dominant species are *Agropyron subsecundum* (awned wheatgrass) and *Poa pratensis* (Kentucky bluegrass). The rare mosses *Phascum cuspidatum* and *Weissia controversa* were collected in this plot.

Unfortunately true dryland shrubbery cannot always be distinguished from beaver-cleared slopes (representing a seral stage of aspen forest) in aerial photographs. As far as we were able to determine from ground inspection, most open slopes in Blackfoot are beaver-cleared, and true dryland shrubbery (without aspen saplings) is restricted to south-facing slopes.

3.1.18. Dry Grassland

Plot 32 documents a grassland community on an extreme south-facing slope immediately above an area of saline seepage on the foreshore of Crooked Lake. The dominants are *Elymus canadensis* (Canada wild rye), *Poa pratensis* (Kentucky bluegrass) and *Glycyrrhiza lepidota* (wild licorice). Shrubs are relatively sparse, consisting mainly of *Symphoricarpos occidentalis* (buckbrush), and are overtopped by the tall grasses and licorice. Both the *Elymus* and *Glycyrrhiza* have been collected at certain sites in the valleys of the North Saskatchewan and Athabasca Rivers. Therefore, it seems likely that similar stands can be found on south-facing slopes in those valleys.

3.1.19. Disturbed Ground

We have documented one stand (plot 34) of pioneering plants colonizing recently deposited moist alluvium below a breached beaver dam. The dominant moss in this plot (*Physcomitrium pyriforme*) is currently listed as rare in Alberta. Prominent herbs were the grasses *Agrostis scabra* (tickle grass), *Poa annua* (annual bluegrass) and *Puccinellia*

distans (slender alkali grass), and the forbs *Crepis tectorum* (annual hawksbeard), *Plantago major* (common plantain) and *Rorippa palustris* (marsh yellow-cress). The vegetation of dry disturbed sites (e.g., roads, trails and staging areas) was not sampled during this study.

3.2. Rare Plant Species

In this section we discuss one species of lichen, six species of mosses, and 19 species of vascular plants (in that order). Comments on distribution in Alberta are based on published information and records of the Alberta Natural Heritage Information Centre.

3.2.1. *Peltigera evansiana* Gyel.

Family: Peltigeraceae Rank: S1 Photos: Roll 3, #13-15

This rare lichen was found growing among mosses on a fallen log in plot 16 (old mixed forest on the island in Islet Lake). Elsewhere it is known in Alberta from Elk Island National Park and the Swan Hills. The species is known mainly from Eastern North America, and its Alberta occurrences may be disjunct. The identification was confirmed by Bernard Goffinet.

3.2.2. *Weissia controversa* Hedw.

Family: Pottiaceae Rank: S1 Photo: Roll 3, #28

This rare moss was collected in plot 22 (dryland shrubbery on a south-facing slope). It is so far known only from five other sites in Alberta (Edmonton district, Dinosaur Provincial Park, Fabyan, Calgary, Lake Agnes). The species is commoner in Eastern North America, where it is "common and weedy" according to Crum and Anderson (1981). The species has a worldwide distribution in warmer climes, so represents a southern element in the Alberta flora.

3.2.3. *Phascum cuspidatum* Hedw.

Family: Pottiaceae Rank: S2 Photo: Roll 5, #34

This is another dryland species collected both in shrubbery (plot 22) and grassland (plot 32). Previous Alberta records are for Mount Allan in Kananaskis, Fabyan (near Wainwright) and between Oyen and Empress on Highway 41. This species is a southern element in the Alberta flora, being distributed in eastern North America from Quebec to Wisconsin south to Texas and Tennessee, with more local western occurrences from British Columbia to Saskatchewan south to California. It also occurs in Northern and Central Europe.

3.2.4. *Desmatodon heimii* (Hedw.) Mitt.

Family: Pottiaceae Rank: S2 Photo: Roll 5, #25

This species was found in moist saline meadow on the foreshore of Blackfoot Lake (plot 29). It was previously found in Alberta in Calgary in 1908. Worldwide, the species has a wide but patchy distribution from arctic to temperate districts in saline habitats. It is known

from scattered localities throughout Canada, south to California, Colorado and Nebraska.

3.2.5. *Physcomitrium pyriforme* (Hedw.) Hampe

Family: Funariaceae Rank: S1 Photo: Roll 2, #23

This species was found abundantly on recently deposited moist alluvium in plot 34. It has been collected at only two other sites in Alberta, one in the Onoway district and one at Fish Creek (near Calgary). It is an ephemeral moss found "on bare, exposed soil, often in disturbed habitats in spring" (Ireland 1982). Whether it is genuinely rare in Alberta or undercollected because of its association with disturbed temporary habitats is unclear. The Alberta localities represent the northern limit of a wide North American distribution extending into Mexico; the species has also been reported from Europe, North Africa, the Caucasus and Macaronesia.

3.2.6. *Drepanocladus crassicostatus* Janssens

Family: Amblystegiaceae Rank: S1 Photo: Roll 3, #39

This is primarily a species of bygone times, known mostly as a fossil (Janssens 1983). We found it in Blackfoot in plot 15 (shore of the south boundary lake on the Islet Lake Road) in relatively deep water (of about 1 m depth) beyond extensive floating mats of the common *D. aduncus*. The species has been collected (as a living plant) at four other localities in Alberta: (1) McLean Creek in Kananaskis Country, (2) Wagner Bog west of Edmonton, (3) Kakwa Falls, and (4) North of Coleman. According to Janssens (1983) this species is endemic to Northwestern North America, ranging from Yukon Territory south to Colorado. It is often very abundant in Pleistocene fossil assemblages from this area.

3.2.7. *Conardia compacta* (C.Muell.) Robins.

Family: Brachytheciaceae Rank: S2 Photo: Roll 4, #27

We collected this species in the minerotrophic larch-black spruce swamp east of the Central Staging Area (near plot 20) in association with the decided calciphiles *Tomenthypnum nitens* and *Helodium blandowii*. This species is poorly known in Alberta, the available material in the University of Alberta Cryptogamic Herbarium [specimens from Whitemud Creek (Edmonton), Johnson Canyon and Sulphur Springs in Banff National Park, Wolf Lake (near Cold Lake) and High Level] being all in need of confirmation. This Blackfoot collection represents the first really good material. Outside Alberta the species has a wide but patchy distribution both to the north and south, its presence being dependent on calcareous conditions. The total North American distribution extends from Yukon Territory to Newfoundland south to Guatemala, and the species also occurs in Europe. It is interesting that McIntosh (1986) reports this species from "the margins of alkaline depressions" in the steppe of south-central British Columbia, a much more arid habitat than in Blackfoot.

3.2.8. *Equisetum scirpoides* Michx. Dwarf Scouring-Rush

Family: Equisetaceae Rank: Locally Rare Photos: Roll 4,#29,30

The first discovery of this species, the smallest of the horsetails, on the Cooking Lake Moraine was made in the stand of larch-black spruce swamp east of the Central Staging Area (near plot 20). Here it grows in dense shade beneath black spruce in leaf litter and mosses in association with *Mitella nuda* (bishop's-cap). Other rare species growing in the immediate vicinity are *Carex gynocrates* (northern bog sedge), *Malaxis monophylla* (white adder's-mouth), *Moneses uniflora* (one-flowered wintergreen), *Gaultheria hispidula* (creeping snowberry) and the moss *Conardia compacta*. This horsetail is a northern species found widely in the Northern Hemisphere, mainly under conifers. In Alberta it is distributed widely in the North and in the mountains, but is confined to refugia in Central Alberta. Other known localities in the Edmonton district are Whitemud Ravine and the Coronado Sandhills.

3.2.9. *Potamogeton foliosus* Raf. var. *macellus* Fern. Leafy Pondweed

Family: Potamogetonaceae Rank: S2 Photo: Roll 5, #44

This submersed aquatic species was found at two sites in Blackfoot: first, in a small but relatively deep pond on the Whitetail Trail (plot 30) in association with *Utricularia vulgaris* (common bladderwort) and *Hippuris vulgaris* (mare's-tail); secondly, in Detour Lake (plot 42) in association with the dominant *Ceratophyllum demersum* (hornwort). The water quality at these sites cannot be identical, because the pond lacks a duckweed mat while Detour Lake has an extensive duckweed mat dominated by *Wolffia borealis* (northern ducksmeal). Why this rare pondweed should be abundant at these two sites but absent from all other waterbodies checked is unknown. Elsewhere on the Cooking Lake Moraine we have reported it only for a single site, a small pond on private land near Wye Knott Village.

Potamogeton foliosus is a widely but rather sporadically distributed American species divided into two varieties in recent taxonomic treatments (e.g., Brayshaw 1985), the southern var. *foliosus* (leaves over 1.5 mm wide with 3-5 veins) and the northern var. *macellus* (leaves less than 1.5 mm wide with 1-3 veins). These varieties were not distinguished in the *Flora of Alberta* (Moss and Packer 1983). The material from the Cooking Lake Moraine and, so far as we are aware, all other Alberta specimens belong to var. *macellus*.

Outside the Cooking Lake Moraine this species is known in Alberta from the Lake Athabasca Dunes, west-central Alberta (Glenevis, Sangudo and Fox Creek) and the vicinity of Lethbridge (map 67 in Moss and Packer 1983). The variety *macellus* is found from central Alaska, the Northwest Territories and Labrador south to the northern United States, where it overlaps with var. *foliosus* whose range extends to Central America.

3.2.10. *Potamogeton obtusifolius* Mert. and Koch — Blunt-Leaved Pondweed

Family: Potamogetonaceae Rank: S1 Photos: Roll 1, #2,21
Roll 3, #4,19

This submersed aquatic species is dominant or codominant in a series of lakes at higher elevation in Blackfoot (close to watershed divides). We refer to these lakes as the "watershed lakes". Included here are Neon Lake (plot 18), Arrowhead Lake (plot 7), Islet Lake (plots 12, 17), the south boundary lake on the Islet Lake Road (plot 15) and Long Lake in the northeast sector (plot 41). In Neon Lake this species covers most of the lake bottom in water of about 1 m depth, where it grows mixed with the larger *Potamogeton zosteriformis* (grass-wrack). In Islet Lake it forms extensive beds in water of 0.5 - 1 m depth, but its coverage is less complete; parts of the lake bottom are occupied by beds of *Potamogeton richardsonii* (clasping-leaf pondweed), *Myriophyllum exalbescens* (spiked water-milfoil) and *Ceratophyllum demersum* (hornwort) or are too deep for rooted aquatics. In Long Lake this species is locally dominant in water of about 0.5 m depth, but much of the lake is occupied by *Myriophyllum*. Quantitative comments cannot be made for Arrowhead Lake and the south boundary lake, since these were sampled only from the shore.

Outside Blackfoot we have found this species on the Cooking Lake Moraine at two sites immediately to the west, in a beaver pond in SE27-52-21-W4 (beneath a duckweed mat) and in low numbers in the bog pond in Voyageur Estates where the dominant pondweed is *Potamogeton pusillus* (small pondweed). Only four collections are recorded for other parts of Alberta (map 30 in Packer and Bradley 1984). These were made west of Edmonton and in northeastern Alberta. The species occurs widely in the Northern Hemisphere, but is very local and scattered in some parts of its range. In North America it is recorded from Yukon and the Northwest Territories to Newfoundland south to Washington State and New Jersey (Packer and Bradley 1984).

While this species may be reduced in rank to S2 as a result of discovery of this series of new localities in Blackfoot, it remains an indicator species for the Provincial significance of the series of watershed lakes in which it is abundant.

3.2.11. *Potamogeton zosteriformis* Fern. — Grass-Wrack

Family: Potamogetonaceae Rank: Locally Rare Photo: Roll 1,#3

This large submersed pondweed is known to us on the Cooking Lake Moraine only from Neon Lake (plot 18), where it has high coverage (±60% in the plot) and grows mixed with *Potamogeton obtusifolius* (blunt-leaved pondweed) in water of about 1 m depth. Since Neon Lake is one of the highest waterbodies in Blackfoot (±760 masl), we surmise that the presence of this pondweed only in that lake may be due to relatively low trophic status. Elsewhere this species is known from a series of localities in west-central and northeastern Alberta (map 78 in Moss and Packer 1983). Although transcontinental in distribution in Canada and the northern United States and common in some districts, it is absent from the prairie zone. The previously known locality closest to the Cooking Lake Moraine is Lily Lake in Sturgeon County (Turner 1949).

3.2.12. *Elymus canadensis* L. — Canada Wild Rye

Family: Gramineae Rank: Locally Rare Photos: Roll 5,#29,30

This is a common grass species in southern Alberta and much of the western United States. But in central and northern Alberta it becomes very local, occurring mainly on the south-facing slopes of major river valleys (map 129 in Moss and Packer 1983). It occurs along the North Saskatchewan River (through Edmonton and Fort Saskatchewan), but there are no previous records of its occurrence on the Cooking Lake Moraine. Therefore we rank this species as locally rare, and its abundance (±30% coverage) in native grassland on the extreme south-facing slope along the north shore of Crooked Lake (plot 32 and vicinity) indicates that this is a refugial site for southern species requiring open sunny habitats without tall shrubs. The large nodding flower spikes of this grass are conspicuous in late summer. It shares this refugium with *Glycyrrhiza lepidota* (wild licorice), which is similarly confined to south-facing slopes in central and northern Alberta.

3.2.13. *Carex gynocrates* Wormsk. — Northern Bog Sedge

Family: Cyperaceae Rank: Locally Rare Photo: Roll 4,#28

This small sedge with filiform leaves is one of the interesting discoveries made in the stand of larch-black spruce swamp east of the Central Staging Area (plot 20 and vicinity). Here it grows in dense shade beneath larch and black spruce on moist mounds of sphagnum and other mosses. The species has an East Siberian-North American, predominantly boreal, distribution. It occurs both in open and forested habitats (commonly among sphagnum mosses) in the north, but becomes confined to shaded habitats further south. Since this species is common in northern and western Alberta, it does not qualify as provincially rare. But this Blackfoot record is the first record of its occurrence on the Cooking Lake Moraine. The nearest recorded localities are on north-facing slopes of the valley of the North Saskatchewan River through Edmonton and Fort Saskatchewan and in adjacent shady ravines.

3.2.14. *Carex trisperma* Dewey — Three-Seeded Sedge

Family: Cyperaceae Rank: S2 Photos: Roll 2, #3,4

This species is something of a speciality of the Cooking Lake Moraine, where it was first recorded from Elk Island National Park by Turner (1949). It is now known from a series of sites on the moraine, including North Cooking Lake Natural Area (Griffiths and Griffiths 1989). The species grows on moist mossy ground on the edge of black spruce bogs, often in association with the commoner *Carex brunnescens* (brownish sedge) and *C. disperma* (two-seeded sedge). One site for this species has been found in Blackfoot, a very wet black spruce bog with extensive sphagnum coverage and pools on its floor (plot 9 and vicinity). This bog is situated on the north side of the Spruce Hollow Trail and is relatively high (perched) in relation to surrounding terrain (±770 masl). The spruce trees are large (up to 16 m high and 32 cm dbh), indicative of a stable environment without recent fire history.

Outside the Cooking Lake Moraine this species is known from a few sites in west-central Alberta, including Coyote Lake (Griffiths and Griffiths 1987) and the Swan Hills, and has recently been collected near Fort McMurray. It is a predominantly eastern boreal species,

considered to be rare in British Columbia and Saskatchewan, as well as in Alberta.

3.2.15. *Carex vulpinoidea* Michx. **Fox Sedge**
Family: Cyperaceae Rank: S2 Photo: Roll 4, #33

The first discovery of this species on the Cooking Lake Moraine was made in plot 36 at the edge of a beaver pond on the north side of the gas pipeline road (near the northwest end of West Sawmill Lake). This is an old stable beaver pond with complete duckweed mat (including both species of *Wolffia*). About ten plants of this sedge were found growing in shallow water in the narrow emergent shoreline zone among the dominant *Carex aquatilis* (water sedge) and *Scirpus microcarpus* (small-fruited bulrush). Elsewhere in Alberta this species is known only from west of Edmonton (Pigeon Lake, Acheson Pond, Gunn, Lesser Slave Lake). The Alberta localities represent the northern limit of the range, which extends southward to Oregon, Arizona and Florida.

3.2.16. *Eriophorum chamissonis* C. A. Mey. **Russet Cottongrass**
Family: Cyperaceae Rank: S2

This stoloniferous cottongrass was found in some numbers in the quaking sedge-reedgrass fen containing plot 26, and we have found it in similar habitats in Elk Island National Park and North Cooking Lake Natural Area (Griffiths and Griffiths 1989). Elsewhere in Alberta it is known from a series of sites in central Alberta north and west of Edmonton, Waterton and Banff National Parks, and the Peace River Region (map 301 in Moss and Packer 1983). It seems likely that the Provincial rank of this species will be reduced, since it is rather widespread. But we include it here provisionally, as it is ranked S2 in the most recent draft tracking list.

Eriophorum Chamissonis in the sense of the *Flora of Alberta* (Moss and Packer 1983) is part of a northern circumpolar complex whose nomenclature is muddled and disputed. Some recent authorities consider the valid name for this complex to be *E. russeolum* E. Fries, within which subspecies and varieties are distinguished.

3.2.17. *Wolffia borealis* (Engelm.) Landolt **Northern Ducksmeal**
Family: Lemnaceae Rank: S2 Photos: Roll 2, #15,29
Roll 4, #34,42

The genus *Wolffia* was not treated by Moss and Packer (1983), but added to the Alberta list subsequently (Griffiths 1988, Griffiths and Griffiths 1990). Included here are the smallest of flowering plants, with thallus length in the order of 1 mm. Like other species of Lemnaceae, they form floating mats on sheltered standing water, either alone or mixed with larger duckweeds (*Lemna turionifera* and/or *Spirodela polyrhiza*). The more common species of *Wolffia* on the Cooking Lake Moraine is *W. borealis* (northern ducksmeal), which is known from rather numerous ponds from the north end of Elk Island National Park southward to the north end of the Ministik Lake Bird Sanctuary. All waterbodies in which we have found this species have shown evidence of beaver activity. *Wolffia* plants cannot survive either desiccation or prolonged freezing. Beaver prevent ponds from drying up by damming them, and deepen them so that there is always plenty of unfrozen water in which the overwintering buds ("turions") of *Wolffia* can survive beneath the ice.

Ducksmeal mats are fed on by American coot and several species of ducks (mallard, gadwall, American wigeon, teals, northern shoveler and ring-necked duck according to Martin *et al.* 1951). The presence of such mats is especially beneficial to waterfowl in the fall, since ducksmeal remains fresh and green after the larger duckweeds have deteriorated.

We have documented the presence of *Wolffia borealis* on seven waterbodies in Blackfoot (plots 10, 14, 25, 36, 42, 43). Six of these are small beaver ponds (the usual habitat), but plot 42 documents the presence of an extensive *Wolffia* mat on Detour Lake; we surmise that the presence of *Wolffia* on such an unusually large waterbody is due to the sheltered location (in a deep depression). We have never found *Wolffia* among emergent vegetation around the larger lakes.

Outside the Cooking Lake Moraine, *Wolffia borealis* (northern ducksmeal) is so far known in Alberta only from Acheson Pond west of Edmonton (collected by P. Cotterill). The occurrence of this species in central Alberta is highly disjunct. The species is distributed mainly in the northeast United States south to Tennessee and north to southern Ontario, with scattered western occurrences in Utah, Colorado, Oregon, Idaho, California (introduced) and southern British Columbia. All these areas are many hundreds of kilometres distant from central Alberta, the nearest occurrence being north of Creston in British Columbia (Češka and Češka 1980); so long-distance dispersal by waterfowl is believed to be responsible for the presence of the species here.

It is clear from recent fieldwork that *Wolffia borealis* (northern ducksmeal) readily colonizes new beaver ponds on the Cooking Lake Moraine within a few years of their establishment. The number of sites at which it occurs, both inside and outside Blackfoot, must greatly exceed 20 (the normal limit for ranking as S2). Although we have documented the occurrence of this species on only seven waterbodies in Blackfoot, we suspect that this is only a fraction of the number of waterbodies on which it actually occurs. The question of how to rank such species which are rare in a broad sense but common within a very limited area of the province is currently under review. The biological factor critical for the prosperity of this species on the Cooking Lake Moraine is the availability of beaver ponds. Thus, any reduction in the abundance of beaver would also reduce the number of waterbodies containing *Wolffia*.

3.2.18. *Wolffia columbiana* Karsten — Columbian Ducksmeal

Family: Lemnaceae Rank: S1

The typical (large-celled) form of this species was found in association with *Wolffia borealis* (northern ducksmeal) but much less abundantly (in a ratio of ±50:1) in plot 36 (a beaver pond on the north side of the pipeline road near the northwest end of West Sawmill Lake). The rare *Carex vulpinoidea* (fox sedge) was found on the shore of this same pond. *Wolffia columbiana* (Columbian ducksmeal) is very restricted in its occurrence on the Cooking Lake Moraine, having been found abundantly only at the north end of the Ministik Lake Bird Sanctuary. Only one occurrence in Elk Island National Park was found during an extensive survey there in 1988 (Griffiths and Griffiths 1990). The first discovery of the typical form of this species in Alberta was at a beaver pond in the Coyote Lake Natural Area west of Edmonton (Griffiths 1988). It also occurs in Acheson Pond west of

Edmonton (collected by P. Cotterill).

Material of *Wolffia* from the Lakeland region of Alberta differs from typical *W. columbiana* in having smaller cells (Griffiths and Griffiths 1990). The taxonomic interpretation of this material needs further study. But, whatever their taxonomic status, the Lakeland populations are morphologically different from typical *columbiana* and should be tracked separately. Such small-celled material has not been found on the Cooking Lake Moraine.

As in the case of *Wolffia borealis* (northern ducksmeal), the occurrence of this species in central Alberta is highly disjunct from its main range. The typical form of *W. columbiana* (Columbian ducksmeal) is known from North, Central and South America; it is widespread in eastern North America as far north as southwest Quebec and also occurs in Riding Mountain National Park in Manitoba. Only isolated occurrences are known in the western United States.

3.2.19. *Malaxis monophylla* (L.) Sw. — White Adder's-Mouth

Family: Orchidaceae Rank: S2 Photo: Roll 4, #29

A colony of this small orchid (±20 individuals seen) was discovered in the stand of larch-black spruce swamp east of the Central Staging Area (near plot 20). Here it grows on moist ground among mosses in moderate to dense shade in association with *Mitella nuda* (bishop's-cap) and the locally rare *Equisetum scirpoides* (dwarf scouring-rush). Other rare species growing in the immediate vicinity are *Carex gynocrates* (northern bog sedge), *Moneses uniflora* (one-flowered wintergreen), *Gaultheria hispidula* (creeping snowberry) and the moss *Conardia compacta*. Previously the only record of this orchid from the Cooking Lake Moraine was for a site on private land near Half Moon Lake. Elsewhere in Alberta this species is known from scattered sites in the Red Deer and Edmonton districts, Lesser Slave Lake and the Lakeland region (map 388 in Moss and Packer 1983). It is a circumpolar boreal species with fragmented distribution commoner in areas of moist climate (including eastern Canada and the northeast United States). Alberta specimens and all others from east of the Rocky Mountains are referred to var. *brachypoda* (A. Gray) Morr. and Eames (with lip lowermost in the flower).

3.2.20. *Rumex orbiculatus* Gray (=*britannica* auctt.) — Water Dock

Family: Polygonaceae Rank: S2 Photos: Roll 4, #9
Roll 5, #3,16

This species is ranked S2 in the current draft tracking list, since until recently it was reported only from a small number of sites in central Alberta from Pigeon Lake north to Calling Lake (map 452 in Moss and Packer 1983). However, it is a relatively common species on the Cooking Lake Moraine occurring in most quaking sedge fens (plots 2, 4, 26, 31 and 38 of the present Blackfoot survey). It seems likely that the Provincial rank of this species will be reduced in view of the numerous occurrences (in Blackfoot, Elk Island National Park and elsewhere on the moraine) recently recorded. Plants from quaking fens in North Cooking Lake Natural Area incorrectly recorded as *Rumex triangulivalvis* by Griffiths and Griffiths (1989) also belong to the present species. Outside Alberta the species is widespread in southern Canada and the northern United States.

3.2.21. *Drosera rotundifolia* L. **Round-leaved Sundew**
Family: Droseraceae Rank: Locally Rare Photo: Roll 4,#10

This insectivorous bog plant is rare on the Cooking Lake Moraine, having been found previously only at two sites in Elk Island National Park and at one site in the North Cooking Lake Natural Area (Griffiths and Griffiths 1989). It becomes a more common plant in northern Alberta (map 609 in Moss and Packer 1983), and has a wide circumpolar distribution.

During the present Blackfoot survey we found a few sundew plants on the peripherae of plot 38 (quaking sedge-willow fen immediately east of the Central Staging Area), where they were growing on a sphagnum mound.

3.2.22. *Glycyrrhiza lepidota* (Nutt.) Pursh **Wild Licorice**
Family: Leguminosae Rank: Locally Rare Photo: Roll 5,#30

This is a tall herb common in southern Alberta and much of the western United States, but becoming confined to exposed south-facing slopes on the northern fringe of its range in central and northern Alberta (map 721 in Moss and Packer 1983). It is known from the valley of the North Saskatchewan River and adjacent ravines (through Edmonton and Fort Saskatchewan) and from still further north along the Athabasca River, but has not previously been reported for the Cooking Lake Moraine. We found this species abundant (±20% coverage) in association with *Elymus canadensis* (Canada wild rye) in native grassland on the extreme south-facing slope along the north shore of Crooked Lake (plot 32 and vicinity). The *Elymus* is similarly confined to south-facing slopes in central and northern Alberta. The abundance of these two conspicuous species indicated that this site is a refugium for southern biota requiring open sunny habitats without tall shrubs.

3.2.23. *Cicuta virosa* L. **Narrow-Leaved Water-Hemlock**
Family: Umbelliferae Rank: S2 Photos: Roll 1, #14
Roll 5, #2,15

This species is ranked S2 in the current draft tracking list, since until recently it was reported only from a small number of sites in Alberta from the Edmonton district northwards (map 811 in Moss and Packer 1983). However, it is a relatively common species on the Cooking Lake Moraine (e.g., in the North Cooking Lake Natural Area, Griffiths and Griffiths 1989), occurring in relatively oligotrophic (especially quaking) fens but replaced by the more widespread *C. maculata* L. at relatively eutrophic sites. During the present survey we recorded this species in sedge-willow fen around Neon Lake (plot 4) and in two quaking fens associated with bogs (plots 26, 31). Many more sites could probably be found. Since the species has also been shown recently to be common in Elk Island National Park, it seems likely that its Provincial rank will be reduced. The species has a boreal circumpolar distribution across Eurasia and North America.

3.2.24. *Moneses uniflora* (L.) A. Gray **One-Flowered Wintergreen**
Family: Pyrolaceae Rank: Locally Rare Photos: Roll 4,#21,22

This species has not previously been reliably reported for the Cooking Lake Moraine. We

found it at two sites in Blackfoot, first in the stand of larch-black spruce swamp east of the Central Staging Area (plot 20 and vicinity), and secondly in the white spruce swamp south of the Blackfoot Lake Staging Area (near plot 28). At both sites the plants grow among mosses in the shade of conifers. This is a circumpolar northern species common in the forests of northern and western Alberta (map 830 in Moss and Packer 1983). The sites where it occurs in Blackfoot are refugia for northern biota.

3.2.25. *Andromeda polifolia* L. **Bog Rosemary**
Family: Ericaceae Rank: Locally Rare Photo: Roll 2,#9

This species was previously known on the Cooking Lake Moraine from a few sites in Elk Island National Park and a site in Strathcona County (Antler Meadows Bog). We found it in Blackfoot in the wet black spruce bog containing plot 9 (on the north side of Spruce Hollow Trail). This bog is also noteworthy for the presence of *Carex trisperma* (three-seeded sedge), and appears to have no recent fire history. *Andromeda* was found growing on mounds of *Sphagnum magellanicum*, together with *Oxycoccus microcarpus* (small bog cranberry), *Ledum groenlandicum* (Labrador tea) and *Vaccinium vitis-idaea* (cranberry). This is a circumpolar species common in northern Alberta in open peat bogs. Its occurrences on the Cooking Lake Moraine are at the edge of its range.

3.2.26. *Gaultheria hispidula* (L.) Bigel. **Creeping Snowberry**
Family: Ericaceae Rank: S2 Photos: Roll 2, #26,27
Roll 4, #23,24

This trailing dwarf shrub was found at two sites in Blackfoot, first in the stand of larch-black spruce swamp east of the Central Staging Area (plot 20 and vicinity), and secondly in the bog near the Waskahegan Staging Area (plot 35 and vicinity). At both sites the plants grew abundantly on mounds of sphagnum and other mosses. We also know this species on the Cooking Lake Moraine from one site in Elk Island National Park (northeast of Astotin Lake) and from the bog in Voyageur Estates in Strathcona County (just outside the Blackfoot boundary). Elsewhere in Alberta the species is known mainly from west-central Alberta north to Lesser Slave Lake, but also occurs at middle elevation in Jasper and Banff National Parks and near Gregoire Lake in northeast Alberta. The species is widely distributed from British Columbia to eastern North America, occurring in the lower boreal zone in peaty habitats usually over sphagnum.

3.3. Significant Ecological Features

Rare species surveys allow significant ecological features to be identified by the use of rare species as indicators of significance. It should be emphasized that, since our survey of our very large study area was incomplete, it is likely that additional significant features will be discovered in future studies. It should not be assumed that there are no significant ecological features in those parts of Blackfoot for which none are indicated on our map.

3.3.1. Watershed Lakes

We apply this term to lakes on heights of land, whose water has not travelled far and so should have lower concentrations of dissolved minerals than the water in neighbouring lakes at lower elevation. Our pondweed data suggest that the rare *Potamogeton obtusifolius* (blunt-leaved pondweed) is a good indicator species for such watershed lakes in Blackfoot. It is abundant in a series of lakes close to the summit of the northwest-southeast ridge running from west of the Blackfoot boundary to north of Islet Lake. These lakes have an elevational range of 740-760 masl (close to a crestline in the range of 770-780 masl). The lakes in question are Neon Lake, Arrowhead Lake, Islet Lake and the south boundary lake on the Islet Lake Road. We also recognize Long Lake in the northeast as a watershed lake on the basis of the presence of the same pondweed; while lower in absolute elevation (715 masl), it is relatively high in relation to the surrounding terrain. One of the highest of these lakes is Neon Lake in the west (760 masl), which is the only lake on the Cooking Lake Moraine known to contain *Potamogeton zosteriformis* (grass-wrack). The most eastern south boundary lake contains the rare aquatic moss *Drepanocladus crassicostatus*. Preservation of water quality in these lakes should have a high management priority. We recommend that baseline data on water chemistry should be gathered for future reference.

3.3.2. Detour Lake

This small lake is situated in what appears to be a glacial meltwater channel. Our belated visit to this site documented that the rare *Potamogeton foliosus* (leafy pondweed) was present, as well as an extensive duckweed mat dominated by *Wolffia borealis* (northern ducksmeal). It is most unusual for *Wolffia* to be found on such a large waterbody, something which is probably attributable to the lake being unusually sheltered from wind. The steep slopes above this lake and other sites in the vicinity deserve botanical investigation.

3.3.3. Central Staging Area to West Sawmill Lake (minerotrophic fens)

Rare plants were found in three wet sites along the pipeline road between the Central Staging Area and West Sawmill Lake. We have no chemical data, but the presence of these rare species and the abundance of tamarack larch (*Larix laricina*) in this area suggest calcareous conditions. The most remarkable site is the small stand of larch-black spruce swamp on the south side of the road (plot 20 and vicinity). This is the "hot spot" for rare plants in Blackfoot, with no less than six rare species observed including four found only here during this study: these are *Carex gynocrates* (northern bog sedge), *Malaxis monophylla* (white adder's-mouth), *Equisetum scirpoides* (dwarf scouring-rush) and the moss *Conardia compacta.* A short distance further east on the north side of the road there is a beaver pond, in which the rare *Carex vulpinoidea* (fox sedge) and *Wolffia columbiana* (Columbian ducksmeal) were found. Neither species was found anywhere else in Blackfoot. Immediately east of the Central Staging Area there is a wet depression with a band of larch along its western edge; this was the only site in Blackfoot where we found *Drosera rotundifolia* (round-leaved sundew). The whole area between the Central Staging Area and West Sawmill Lake deserves further investigation and protection from disturbance.

3.3.4. Crooked Lake and Vicinity (grassland and saline meadows)

By "Crooked Lake" we mean the small lake separated from the northeast corner of Blackfoot Lake by a causeway. This area contains saline seepage zones, with stands of moist saline meadow. The rare moss *Desmatodon heimii* was found in saline meadow on the Blackfoot Lake side of the causeway. Two locally rare vascular plants, *Elymus canadensis* (Canada wild rye) and *Glycyrrhiza lepidota* (wild licorice), together with the rare moss *Phascum cuspidatum*, were found on the extreme south-facing slope on the opposite side of Crooked Lake. This is the only stand of dry grassland we found in Blackfoot. Slightly further south there is a small pond along the Whitetail Trail containing the rare *Potamogeton foliosus* (leafy pondweed).

The value of this area for conservation is enhanced by the regular use of Crooked Lake for feeding by trumpeter swans (present during three out of four visits). Our aquatic plot suggests that they are attracted to the extensive beds of *Potamogeton vaginatus* (large-sheath pondweed) present in that lake.

3.3.5. West of Elk Push Lake (high relief area)

Permanent dryland shrubbery (as distinct from beaver-cleared seral shrubbery) occurs on south-facing slopes in this area. The stand documented (below a headland along the Elk Push Trail) contains the rare mosses *Phascum cuspidatum* and *Weissia controversa*. Slopes in this area deserve further botanical investigation.

3.3.6. Island Refugia (Islet Lake)

The islands in Islet Lake, especially the large island, contain forest stands protected from past fires and cutting. Some spruce trees on the large island are believed to be over 100 years old. The summit of the large island was the only site in Blackfoot where we found old mixed forest with large trees of true paper birch *(Betula papyrifera* s.s.). The rare lichen *Peltigera evansiana* was discovered in our plot on this island.

3.3.7. Other Refugia for Northern Biota (coniferous bogs and swamps)

Three other features of more limited extent deserve mention as refugia for rare northern species: (1) the bog forest immediately northeast of the Waskahegan Staging Area contains extensive mats of *Gaultheria hispidula* (creeping snowberry), otherwise found by us only in the "hot spot" east of the Central Staging Area (see above); (2) the very wet bog forest on the north side of Spruce Hollow Trail was the only site in Blackfoot where we found *Carex trisperma* (three-seeded sedge) and *Andromeda polifolia* (bog rosemary); and (3) a small stand of swamp with old white spruce trees just south of the Blackfoot Lake Staging Area contains the locally rare *Moneses uniflora* (one-flowered wintergreen), otherwise found by us only in the "hot spot".

4.0. DISCUSSION

4.1. Rare Plant Ecology and Biogeography

The rare plant species found in Blackfoot are more or less divisible into three categories: (1) submersed or floating aquatics, whose presence on the Cooking Lake Moraine is facilitated by the high density and diversity of waterbodies; (2) northern and/or cordilleran species finding refugia here in cool shaded habitats or relatively oligotrophic fens; and (3) southern species finding refugia in open sunny habitats or eutrophic/saline fens.

With respect to the first category, there are four species of submersed aquatics and two floating species. The submersed species consist of three species of pondweeds (*Potamogeton foliosus* var. *macellus*, *P. obtusifolius* and *P. zosteriformis*), all of widespread northern distributions. The last two of these species are characteristic of relatively oligotrophic watershed lakes. Also included in the submersed aquatic category is the recently described moss *Drepanocladus crassicostatus*, considered by its describer Janssens (1983) to be a cordilleran endemic ranging from Yukon Territory to Colorado. The two floating ducksmeal species (*Wolffia borealis* and *W. columbiana*) are both predominantly eastern species with remarkably disjunct ranges in central Alberta far to the north of their other isolated occurrences in western North America. It is unknown how long these two species have been present in central Alberta prior to their first discovery here in the late eighties. Both live in beaver ponds, so were doubtless rarer (or even absent) before the increase in beaver numbers in recent decades.

Cool shaded sites are the habitat of several rare vascular species with boreal (in some cases boreal-cordilleran) distributions. Here belong *Equisetum scirpoides* (dwarf scouring-rush), *Carex gynocrates* (northern bog sedge), *Malaxis monophylla* (white adder's-mouth), *Moneses uniflora* (one-flowered wintergreen) and *Gaultheria hispidula* (creeping snowberry), all of which grow together in the remarkable "hot spot" (larch-black spruce swamp) east of the Central Staging Area. The site presents a mosaic of minerotrophic depressions and ombrotrophic sphagnum mounds. The rare moss occurring at this site, *Conardia compacta*, is decidedly calciphile; it has a wide but patchy distribution outside Alberta but cannot be characterized as northern or southern (its presence apparently being more dependent on the presence of calcareous conditions than on climate). Other shaded sites where rare northern species were found include certain wet or moist bogs, where *Carex trisperma* (three-seeded sedge), *Andromeda polifolia* (bog rosemary) and *Gaultheria hispidula* (creeping snowberry) occur; also the old mixed forest on the large island on Islet Lake, the sole location for the rare lichen *Peltigera evansiana* (on mossy fallen logs).

Open, relatively oligotrophic fens contain a few northern species on our second priority list, namely *Eriophorum chamissonis* (russet cottongrass), *Rumex orbiculatus* (water dock) and *Cicuta virosa* (narrow-leaved water-hemlock). The locally rare northern *Drosera rotundifolia* (round-leaved sundew) was found on the edge of a rather calcareous fen, but in an oligotrophic microhabitat (on a sphagnum mound).

Conversely, open sunny sites provide refugial habitats for certain southern species not found in forest. Good examples are the tall herbs *Elymus canadensis* (Canada wild rye)

and *Glycyrrhiza lepidota* (wild licorice) found only at a single site in Blackfoot on an extreme south-facing slope (above Crooked Lake). The rare moss *Phascum cuspidatum* found at this site is also a southern species found here north of its main range. This moss was also found in dryland shrubbery west of Elk Push Lake, here in association with another rare moss of southern origin, *Weissia controversa.*

The emergent marsh plants found in Blackfoot include only one rare species of southern origin, namely *Carex vulpinoidea* (fox sedge) known elsewhere in Alberta only from a few sites west of Edmonton (north to Lesser Slave Lake). This species was found in the same beaver pond as *Wolffia columbiana* (Columbian ducksmeal), in the calcareous area near West Sawmill Lake. The ephemeral moss *Physcomitrium pyriforme* found on recently deposited alluvium in Blackfoot is also of southern origin (commoner in eastern North America).

Finally, we mention a moss with special ecological requirements, namely *Desmatodon heimii* found in moist saline meadow on the foreshore of Blackfoot Lake. This species has a wide but patchy distribution in saline habitats both north and south of Alberta.

4.2. Recommendations for Further Research

The following are suggested as possible future research projects relating to the maintenance of biological diversity in the Blackfoot Provincial Recreation Area.

(1) Expanded Rare Plants Survey. We were not able to visit our entire study area on account of its large size and the short time available. We adequately surveyed only areas close to the four main staging areas (see map). An extensive tract in the middle of Blackfoot (between Detour and Islet lakes in the south, and between Dynamite Lodge and Geese and the Bog Lakes in the north) was not visited. In the areas visited additional survey work is recommended for the area around Detour Lake (showing high relief and interesting glacial features), for calcareous fens towards West Sawmill Lake, and for saline areas and open slopes in the northeast. Some of the uncleared areas within pastures may also include wetlands containing rare plants. The optimal period for botanical surveys in this area is mid-June to mid-August.

(2) Water Chemistry Study. The presence of rare aquatic plants in some waterbodies in Blackfoot suggests that a water chemistry study would provide benchmark data valuable for future management purposes.

(3) Breeding Bird Survey. Some very local waterbirds (such as cormorants, herons, pelicans and trumpeter swans) can be seen regularly in Blackfoot. But there is inadequate information to establish their distribution, abundance and reproductive status. Documentation of the status of other waterbirds, as well as landbirds, is also inadequate. We recommend that a comprehensive survey of all land- and waterbirds should be undertaken, so that important nesting habitats can be identified and protected. Differences in waterbird fauna of various waterbodies may be related to differences in aquatic vegetation.

(4) Small Mammal Survey. Small mammals provide the main food source for mammal and bird predators. Their abundance and diversity thus has a strong direct or indirect influence on other species in the ecosystem.

(5) Beaver Conflict Management Study The present high beaver population has both positive and negative impacts on the ecology and the recreational use of Blackfoot. Negative impacts arise from flooding of desirable marshland, bogs and recreational facilities. Positive impacts arise from increased water storage so that the area is more drought-resistant with enhanced groundwater recharge; additionally, many plants and animals benefit from the stabilization of water levels and deepening of ponds resulting from beaver activity. At present the main form of land disturbance in Blackfoot consists of drainage and reflooding of beaver ponds at locations where there is conflict between beaver activity and recreational facilities. Sudden changes in water levels (in either direction) are detrimental to many plants and animals, including the two rare species of ducksmeal (*Wolffia* spp.), fox sedge (*Carex vulpinoidea*) and leafy pondweed (*Potamogeton foliosus*). These rare species all require ponds with stable water levels. Only a few local species, notably the rare moss *Physcomitrium pyriforme* found on fresh alluvium, are adapted to instability in water levels. The quality of the habitat in Blackfoot for most plants and animals (including rare species) would be improved, if the need to breach beaver dams could be reduced.

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Appendix 1. Lichens, Bryophytes and Vascular Plants of the Blackfoot Provincial Recreation Area

No comprehensive floristic survey has previously been conducted in Blackfoot. There is a checklist of vascular plant species (author unknown) available to visitors as a leaflet, apparently prepared in the mid-eighties (latest reference cited 1984). Unfortunately, this list is not supported by specimens or site-specific data. While we have confirmed the occurrence of most of the species listed in the leaflet, there are a few unlikely to occur in Blackfoot. The author presumably included some species known from Elk Island National Park on the assumption that they also occur in Blackfoot. But this is not necessarily the case, because some of the habitats available in Elk Island (e.g., sandhills and highly calcareous fens) have not been found in Blackfoot. In these circumstances we have restricted our plant list to species observed during the present study, and do not regard the listing of a few additional species in the leaflet as sufficient evidence of their occurrence in Blackfoot.

H in the left margin signifies that specimens have been deposited in the Alberta Environmental Protection Herbarium (vascular species only) or the Cryptogamic Herbarium of the University of Alberta (lichens and bryophytes)
P in the left margin signifies that close-up photographs are available (see list in Appendix 2)

The sequence for vascular plants in this list follows Moss and Packer (1983). Families of non-vascular plants have been sequenced alphabetically. This list includes 25 species of lichens, 17 species of liverworts, 63 species of mosses, and 295 species (plus one hybrid) of vascular plants.

Latin Name	English Name	Plot Numbers	Comments
LICHENS			
CANDELARIACEAE			
HP *Candelaria concolor* (Dickson) Stein	—	16,20,28,35,37	-common on spruce bark and twigs
CLADONIACEAE			
H *Cladina mitis* (Sandst.) Hustich	—	8	-occasional in bogs
H *Cladina rangiferina* (L.) Nyl.	—	8,35	-occasional in bogs
H *Cladonia carneola* (Fr.) Fr.	—	9	-found once in closed bog forest
H *Cladonia cervicornis* (Ach.) Flot.	—	35	-found once in mesic bog
H *Cladonia chlorophaea* (Floerke ex Sommerf.) Sprengel	—	near 9	-occasional in bogs
H *Cladonia squamosa* Hoffm.	—	20	-found once in larch-black spruce swamp

	HYPOGYMNIACEAE			
H	*Hypogymnia physodes* (L.) Nyl.	—	1,9,20,26,35	-frequent on twigs in bogs
	PARMELIACEAE			
H	*Flavopunctelia flaventior* (Stirton) Hale	—	11,16,20,21,27, 28,35,37	-common on twigs and bark of deciduous trees
H	*Melanelia exasperata* (De Not.) Essl.	—	8,20,21	-occasional on twigs
HP	*Parmelia sulcata* Taylor	—	1,2,5,6,8,9,11,13, 16,20,21,23,26,27, 28,35,37	-very common epiphyte
H	*Vulpicida pinastri* (Scop.) J.E.Mattson & M.J. Lai	—	8,9,35	-occasional on low twigs in bogs
	PELTIGERACEAE			
H	*Peltigera elisabethae* Gyelnik	—	28	-found once in wet white spruce stand
HP	*Peltigera evansiana* Gyelnik	—	16	-see section 3.2
H	*Peltigera membranacea* (Ach.) Nyl.	—	20	-found once in larch-black spruce swamp
H	*Peltigera praetextata* (Floerke ex Sommerf.) Zopf	—	13	-found once in aspen forest
	PHYSCIACEAE			
H	*Phaeophyscia orbicularis* (Necker) Moberg	—	27	-occasional on poplar bark
H	*Physcia adscendens* (Fr.) H. Olivier	—	6,11,13,16,20,21, 22,23,26,27,28,37,38	-very common on bark and twigs
H	*Physcia aipolia* (Ehrh. ex Humb.) Furnr.	—	27,37	-occasional on poplar bark
	RAMALINACEAE			
H	*Ramalina dilacerata* (Hoffm.) Hoffm.	—	23	-found once on willow bark
	TELOSCHISTACEAE			
H	*Caloplaca holocarpa* (Hoffm. ex Ach.) M. Wade	—	27	-common on poplar bark
	Xanthoria fallax (Hepp) Arn.	—	22,37	-common epiphyte
H	*Xanthoria polycarpa* (Hoffm.) Rieber	—	5,6,11,13,16,27,37	-common epiphyte

	USNEACEAE			
H	*Evernia mesomorpha* Nyl.	—	1,2,9,11,23,35,37	-common epiphyte
HP	*Usnea hirta* (L.) F.H. Wigg	—	1,2,6,8,9,20,21,22, 23,26,28,35,38	-common epiphyte

LIVERWORTS

	ANEURACEAE			
	Aneura pinguis (L.) Dum.	—	20	-in larch-black spruce swamp
	CALYPOGEIACEAE			
H	*Calypogeia* sp.	—	near 9,20,26,31	-common in bogs
	CEPHALOZIACEAE			
H	*Cephalozia connivens* (Dicks.) Lindb.	—	20, near 1,9	-frequent in bogs
	JUNGERMANNIACEAE			
H	*Jamesoniella autumnalis* (DC.) Steph.	—	near 16	-found once at north end of island in Islet Lake
H	*Jungermannia lanceolata* L.	—	near 1	-found once near bog moat
H	*Lophozia ventricosa* (Dicks.) Dum.	—	near 26	-found once in bog
H	*Mylia anomola* (Hook.) S. Gray	—	near 8	-occasional in bogs
	LEPIDOZIACEAE			
H	*Lepidozia reptans* (L.) Dum.	—	1,20,35, near 9	-frequent in bogs
	LOPHOCOLEACEAE			
H	*Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dum.	—	near 1	-found once near bog moat
H	*Lophocolea heterophylla* (Schrad.) Dum.	—	9,20,26,35, near 1,8,16	-common in bogs and moats
H	*Lophocolea minor* Nees	—	28, near 16	-occasional in white spruce stands

	MARCHANTIACEAE			
H	*Marchantia polymorpha* L.	—	11,37,38, near 7	-common along streams and in fens
	PLAGIOCHILACEAE			
H	*Plagiochila asplenioides* (L.) Dum.	—	28	-found once in white spruce swamp
	PTILIDIACEAE			
H	*Ptilidium pulcherrimum* (G.Web.) Hampe	—	1,9,20,23,35, near 16	-common in bogs and forest
	RICCIACEAE			
HP	*Riccia fluitans* L.	—	2,19,24,34 (land form), 36,42, near 26	-common in ponds (floating below the surface)
HP	*Ricciocarpus natans* (L.) Corda	—	2,10,11,12,14,19,24, 25,34 (land form), 36,42	-common in ponds (floating on the surface)
	SCAPANIACEAE			
H	*Scapania glaucocephala* (Tayl.) Aust. (verified by W.S. Hong)	—	near 1,31	-occasional in poplar forest

MOSSES

	AMBLYSTEGIACEAE			
H	*Amblystegium serpens* (Hedw.) Schimp. in B.S.G.	—	1,3,7,11,12,13,16, 20,27,29,37	-common and ubiquitous
H	*Calliergon stramineum* (Brid.) Kindb.	—	31,38, near 26	-occasional in quaking fens
H	*Campylium stellatum* (Hedw.) C. Jens.	—	1,11, near 9	-occasional on trails and elsewhere
HP	*Conardia compacta* (C.Muell.) Robins.	—	near 20	-see section 3.2
HP	*Drepanocladus aduncus* (Hedw.) Warnst.	—	1,2,4,7,11,14,15,19, 20,21,24,26,28,29, 31,33,38	-common in fens and wet places, sometimes submersed
HP	*Drepanocladus crassicostatus* Janssens	—	15	-see section 3.2
H	*Hamatocaulis vernicosus* (Mitt.) Hedenas	—	20,29,37, near 6	-occasional in fen margins
H	*Sanionia uncinata* (Hedw.) Loeske	—	11,20, near 9, 16	-occasional on trails and elsewhere

	AULACOMNIACEAE			
	Aulacomnium palustre (Hedw.) Schwaegr.	—	2,9,20,23,26,28,31,35,38	-common in bogs and fens
	BRACHYTHECIACEAE			
H	*Brachythecium campestre* (C.Muell.) Schimp. in B.S.G.	—	5,13,16,23,27, 35, near 32	-common in wetter areas
H	*Brachythecium salebrosum* (Web. & Mohr) Schimp in B.S.G.	—	3,9,20,21,22,26, 27,28,37	-common in poplar forest and elsewhere
H	*Eurhynchium pulchellum* (Hedw.) Jenn.	—	3,5,28, near 16	-mainly in white spruce stands
H	*Tomenthypnum nitens* (Hedw.) Loeske	—	20	-found once in larch-black spruce swamp
	BRYACEAE			
	Bryum argenteum Hedw.	—	22,29,32	-common on dry trailsides, dry open slopes and saline meadow
H	*Bryum caespiticium* Hedw.	—	8	-occasional in bogs on dead birch
H	*Bryum pseudotriquetrum* (Hedw.) Gaertn. *et al.*	—	7,12,16,29,37	-common along lakeshores and streamsides
H	*Bryum weigelii* Spreng. in Biehler	—	near 6	-occasional on trails
H	*Leptobryum pyriforme* (Hedw.) Wils.	—	11,12,20,34	-occasional on disturbed lakeshores and alluvium
H	*Pohlia nutans* (Hedw.) Lindb.	—	1,8,35, near 9	-common in bogs, etc.
H	*Pohlia sphagnicola* (Bruch & Schimp.) Lindb. & Arnell	—	9, near 23	-occasional in bogs
	CLIMACIACEAE			
HP	*Climacium dendroides* (Hedw.) Web. & Mohr	—	2,23,28, near 31	-common in bog moats, also in white spruce swamp and some fens
	DICRANACEAE			
H	*Dicranum flagellare* Hedw.	—	near 1,9	-occasional in bogs
H	*Dicranum fuscescens* Turn.	—	near 1	-occasional in bogs
H	*Dicranum scoparium* Hedw.	—	near 9	-occasional in bogs
H	*Dicranum undulatum* Brid.	—	1,9,20,28,35, near 8	-frequent in bogs and coniferous swamps

H	*Oncophorus virens* (Hedw.) Brid.	—	near 1	-found once in bog moat
	DITRICHACEAE			
H	*Ceratodon purpureus* (Hedw.) Brid.	—	8,11,28,37, near 1,6,9	-common along trails, in disturbed areas, bogs, etc.
	FUNARIACEAE			
H	*Funaria hygrometrica* Hedw.	—	11	-common along trails, on upturned tree roots, disturbed areas, etc.
HP	*Physcomitrium pyriforme* (Hedw.) Hampe	—	34	-see section 3.2
	HELODIACEAE			
H	*Helodium blandowii* (Web. & Mohr) Warnst.	—	20	-an uncommon calciphile found only in larch-black spruce swamp
	HYLOCOMIACEAE			
	Hylocomium splendens (Hedw.) Schimp. in B.S.G.	—	1,9,20,28,35	-common in bogs and swamps
HP	*Pleurozium schreberi* (Brid.) Mitt.	—	1,8,9,20,35	-common in bogs and swamps
	HYPNACEAE			
H	*Hypnum cupressiforme* Hedw.	—	22	-in dryland shrubbery
H	*Hypnum lindbergii* Mitt.	—	20, near 35	-in larch-black spruce swamp and in bog margin
H	*Platygyrium repens* (Brid.) Schimp. in B.S.G.	—	1,3,13,16,28,37	-frequent in forest and swamp
HP	*Ptilium crista-castrensis* (Hedw.) De Not.	—	1,5,9,20,35	-common in coniferous bogs and swamps, occasional in poplar forest
H	*Pylaisiella polyantha* (Hedw.) Grout	—	1,3,5,12,13,16, 23,27,28,37	-very common in poplar forest
	LESKEACEAE			
H	*Bryohaplocladium microphyllum* (Hedw.) Wat. & Iwats.	—	13,16,27, near 11	-common in poplar forest

	MNIACEAE			
HP	*Plagiomnium cuspidatum* (Hedw.) T. Kop.	—	3,5,11,13,16,27,28,37	-common in poplar forest
H	*Plagiomnium ellipticum* (Brid.) T. Kop.	—	2,14,20,21	-common in fens
HP	*Rhizomnium gracile* T. Kop.	—	near 20	-only in larch-black spruce swamp
H	*Rhizomnium pseudopunctatum* (Bruch & Schimp.) T. Kop.	—	28, near 7	-occasional in fens and swamp
	ORTHOTRICHACEAE			
H	*Orthotrichum obtusifolium* Brid.	—	3,5,16	-common on poplar
H	*Orthotrichum speciosum* Nees in Sturm	—	3,13,16,37, near 12	-common on poplar
	PLAGIOTHECIACEAE			
H	*Plagiothecium denticulatum* (Hedw.) Schimp. in B.S.G.	—	1,2,9,20,21,23,28,35	-common in bogs, swamps and fens
	POLYTRICHACEAE			
H	*Polytrichum juniperinum* Hedw.	—	near 16	-occasional in poplar forest
HP	*Polytrichum strictum* Brid.	—	1,8,9,20,23,35	-common in bogs
	POTTIACEAE			
H	*Barbula convoluta* Hedw.	—	22,29,32	-common on dry trailsides and open grassy slopes, also in saline meadow
H	*Bryoerythrophyllum recurvirostre* (Hedw.) Chen.	—	near 16	-found once on island in Islet Lake
HP	*Desmatodon heimii* (Hedw.) Mitt.	—	29	-see section 3.2
HP	*Phascum cuspidatum* Hedw.	—	22,32	-see section 3.2
H	*Tortula mucronifolia* Schwaegr.	—	near 24	-found once on trailside near Elk Push Lake
H	*Tortula ruralis* (Hedw.) Gaertn. *et al.*	—	near 16	-found once at north end of island in Islet Lake
HP	*Weissia controversa* Hedw.	—	22	-see section 3.2
	SPHAGNACEAE			
HP	*Sphagnum angustifolium* (C. Jens. ex Russ.) C. Jens. in Tolf	—	38	-dominant in minerotrophic fen near Central Staging Area
H	*Sphagnum fuscum* (Schimp.) Klinggr.	—	8,9, near 31	-common in bogs

HP	*Sphagnum magellanicum* Brid.	—	9,23,35, near 1	-common in bogs and in balsam willow carr on bog margins
H	*Sphagnum riparium* Angstr.	—	near 26	-found once in quaking fen around pond in boggy depression
HP	*Sphagnum squarrosum* Crome	—	2,9,20,23,26,31,38	-common in minerotrophic quaking fens, wet bogs and swamps
H	*Sphagnum warnstorfii* Russ.	—	1,8,9,20,23,35	-common in bogs, also in balsam willow carr and larch-black spruce swamp
	SPLACHNACEAE			
HP	*Tetraplodon angustatus* (Hedw.) Bruch & Schimp. in B.S.G.	—	1,9,28,35	-on dung in bogs
	TETRAPHIDACEAE			
H	*Tetraphis pellucida* Hedw.	—	1,35, near 8	-frequent along animal trails in bogs
	THUIDIACEAE			
H	*Thuidium recognitum* (Hedw.) Lindb.	—	20,28	-occasional in swamp and poplar forest

PTERIDOPHYTES

	LYCOPODIACEAE			
	Lycopodium annotinum L.	stiff clubmoss	near 9,31,35	-forming beds on moist margins of black spruce bogs
	EQUISETACEAE			
	Equisetum arvense L.	common horsetail	7,28,34,37, near 20	-on moist disturbed ground (including alluvium) and in swamps
	Equisetum fluviatile L.	swamp horsetail	2,4,20	-in fens around Neon Lake and in larch-black spruce swamp
	Equisetum pratense Ehrh.	meadow horsetail	23,28,37	-in swamps and balsam willow carr
P	*Equisetum scirpoides* Michx.	dwarf scouring-rush	near 20	-see section 3.2

P	*Equisetum sylvaticum* L.	woodland horsetail	27,28	-in swamp and poplar forest
	OPHIOGLOSSACEAE			
P	*Botrychium virginianum* (L.) Sw.	rattlesnake fern	27, near 35	-occasional in poplar forest
	POLYPODIACEAE			
P	*Dryopteris assimilis* S. Walker	broad spinulose shield fern	35, near 1,9,20,26,38	-frequent on moist margins of black spruce bogs, apparently intergrading with next species at some sites
P	*Dryopteris carthusiana* (Vill.) J.P. Fuchs	narrow spinulose shield fern	21, near 35	-in sedge fens, also abundant around outlet of bog near Waskahegan Staging Area
	Gymnocarpium dryopteris (L.) Newm.	oak fern	near 35	-found once at foot of north-facing slope above bog

GYMNOSPERMS

	PINACEAE			
P	*Larix laricina* (Du Roi) K. Koch	tamarack larch	8,20, near 26,38	-indicative of minerotrophic conditions, numerous only east of Central Staging Area
P	*Picea glauca* (Moench) Voss	white spruce	3,16,20,28	-small relict stands mainly in west, also on islands in Islet Lake; saplings invading some areas
P	*Picea mariana* (Mill.) BSP.	black spruce	1,8,9,20,35	-dominant in bog forest, also codominant with larch in swamp

MONOCOTYLEDONS

	TYPHACEAE			
P	*Typha latifolia* L.	common cattail	12,14,15,30,31,42	-abundant along shores of lakes and ponds

	SPARGANIACEAE			
P	*Sparganium eurycarpum* Engelm.	giant burreed	—	-abundant along shores of lakes and ponds
	POTAMOGETONACEAE			
HP	*Potamogeton foliosus* Raf. var. *macellus* Fern.	leafy pondweed	30,42	-see section 3.2
	Potamogeton friesii Rupr.	Fries' pondweed	24 (?)	-fragments from shore of Elk Push Lake probably belonging to this species, but better specimens needed
HP	*Potamogeton obtusifolius* Mert. & Koch	blunt-leaved pondweed	7,12,15,17,18,41	-see section 3.2
HP	*Potamogeton pectinatus* L.	sago pondweed	12,39,40	-common in eutrophic lakes, scarce in Islet Lake
HP	*Potamogeton pusillus* L. var. *tenuissimus* Mert. & Koch	small pondweed	19,40,41	-codominant in pond at Central Staging Area, also in Blackfoot and Long Lakes
P	*Potamogeton richardsonii* (Benn.) Rydb.	clasping-leaf pondweed	17,24	-common in Islet and Elk Push Lakes, scarce in Neon Lake
HP	*Potamogeton vaginatus* Turcz.	large-sheath pondweed	39	-abundant in Crooked Lake
HP	*Potamogeton zosteriformis* Fern.	grass-wrack	18	-see section 3.2
	JUNCAGINACEAE			
	Triglochin maritima L.	seaside arrowgrass	29	-in moist saline meadow
	Triglochin palustris L.	slender arrowgrass	30, near 31	-on shore of pond and in quaking sedge fen
	ALISMATACEAE			
P	*Sagittaria cuneata* Sheld.	arum-leaved arrowhead	7,12,15,17	-common in Arrowhead and Islet Lakes, also in the south boundary lake on the Islet Lake Road
	GRAMINEAE			
	Agropyron pectiniforme R. & S.	crested wheatgrass	—	-weed of disturbed dry ground (borrow pits, roadsides, staging areas)

	Agropyron repens (L.) Beauv.	quack grass	below 32	-introduced weed established in saline meadow
HP	*Agropyron subsecundum* (Link) A.S. Hitchc. [=*A. trachycaulum* var. *unilaterale* (Cassidy) Malte]	awned wheatgrass	22,29,32	-abundant on open south-facing slopes, also in saline meadow and along trails
H	*Agropyron trachycaulum* (Link) Malte	slender wheatgrass	22,27,29,32	-in poplar forest, as well as with the preceding on open slopes and in saline meadow
	Agrostis scabra Willd.	tickle grass	7,11,22,26,31,34,38	-common colonist of open disturbed ground
	Alopecurus aequalis Sobol.	water foxtail	near 21	-occasional in pools on trails
	Beckmannia syzigachne (Steud.) Fern. ssp. *baicalensis* (Kusnez.) Koyama & Kawano	slough grass	34	-common on moist disturbed ground, especially along trails
	Bromus ciliatus L.	fringed brome	27	-in poplar forest
	Bromus inermis Leyss. ssp. *inermis*	awnless brome	near 32	-introduced, mainly along trails
P	*Calamagrostis canadensis* (Michx.) Beauv.	bluejoint	2,3,4,5,6,7,10,11, 12,13,15,16,19,21, 23,24,27,33,36,37, 38,42	-abundant throughout Blackfoot, locally dominant in fens and moist places in forest
P	*Calamagrostis stricta* (Timm) Koeler	narrow reedgrass	7,25,26,31	-locally abundant in fens and on shores
P	*Cinna latifolia* (Trev.) Griseb.	drooping wood reed	9,35,37, near 1,20	-in moist bogs and swamps
	Dactylis glomerata L.	orchard grass	31,38	-introduced, common along trails but showing low vigour in native vegetation
HP	*Elymus canadensis* L.	Canada wild rye	32	-see section 3.2
H	*Elymus innovatus* Beal	hairy wild rye	22, near 32	-occasional on dry open slopes
P	*Glyceria grandis* S. Wats. ex A. Gray	common manna grass	2,7,11,19,25,36	-locally abundant on shores of lakes and ponds
H	*Glyceria pulchella* (Nash) K. Schum.	graceful manna grass	4	-in flooded willow-sedge fen on shore of Neon Lake
H	*Glyceria striata* (Lam.) A.S. Hitchc. ssp. *stricta* (Scribn.) Hult.	fowl manna grass	7,11,20,37	-locally common in lakeshore fens and swamps
P	*Hordeum jubatum* L. ssp. *jubatum*	foxtail barley	29	-dominant in saline meadow, also along trails

	Oryzopsis asperifolia Michx.	rough-leaved rice grass	—	-in dry poplar forest (noted only for vicinity of Wanisan Lake, but possibly more widespread since inconspicuous in late summer after shedding seeds)
	Phalaris arundinacea L.	reed canary grass	12	-on lakeshores and on moist ground along trails (probably introduced through seed mixtures at some sites)
	Phleum pratense L.	timothy	22	-sown along trails and penetrating neighboring native vegetation on open slopes
	Phragmites australis (Cav.) Trin. ex Steud.	reed	10	-uncommon, noted only on Mallard Pond and west shore of Crooked Lake
H	*Poa annua* L.	annual bluegrass	34	-on alluvium and on disturbed moist ground along trails
	Poa palustris L.	fowl bluegrass	4,11,25,29,36	-locally common in fens and on shores of lakes and ponds
	Poa pratensis L.	Kentucky bluegrass	22,29,32	-abundant on open slopes, also in saline meadow, along trails, etc.
HP	*Puccinellia distans* (L.) Parl.	slender alkali grass	29,30,34	-on alluvium and in moist saline meadow
HP	*Puccinellia nuttalliana* (Schult.) A.S. Hitchc.	Nuttall's alkali grass	29	-in moist saline meadow
	Schizachne purpurascens (Torr.) Swallen ssp. *purpurascens*	purple oat grass	22	-frequent in shrubbery and on beaver-cleared slopes
P	*Scolochloa festucacea* (Willd.) Link	spangletop	21,33, near 31	-locally common in sedge fens
H	*Stipa viridula* Trin.	green needle grass	—	-on causeway between Blackfoot and Crooked lakes
	CYPERACEAE			
P	*Carex aquatilis* Wahlenb. ssp. *altior* (Rydb.) Hult.	water sedge	2,4,7,12,14,15,21,24 25,26,30,31,36,38,42	-abundant, often dominant, in sedge fens throughout Blackfoot

P	*Carex atherodes* Spreng.	awned sedge	4,6,10,11,14, 19,24,33,36	-abundant, sometimes dominant, in sedge fens
	Carex aurea Nutt.	golden sedge	—	-noted on moist disturbed ground at bend in pipeline road north of Elk Push Lake
	Carex bebbii Olney ex Fern.	Bebb's sedge	2,7,10,11,36	-on shores of lakes and ponds
H	*Carex brunnescens* (Pers.) Poir.	brownish sedge	9, 23, 35, near 1,8,31	-in moist black spruce bogs and on bog margins
H	*Carex capillaris* L.	hairlike sedge	20	-found only in larch-black spruce swamp
	Carex curta Good.	short sedge	2,26,38, near 9	-in quaking fens and on wet bog margins
	Carex diandra Schrank	two-stamened sedge	7,12,15,29,31,38	-on lakeshores, in quaking fens and in moist saline meadow
H	*Carex disperma* Dewey	two-seeded sedge	20,21,23,37, near 8,31	-common in moist bogs, bog margins and swamps
HP	*Carex gynocrates* Wormsk.	northern bog sedge	20	-see section 3.2
HP	*Carex paupercula* Michx.	bog sedge	9,31, near 38	-in wet bogs and quaking fens
P	*Carex peckii* Howe	Peck's sedge	near 3	-found once beneath white spruce
	Carex praticola Rydb.	meadow sedge	near 21	-noted on Wapiti Trail
	Carex sartwellii Dewey	Sartwell's sedge	24	-noted only at north end of Elk Push Lake and on ponds in vicinity
	Carex siccata Dewey	hay sedge	22	-found once on dry open slope
	Carex stipata Muhl. ex Willd.	awl-fruited sedge	—	-occasional in wet places on trails, also in gully near Dynamite Lodge
H	*Carex sychnocephala* Carey	long-beaked sedge	34	-found once on alluvium
HP	*Carex trisperma* Dewey	three-seeded sedge	9	-see section 3.2
H	*Carex utriculata* Boott (=*rostrata* auctt.)	greater beaked sedge	2,4,7,14,19,21, 24,25,26,33	-common in sedge fens
HP	*Carex vulpinoidea* Michx.	fox sedge	36	-see section 3.2
HP	*Eleocharis palustris* (L.) R. & S.	creeping spikerush	15,19,30,31,42	-on shores of lakes and ponds, also in quaking fen
H	*Eriophorum chamissonis* C.A. Mey.	russet cottongrass	26	-see section 3.2
H	*Eriophorum polystachion* L.	tall cottongrass	near 26	-in quaking fen
H	*Eriophorum vaginatum* L.	sheathed cottongrass	near 8,26	-in openings in bogs

	Scirpus acutus Muhl. ex Bigel.	hard-stemmed bulrush	—	-on lakeshores, apparently less common in Blackfoot than *S. validus* (with which it is considered conspecific by some authors)
	Scirpus microcarpus Presl	small-fruited bulrush	25,36	-on shores of beaver ponds and moist disturbed ground
H	*Scirpus pungens* Vahl	three-square rush	29, near 32	-in saline meadow
	Scirpus validus Vahl	soft-stemmed bulrush	15,30	-common on shores of lakes and ponds
	ARACEAE			
	Calla palustris L.	water arum	—	-in beaver ponds southeast of Neon Lake
	LEMNACEAE			
	Lemna trisulca L.	ivy-leaved duckweed	2,7,10,11,12,14,15, 17,19,24,25, 36,39,40,41,42	-subsurface floating aquatic, abundant in most lakes and ponds
HP	*Lemna turionifera* Landolt (=*minor* auctt.)	common duckweed	2,6,10,11,12,14,15, 19,24,25,30,33,36,42	-floating plant abundant on most ponds and on sheltered water on lakeshores
HP	*Spirodela polyrhiza* (L.) Schleiden	larger duckweed	2,7,10,11,12,15, 19,24,42	-floating plant abundant on some ponds and on sheltered water on lakeshores
HP	*Wolffia borealis* (Engelm.) Landolt	northern ducksmeal	10,14,25,36,42,43	-see section 3.2
H	*Wolffia columbiana* Karsten	Columbian ducksmeal	36	-see section 3.2
	JUNCACEAE			
P	*Juncus balticus* Willd.	wire rush	29	-abundant in saline meadow
	Juncus bufonius L.	toad rush	30,34	-on alluvium and on wet disturbed ground along trails
H	*Juncus tenuis* Willd. var. *dudleyi* (Wieg.) Hermann	slender rush	—	-found once on moist ground on Wanisan Trail

	LILIACEAE			
	Disporum trachycarpum (S.Wats.) B. & H.	fairybells	3,5,13,16,27	-common in forest
	Maianthemum canadense Desf.	wild lily-of-the-valley	3,5,13,23,27,37, near 16,35	-common in forest, also in alder swamp and balsam willow carr
	Smilacina stellata (L.) Desf.	star-flowered Solomon's seal	16	-in open forest on island in Islet Lake
P	*Smilacina trifolia* (L.) Desf.	three-leaved Solomon's seal	8,9,20,23, near 1	-common in moist bogs and balsam willow carr
	IRIDACEAE			
	Sisyrinchium montanum Greene	common blue-eyed grass	—	-noted on causeway between Blackfoot and Crooked lakes and along trail from Waskahegan Staging Area to Neon Lake
	ORCHIDACEAE			
	Corallorhiza maculata Raf.	spotted coralroot	near 35	-one patch at base of north-facing slope above bog
	Corallorhiza trifida Châtelain	pale coralroot	20	-in larch-black spruce swamp
	Habenaria hyperborea (L.) R. Br.	northern green orchid	20, near 7,37	-occasional on shores and fen margins, also in larch-black spruce swamp
	Habenaria viridis (L.) R. Br.	bracted orchid	27	-occasional in poplar forest
P	*Malaxis monophylla* (L.) Sw.	white adder's-mouth	near 20	-see section 3.2

DICOTYLEDONS

	SALICACEAE			
	Populus balsamifera L. ssp. *balsamifera*	balsam poplar	3,5,20,37, near 16	-codominant with aspen on moister ground but absent from dry upland sites, also in swamps
P	*Populus tremuloides* Michx.	aspen poplar	3,5,11,13,16,27	-dominant upland forest tree throughout Blackfoot
	Salix bebbiana Sarg.	beaked willow	5,6,27,37	-frequent in poplar forest and swamps

	Salix candida Fluegge ex Willd.	hoary willow	near 20	-found once in larch-black spruce swamp
	Salix discolor Muhl.	pussy willow	6,37	-common in willow and alder swamps, also at edges of fens
	Salix lucida Muhl. ssp. *lasiandra* (Benth.) Argus	shining willow	—	-large tree by gate on pipeline road on west side of Central Staging Area
	Salix maccalliana Rowlee	velvet-fruited willow	6,28,37, near 20	-common in swamps
	Salix novae-angliae Anderss. [=*S. myrtillifolia* Anderss. var. *cordata* (Anderss.) Dorn]	tall myrtle-leaved willow	6,20,28	-tall shrub or small tree common in swamps
P	*Salix pedicellaris* Pursh	bog willow	38, near 26	-in minerotrophic quaking fens
	Salix petiolaris J.E. Smith	basket willow	4,6,11	-frequent in swamps and lakeshore fens
P	*Salix planifolia* Pursh	flat-leaved willow	2,4,6,11,15,20,21, 24,26,31,36,38	-abundant (often dominant) in fens and swamps
	Salix pseudomonticola Ball	cordate-leaved willow	6,37	-common in swamps
P	*Salix pyrifolia* Anderss.	balsam willow	2,19,20,23,26,38, near 9,31,38	-common in fens and dominant in carr along bog margins, also in larch-black spruce swamp
H	*Salix serissima* (Bailey) Fern.	autumn willow	28	-in white spruce swamp
	BETULACEAE			
P	*Alnus crispa* (Ait.) Pursh	green alder	near 9	-found once beside Spruce Hollow Trail
P	*Alnus tenuifolia* Nutt.	river alder	2,3,37, near 9	-abundant along stream channels and in bog moats, also in fens, moist forest, etc.
HP	*Betula neoalaskana* Sargent	Alaska birch	2,4,8,9,11,16,20,21, 23,26,31,35,38, near 1	-abundant in fens, bogs and swamps
HP	*Betula papyrifera* Marsh.	paper birch	16	-on summit of island in Islet Lake, where intergrades with *neoalaskana* also occur; also on high ground on Moose Link Trail

	Betula pumila L. var. *glandulifera* Regel	swamp birch	8,20,28, near 38	-in bogs, swamps and quaking fens
H	*Betula* X *uliginosa* Dugle [=*neoalaskana* X *pumila* var. *glandulifera*]	hybrid birch	20	-with the parents in larch-black spruce swamp; see Dugle (1966)
P	*Corylus cornuta* Marsh.	beaked hazel	3,5,13,16,27	-forest shrub, normally dominant in tall shrub layer of aspen forest
	URTICACEAE			
	Urtica dioica L. ssp. *gracilis* (Ait.) Selander	common nettle	7,11,28,37	-on muddy ground of lakeshores and swamps, often on beaver lodges
	POLYGONACEAE			
P	*Polygonum amphibium* L.	water smartweed	10,12,25,37, near 26	-on shores in shallow water and on mud, also in alder swamp
	Polygonum arenastrum Jord. ex Bor.	common knotweed	34	-on alluvium and disturbed ground on trails
H	*Polygonum erectum* L.	striate knotweed	32	-on dry grassy slope, also occasional on trails
	Polygonum lapathifolium L.	pale persicaria	34	-on alluvium
H	*Polygonum ramosissimum* Michx.	bushy knotweed	30, below 32	-on mud on shore of pond and in saline seepage zone
	Rumex maritimus L. ssp. *fueginus* (Phil.) Hult.	golden dock	15,30,34	-on alluvium and occasionally on shores of lakes and ponds
	Rumex occidentalis S. Wats.	western dock	15,21,33	-frequent in fens among sedges
HP	*Rumex orbiculatus* Gray (=*britannica* auctt.)	water dock	2,4,26,31,38	-see section 3.2
	Rumex triangulivalvis (Dans.) Rech. f.	narrow-leaved dock	—	-noted only on trails north of Central Staging Area
	CHENOPODIACEAE			
	Axyris amaranthoides L.	Russian pigweed	—	-introduced weed noted on causeway between Blackfoot and Crooked lakes
	Chenopodium album L.	lamb's-quarters	—	-introduced weed noted on trails near Dynamite Lodge

HP	*Chenopodium leptophyllum* (Nutt. ex Moq.) S.Wats.	narrow-leaved goosefoot	32	-on dry grassy slope; this native goosefoot is known from other sites in the Edmonton Region and its listing as rare in Alberta seems to be due to confusion of data
P	*Monolepis nuttalliana* (Schultes) Greene	spear-leaved goosefoot	32	-on dry grassy slope on loose soil especially of anthills
	CARYOPHYLLACEAE			
	Cerastium nutans Raf.	long-stalked chickweed	34	-on alluvium
	Moehringia lateriflora (L.) Fenzl.	blunt-leaved sandwort	5,23,27,28	-frequent in forest and on bog margins
H	*Stellaria calycantha* (Ledeb.) Bong.	northern stitchwort	38, near 35	-in quaking fen (on sphagnum) and on bog margin
	Stellaria longifolia Muhl.	long-leaved chickweed	14,23,28,38	-in fens, swamps and bog margins
	Stellaria longipes Goldie	glaucous chickweed	—	-found only on slopes of causeway between Blackfoot and Crooked Lakes
	Stellaria media (L.) Cyrill.	common chickweed	34,35	-introduced weed noted on alluvium and beneath black spruce
	CERATOPHYLLACEAE			
P	*Ceratophyllum demersum* L.	hornwort	7,10,11,12,14,15, 17,18,19,24,30, 39,40,41,42	-present in most waterbodies, dominant in Blackfoot and Detour Lakes
	RANUNCULACEAE			
	Actaea rubra (Ait.) Willd.	baneberry	near 16	-in forest on island in Islet Lake, occasional elsewhere
	Anemone canadensis L.	Canada anemone	37, near 32	-in alder swamp, also along tails and on disturbed ground
	Anemone riparia Fern.	tall anemone	27	-along trails in poplar forest
P	*Caltha palustris* L.	marsh marigold	28,37	-locally abundant in swamp
P	*Ranunculus cymbalaria* Pursh	seaside buttercup	29, below 32	-in saline meadow
	Ranunculus gmelinii DC. var. *hookeri* (D.Don) L. Benson	yellow watercrowfoot	19	-found once in pond at Central Staging Area

	Ranunculus macounii Britt.	Macoun's buttercup	21,34	-in sedge-willow fen and on alluvium
P	*Ranunculus sceleratus* L.	celery-leaved buttercup	30,34	-on alluvium and muddy shores
	Thalictrum venulosum Trel.	veiny meadowrue	22,28,37	-in swamps, moist woodland and shrubbery
	CRUCIFERAE			
H	*Cardamine pensylvanica* Muhl.	common bitter cress	28,34, near 33	-on alluvium and in swamps
	Descurainia sophia (L.) Webb	flixweed	32	-on dry grassy slope (introduced)
	Draba nemorosa L.	yellow whitlow-grass	22	-on dry soil in shrubbery and on disturbed ground (borrow pits, etc.)
H	*Rorippa palustris* (L.) Besser ssp. *palustris*	marsh yellow-cress	34, near 33	-abundant on alluvium, occasional in stable fens
	DROSERACEAE			
P	*Drosera rotundifolia* L.	round-leaved sundew	near 38	-see section 3.2
	SAXIFRAGACEAE			
	Chrysosplenium iowense Rydb.	golden saxifrage	28,37	-in swamps
P	*Mitella nuda* L.	bishop's-cap	3,20,28,37	-abundant in moist forest (especially under white spruce), swamps and bog margins
	PARNASSIACEAE			
	Parnassia palustris L.	northern grass-of-parnassus	7	-found once on shore of Arrowhead Lake
	GROSSULARIACEAE			
	Ribes americanum Mill.	American blackcurrant	near 37	-noted once near West Sawmill Lake (in moist forest edge)
	Ribes glandulosum Grauer	skunk currant	23,28, near 1	-locally common in balsam willow carr and swamps
P	*Ribes hudsonianum* Richards.	northern blackcurrant	11,20,28,37	-common in swamps, fen margins etc.

P	*Ribes oxyacanthoides* L.	wild gooseberry	3,5,16,21,23,28, 32, 37 near 20	-common in forest, swamps and bog margins
	Ribes triste Pall.	wild redcurrant	3,5,16,23,28,37	-common in forest, swamps and bog margins
	ROSACEAE			
	Agrimonia striata Michx.	agrimony	22	-on shrubby slopes and along trails
P	*Amelanchier alnifolia* Nutt.	saskatoon	5,13,16,22,27,28,32	-common in forest and on dry shrubby slopes
	Fragaria vesca L.	woodland strawberry	16	-in old mixed forest on island in Islet Lake
	Fragaria virginiana Duchesne ssp. *glauca* (S. Wats.) Staudt.	smooth wild strawberry	3,5,22,27	-common in dry forest and on shrubby slopes
	Geum macrophyllum Willd. ssp. *perincisum* (Rydb.) Hult.	large-leaved avens	11,14,21,28,33,37	-in fens and swamps
	Potentilla anserina L.	silverweed	29	-in saline meadow
	Potentilla norvegica L.	rough cinquefoil	2,7,11,34	-in fens and on alluvium
P	*Potentilla palustris* (L.) Scop.	marsh cinquefoil	2,4,21,26,28,31,38	-common in fens, swamps and bog margins
	Potentilla pensylvanica L.	prairie cinquefoil	—	-on dry open ground, noted near Dynamite Lodge and on the causeway between Blackfoot and Crooked Lakes
P	*Prunus pensylvanica* L. f.	pincherry	13	-in dry aspen forest and beaver-cleared slopes in vicinity
P	*Prunus virginiana* L.	chokecherry	5,13,16,22, near 32	-common in forest and on dry shrubby slopes
	Rosa acicularis Lindl.	prickly rose	3,5,13,16,27,28	-common forest species
	Rosa woodsii Lindl.	common wild rose	22,32	-replacing the preceding on dry open slopes
	Rubus arcticus L. ssp. *acaulis* (Michx.) Focke	dwarf raspberry	20,23,28,35,38	-in swamps, quaking fens, balsam willow carr, bog margins, etc., often on sphagnum mounds
P	*Rubus chamaemorus* L.	cloudberry	1,8,9,23,35	-common in black spruce bogs and balsam willow carr

P	*Rubus idaeus* L. ssp. *melanolasius* Focke	wild raspberry	3,5,11,13,16, 21,22,27,35	-common in forest and penetrating other habitats to varying degree
P	*Rubus pubescens* Raf.	dewberry	3,5,13,16, 23,27,28,37	-common in forest, swamp and bog margins
	Sorbus aucuparia L.	European mountain ash	28	-seedlings occasional, but no mature trees found (introduced)
	LEGUMINOSAE			
	Astragalus dasyglottis Fisch. ex DC.	purple milkvetch	—	-noted only on causeway between Blackfoot and Crooked Lakes
P	*Glycyrrhiza lepidota* (Nutt.) Pursh	wild licorice	32	-see section 3.2
	Lathyrus ochroleucus Hook.	white peavine	3,16,22,27	-frequent in forest and on open shrubby slopes
P	*Lathyrus venosus* Muhl.	—	22, near 32	-on dry open slopes
	Melilotus officinalis (L.) Lam.	yellow sweet clover	—	-along trails (introduced)
	Oxytropis monticola A. Gray	late yellow locoweed	—	-found once on trail through poplar forest near West Sawmill Lake
	Trifolium hybridum L.	Alsike clover	22,32,34	-introduced, common along trails and penetrating native vegetation on open slopes, also on alluvium
	Trifolium repens L.	white clover	29,34, near 32	-introduced, common along trails, also on open slopes and alluvium, in saline meadow, etc.
P	*Vicia americana* Muhl.	American vetch	5,22,27,28,32	-common in forest and on open slopes
	GERANIACEAE			
	Geranium richardsonii Fisch. & Trautv.	wild white geranium	near 37	-noted on trails north of Central Staging Area and on forest edges near West Sawmill Lake

	CALLITRICHACEAE			
HP	*Callitriche verna* L.	vernal water-starwort	30, near 21,26	-in temporary pools on trails, at edges of ponds, on alluvium, etc.
	BALSAMINACEAE			
	Impatiens capensis Meerb.	spotted touch-me-not	3,7,11,12,15,28,37, near 35	-in swamps, moist places in forest, lakeshore fens, etc.
	VIOLACEAE			
	Viola adunca J.E. Smith	early blue violet	22, near 32	-on dry open ground
	Viola canadensis L.	western Canada violet	3,13	-in dry forest
P	*Viola palustris* L.	marsh violet	21,28,37,38	-locally common in fens and swamps
	Viola renifolia A. Gray	kidney-leaved violet	3,20, near 35	-in white spruce stand, larch-black spruce swamp and on north-facing slope above bog
	ELAEAGNACEAE			
	Shepherdia canadensis (L.) Nutt.	Canada buffaloberry	16,27	-in mixed and poplar forest, where taller shrubs are not too dense
	ONAGRACEAE			
	Circaea alpina L.	small enchanter's nightshade	near 20,28,33,35	-locally numerous in swamp and bog margins
	Epilobium angustifolium L. ssp. *angustifolium*	fireweed	11,13,21,23,27,28	-occasional in forest and margins of fens and bogs
P	*Epilobium ciliatum* Raf. ssp. *glandulosum* (Lehm.) Hoch & Raven	northern willowherb	7,11,21,33,37	-in fens and alder swamp
	Epilobium leptophyllum Raf.	narrow-leaved marsh willowherb	15,26,31,38	-in quaking fens
H	*Epilobium palustre* L.	marsh willowherb	14,20,25	-occasional on shores, also in larch-black spruce swamp
	HALORAGACEAE			
	Myriophyllum exalbescens Fern.	spiked water-milfoil	15,17,18,24,39,41	-in most lakes, sometimes dominant

	HIPPURIDACEAE			
P	*Hippuris vulgaris* L.	mare's-tail	30	-in small pond with *Potamogeton foliosus*
	ARALIACEAE			
P	*Aralia nudicaulis* L.	wild sarsaparilla	3,5,13,16,27	-abundant, often dominant, in herb layer of forest
	UMBELLIFERAE			
	Cicuta bulbifera L.	bulb-bearing water-hemlock	4,7,15,24,38	-on lakeshores and in quaking fens
	Cicuta maculata L.	spotted water-hemlock	37	-in alder swamp and on shores of eutrophic lakes
HP	*Cicuta virosa* L.	narrow-leaved water-hemlock	4,26,31	-see section 3.2
	Heracleum lanatum Michx.	cow-parsnip	5,13,27	-in moist places in poplar forest
	Osmorhiza depauperata Philippi	spreading sweet cicely	near 20	-found once in larch-black spruce swamp
	Sanicula marilandica L.	snakeroot	13,27	-in poplar forest
P	*Sium sauve* Walt.	water parsnip	2,4,7,10,11,12,14, 15,19,21,24,25,33,36	-common in open fens, especially on shores
	CORNACEAE			
P	*Cornus canadensis* L.	bunchberry	3,5,13,16,23,27,28, near 1	-common in forest and bog margins
	Cornus stolonifera Michx.	red-osier dogwood	3,5,16,28,37	-common in moist forest
	PYROLACEAE			
P	*Moneses uniflora* (L.) A.Gray	one-flowered wintergreen	20, near 28	-see section 3.2
P	*Orthilia secunda* (L.) House	one-sided wintergreen	3,20,27, near 16,26	-in moist forest and larch-black spruce swamp
P	*Pyrola asarifolia* Michx.	common pink wintergreen	3,5,16,20,27	-common in forest, also in larch-black spruce swamp

	ERICACEAE			
P	*Andromeda polifolia* L.	bog rosemary	near 9	-see section 3.2
HP	*Gaultheria hispidula* (L.) Bigel.	creeping snowberry	20,35	-see section 3.2
P	*Ledum groenlandicum* Oeder	common Labrador tea	1,8,9,20,23,35, near 38	-dominant low shrub in black spruce bogs and larch-black spruce swamp, also in balsam willow carr
	Oxycoccus microcarpus Turcz.	small bog cranberry	8,20,35, near 9 26,31	-on sphagnum in black spruce bogs and larch-black spruce swamp
P	*Oxycoccus quadripetalus* Gilib.	large bog cranberry	near 38	-replacing the preceding in minerotrophic fen
	Vaccinium myrtilloides Michx.	blueberry	1,8,23,35	-in black spruce bogs, especially on margins
	Vaccinium vitis-idaea L.	cranberry	1,8,9,20,23,35	-abundant in black spruce bogs and larch-black spruce swamp
	PRIMULACEAE			
	Androsace septentrionalis L.	fairy candelabra	32	-on dry grassy slope, also on dry disturbed ground (borrow pits, etc.)
	Lysimachia ciliata L.	fringed loosestrife	37	-in alder swamp, also along trails
	Lysimachia thyrsiflora L.	tufted loosestrife	2,7,10,14,19,21,26,31,38	-common in fens
	GENTIANACEAE			
	Gentianella amarella (L.) Börner	felwort	—	-frequent along trails and on open ground
	Halenia deflexa (Sm.) Griseb.	spurred gentian	—	-common along trails
	APOCYNACEAE			
	Apocynum androsaemifolium L.	spreading dogbane	5,13,22	-in dry poplar forest and on shrubby slopes
	BORAGINACEAE			
	Mertensia paniculata (Ait.) G. Don	tall lungwort	16,27,28, near 20	-in moist forest and swamp

	LABIATAE			
P	*Agastache foeniculum* (Pursh) Ktze.	giant hyssop	near 32	-on open slopes and along trails
	Dracocephalum parviflorum Nutt.	American dragonhead	—	-found once on slope above lake near Dynamite Lodge
	Galeopsis tetrahit L.	hemp nettle	28,34,37	-introduced, noted in swamps and on alluvium
	Lycopus asper Greene	American water-horehound	below 32	-on shores of eutrophic lakes
H	*Lycopus uniflorus* Michx.	northern water-horehound	2,4,7,10,11,12, 15,19,21,37	-common in fens and swamps, along shores, etc.
	Mentha arvensis L.	wild mint	7,10,11,12,14,21, 28,30,33,34,37	-common in fens and swamps, along shores, on alluvium, etc.
P	*Monarda fistulosa* L.	wild bergamot	32	-on dry grassy slope and causeway between Blackfoot and Crooked lakes
P	*Scutellaria galericulata* L.	marsh skullcap	2,4,7,10,11,12,14, 15,19,21,26,28,33, 36,42	-abundant in fens and along shores, also in white spruce swamp
	Stachys palustris L.	marsh hedge-nettle	4,11,25,37	-in shoreline fens, also alder swamp
	SCROPHULARIACEAE			
	Castilleja miniata Dougl. ex Hook.	common red paintbrush	22	-on shrubby slope, also occasionally on dry trailsides
	Limosella aquatica L.	mudwort	—	-found once in temporary pool near bend in pipeline road north of Elk Push Lake
	Veronica americana (Raf.) Schw.	American brooklime	11,34,37	-in lakeshore fens and alder swamp, also on alluvium
P	*Veronica peregrina* L.	hairy speedwell	34, near 21	-on alluvium and wet disturbed ground on trails
	LENTIBULARIACEAE			
P	*Utricularia vulgaris* L.	common bladderwort	2,11,15,30, near 26,38	-in pools and sheltered bays of lakes and ponds

	PLANTAGINACEAE			
	Plantago major L.	common plantain	29,32,34,37	-introduced weed common along trails, also in saline meadow, open slopes, alder swamp and on alluvium
	RUBIACEAE			
	Galium boreale L.	northern bedstraw	3,13,16,22,27,32,38	-common in forest and on open slopes, also noted in quaking fen
	Galium trifidum L.	small bedstraw	2,4,11,12,14,15,21, 26,31,34,37,38,42	-common in fens and swamps, also on alluvium
	Galium triflorum Michx.	sweet-scented bedstraw	5,13,16,20,27,28,37	-common in forest and swamp
	CAPRIFOLIACEAE			
P	*Linnaea borealis* L. ssp. *americana* (Forbes) Hult.	twinflower	3,5,16,20	-in forest and larch-black spruce swamp
	Lonicera dioica L.	twining honeysuckle	16,28	-in moist forest and swamp
	Lonicera involucrata (Richards.) Banks	bracted honeysuckle	16,20,21,23,28,37	-in moist forest, swamps and bog margins
	Symphoricarpos albus (L.) Blake	snowberry	3,5,13,16,22,27	-common in forest, also on open shrubby slopes
P	*Symphoricarpos occidentalis* Hook.	buckbrush	22,32	-on dry open slopes
	Viburnum edule (Michx.) Raf.	low-bush cranberry	3,5,16,27	-in moist forest
	Viburnum opulus L. ssp. *trilobum* (Marsh) Clausen	high-bush cranberry	near 27	-noted once along Wellsite Trail
	ADOXACEAE			
	Adoxa moschatellina L.	moschatel	near 31	-found once in bog margin
	CAMPANULACEAE			
	Campanula rotundifolia L.	harebell	32	-on dry grassy slope and causeway between Blackfoot and Crooked Lakes

COMPOSITAE				
	Achillea millefolium L.	common yarrow	22,29,32	-on open slopes and dry disturbed ground, also in saline meadow
	Achillea sibirica Ledeb.	Siberian yarrow	28	-along trails through forest
	Antennaria parvifolia Nutt.	small-leaved everlasting	22	-on dry open slopes, also in borrow pits
	Artemisia absinthium L.	wormwood	—	-found once by trail near West Sawmill Lake (introduced)
	Artemisia ludoviciana Nutt.	prairie sagewort	—	-on causeway between Blackfoot and Crooked lakes
P	*Aster brachyactis* Blake	rayless aster	below 32	-in saline seepage zone on shore of Crooked Lake
	Aster ciliolatus Lindl.	Lindley's aster	3,5,13,16,27, 28,29,37	-common forest species, also noted in saline meadow and alder swamp
	Aster conspicuus Lindl.	showy aster	3,13,16,22,27	-common in forest and on shrubby slopes
P	*Aster falcatus* Lindl. ssp. *falcatus*	creeping white prairie aster	29,32	-abundant in saline meadow, also on dry open slopes in vicinity of Blackfoot and Crooked Lakes
	Aster hesperius A. Gray	western willow aster	—	-occasional in eutrophic fens, etc.
P	*Aster laevis* L.	smooth aster	22,32	-on dry open slopes, also on dry trailsides
	Aster modestus Lindl.	large northern aster	10, 37	-locally common in fens and alder swamp
P	*Aster puniceus* L.	purple-stemmed aster	4,21,26,28,33,38	-common in fens, also in white spruce swamp
	Bidens cernua L.	nodding beggarticks	7,15,19,21,30,31, 34,42, near 26	-on alluvium and disturbed wet ground
	Cirsium arvense (L.) Scop.	Canada thistle	11,19,25,29,30,32,34	-introduced weed prevalent in Blackfoot, found on shores, dry slopes, alluvium and disturbed ground
P	*Cirsium flodmanii* (Rydb.) Arthur	Flodman's thistle	near 32	-on dry open ground

	Crepis tectorum L.	annual hawksbeard	32,34	-introduced weed, noted on dry grassy slope and on alluvium
	Erigeron glabellus Nutt. ssp. *glabellus*	smooth fleabane	—	-noted only on slopes and trails near Dynamite Lodge
	Erigeron lonchophyllus Hook.	lance-leaved fleabane	below 32	-in saline seepage zone on shore of Crooked Lake
	Erigeron philadelphicus L.	Philadelphia fleabane	7,10,11,28,37	-common in swamps and on shores of lakes and ponds
	Gnaphalium uliginosum L.	low cudweed	34, near 21	-on alluvium and in wet places on trails
	Hieracium umbellatum L. (s.l.)	narrow-leaved hawkweed	22,27	-occasional in forest and on shrubby slopes
	Lactuca pulchella (Pursh) DC.	common blue lettuce	32	-on dry grassy slope and causeway between Blackfoot and Crooked lakes
	Petasites palmatus (Ait.) A. Gray	palmate-leaved coltsfoot	3,27	-frequent in forest
P	*Petasites sagittatus* (Pursh) A. Gray	arrow-leaved coltsfoot	21,28	-locally common in sedge-willow fen and white spruce swamp
	Petasites vitifolius Greene	vine-leaved coltsfoot	3,23	-frequent in forest and bog margins
	Senecio eremophilus Richards.	cut-leaved ragwort	11	-occasional in fens
	Solidago canadensis L.	Canada goldenrod	22	-on shrubby slopes and open disturbed ground
	Solidago gigantea Ait.	late goldenrod	13,16,27	-common in forest
	Sonchus arvensis L. (incl. *uliginosus* Bieb.)	perennial sowthistle	2,11,19,29,32,37	-introduced weed noted in fens, saline meadow, alder swamp and on dry slopes
	Tanacetum vulgare L.	common tansy	—	-introduced, occasional along trails
	Taraxacum officinale Weber	common dandelion	13,22,28,29,32,34,35,37	-introduced weed, common along trails and penetrating native vegetation to varying degree

Appendix 2. List of Colour Slides

The following is a complete list of the 184 colour slides taken in the course of this project and deposited in the Alberta Environmental Protection (Parks) Slide Collection. They have been grouped into five batches ("rolls") according to geographical location. Prints made from a selection of these slides are reproduced in Appendix 3.

Roll and Slide Numbers	Dates (1996)	Subject
Roll 1, 01	July 22	east side of Neon Lake and the black spruce bogs draining into to it viewed from the north shore
02	August 5	*Potamogeton obtusfolius* (blunt-leaved pondweed) from Neon Lake (plot 18), close-up taken in tray
03	August 5	*Potamogeton zosteriformis* (grass-wrack) from Neon Lake (plot 18), close-up taken in tray
04	July 22	interior of black spruce bog draining into NE corner of Neon Lake (plot 1)
05	July 22	close-up of the feathermosses *Pleurozium schreberi* and *Ptilium crista-castrensis* in black spruce bog (plot 1)
06	July 22	close-up of *Sphagnum* mound in black spruce bog (plot 1)
07	July 22	*Dryopteris assimilis* (broad spinulose shield fern) in black spruce bog (near plot 1)
08	July 22	willow carr on east side of Neon Lake (plot 2, looking SW)
09	July 22	the floating (subsurface) liverwort *Riccia fluitans* in pool in willow carr (plot 2)
10	July 22	mature white spruce trees drowned by rise in water level (near plot 3, viewed from Neon Lake Trail)
11	July 22	relict white spruce stand on gentle NE-facing slope (plot 3 on Neon Lake Trail)
12	July 22	close-up of *Carex peckii* (Peck's Sedge) beneath white spruce at edge of Neon Lake Trail (near plot 3)

	13	July 22	sedge-willow fen in NW corner of Neon Lake (looking SSW from forest edge, near plot 4)
	14	July 22	*Cicuta virosa* (narrow-leaved water-hemlock) in sedge-willow fen on north shore of Neon Lake (plot 4)
	15	July 22	interior of open poplar forest north of Neon Lake (plot 5)
	16	July 24	interior of willow swamp with water level recently raised by beaver activity (plot 6 on south side of Grouse Trail)
	17	July 24	another interior view of same swamp (near plot 6)
	18	July 24	shoreline marsh at SE corner of Arrowhead Lake (plot 7)
	19	July 24	close-up of *Sparganium eurycarpum* (giant burreed), the dominant emergent in this shoreline marsh (plot 7)
	20	July 24	close-up of *Potamogeton obtusifolius* (blunt-leaved pondweed) growing in a beaver canal through this shoreline marsh (plot 7)
	21	July 24	*Potamogeton obtusifolius* (blunt-leaved pondweed) from Arrowhead Lake (plot 7), close-up taken in tray
	22	July 24	open black spruce bog on north side of Spruce Hollow Trail (plot 8), with ground totally covered by *Ledum groenlandicum* (Labrador tea)
	23	July 24	another view of same black spruce bog (plot 8), with occasional larch and birch
Roll 2,	01	July 26	interior of wet black spruce bog (with old trees up to 32 cm dbh) on north side of Spruce Hollow Trail (plot 9), with *Ledum groenlandicum* (Labrador tea) in opening
	02	July 26	closer view of same, showing pool and luxuriant growth of mosses (plot 9)

03	July 26	*Carex trisperma* (three-seeded sedge) growing at edge of pool in black spruce bog (plot 9)
04	July 26	*Carex trisperma* (three-seeded sedge), close-up of inflorescence (plot 9)
05	July 26	*Carex paupercula* (bog sedge) growing in pool in black spruce bog (plot 9)
06	July 26	*Sphagnum magellanicum*, the largest species of *Sphagnum*, in wet black spruce bog (plot 9)
07	July 26	diverse mosses (*Pleurozium schreberi, Polytrichum strictum, Sphagnum* spp.) and cone scales in wet black spruce bog (plot 9)
08	July 26	the moss *Tetraplodon angustatus* on carnivore dung in wet black spruce bog (plot 9)
09	July 24	*Andromeda polifolia* (bog rosemary) on moss mound (*Sphagnum magellanicum* and *Polytrichum strictum*) in opening in wet black spruce bog (near plot 9)
10	July 26	*Alnus crispa* (green alder) on north side of Spruce Hollow Trail (above the bog containing plot 9)
11	July 26	*Alnus tenuifolia* (river alder) at same location as preceding
12	July 26	Mallard Pond, showing shoreline marsh and duckweed mat (plot 10)
13	July 26	closer view of shore of Mallard Pond (plot 10), showing *Sparganium eurycarpum* (giant burreed), *Polygonum amphibium* (water smartweed) and duckweed mat
14	July 26	duckweed mat at edge of Mallard Pond (plot 10), showing *Wolffia borealis* (northern ducksmeal), *Spirodela polyrhiza* (larger duckweed) and *Lemna turionifera* (common duckweed)

15	July 26	close-up of duckweeds (plot 10), showing differences between *Wolffia borealis* (northern ducksmeal), *Spirodela polyrhiza* (larger duckweed) and *Lemna turionifera* (common duckweed)
16	August 18	outlet stream from Dynamite Lake system, showing colonization of silt deposited following breach of a beaver dam earlier the same season (near plot 34)
17	August 18	patches of *Callitriche verna* (vernal water-starwort) on moist silt (alluvium) along same stream (near plot 34)
18	August 18	pioneer vegetation on moist silt (alluvium) deposited following breach of a beaver dam in the Dynamite Lake system (plot 34)
19	August 18	closer view of same, showing diverse forbs and grasses (plot 34)
20	August 18	*Veronica peregrina* (hairy speedwell) and *Ranunculus sceleratus* (celery-leaved buttercup), annual colonists of moist alluvium (plot 34)
21	August 18	close-up of moist alluvium (plot 34), showing the land form of the liverwort *Riccia fluitans*
22	August 18	close-up of moist alluvium (plot 34), showing the land form of another liverwort, *Ricciocarpus natans*
23	August 18	the rare moss *Physcomitrium pyriforme* growing in moist silt (from plot 34), close-up taken in tray
24	August 18	interior of mesic black spruce bog NE of Waskahegan Staging Area, showing mature trees, patches of mosses and *Ledum groenlandicum* (Labrador tea), and red squirrel midden (plot 35)
25	August 18	opening in same bog, with *Dryopteris assimilis* (broad spinulose shield fern), *Ledum groenlandicum* (Labrador tea) and mosses (plot 35)

	26	August 18	close-up of mossy area in same bog with abundant *Gaultheria hispidula* (creeping snowberry), also *Ledum groenlandicum* (Labrador tea) and *Rubus chamaemorus* (cloudberry) (plot 35)
	27	August 18	close-up of *Gaultheria hispidula* (creeping snowberry) on moss mound in same bog (near plot 35)
	28	September 3	south shore of Detour Lake, showing extensive duckweed mat (plot 42)
	29	September 3	close-up of duckweed mat on Detour Lake (plot 42), showing *Wolffia borealis* (northern ducksmeal), *Spirodela polyrhiza* (larger duckweed) and *Lemna turionifera* (common duckweed)
Roll 3,	01	July 30	shoreline marsh in sheltered bay in SE corner of Islet Lake (plot 11, looking SSW)
	02	July 30	close-up of inflow channel in same marsh (plot 11), showing *Scutellaria galericulata* (marsh skullcap) and *Lemna turionifera* (common duckweed)
	03	July 30	east shore of Islet Lake, showing floating wood and narrow zone of emergent aquatics (plot 12)
	04	July 30	open water at same site (plot 12), showing *Potamogeton obtusifolius* (blunt-leaved pondweed)
	05	July 30	mixed forest on the large island in Islet Lake (containing plot 16), viewed from the east shore of the lake
	06	August 1	white spruce stand in the old-growth open mixed forest on the large island in Islet Lake (plot 16)
	07	August 1	interior of same white spruce stand (plot 16)
	08	August 1	*Prunus virginiana* (chokecherry) of tree size in old-growth mixed forest (plot 16)

09	August 1	close-up of *Ribes oxyacanthoides* (wild gooseberry) in plot 16
10	August 1	ground cover in plot 16, showing the dominant herb *Aralia nudicaulis* (wild sarsaparilla)
11	August 1	lichens on an old trunk of *Prunus virginiana* (chokecherry), including the yellowish *Candelaria concolor* (plot 16)
12	August 1	mosses and lichens on stump in old-growth forest (plot 16)
13	August 1	the rare lichen *Peltigera evansiana* growing among mosses on a fallen log in old-growth forest (plot 16)
14	August 1	the rare lichen *Peltigera evansiana* (from plot 16) in dry condition, close-up taken in tray
15	August 1	the same after wetting (taken in tray)
16	August 1	close-up of foliage of the true paper birch (*Betula papyrifera*) in open mixed forest on summit of island (near plot 16)
17	August 1	close-up of foliage and glandular twigs of Alaska birch (*Betula neoalaskana*) in open mixed forest (near plot 16)
18	August 1	patch of *Sagittaria cuneata* (arrowhead) in shallow water near the large island in Islet Lake (plot 17)
19	August 1	the submersed aquatic plants *Potamogeton obtusifolius* (blunt-leaved pondweed) and *P. richardsonii* (clasping-leaf pondweed) in shallow water of Islet Lake (plot 17)
20	July 30	interior of mature aspen poplar forest on west-facing slope above east shore of Islet Lake (plot 13)
21	July 30	same, another part of plot 13
22	July 30	inside the tall shrub layer of aspen forest formed by *Corylus cornuta* (beaked hazel) and *Prunus pensylvanica* (pincherry) (plot 13)

23	July 30	densely shaded herb layer of plot 13, showing the dominant *Aralia nudicaulis* (wild sarsaparilla)
24	August 10	shrub slope west of Elk Push Lake (looking west across plot 22), showing flowerheads of the dominant grass *Agropyron subsecundum* (awned wheatgrass) raised above the shrubs
25	August 10	the shrubs *Amelanchier alnifolia* (saskatoon), *Prunus virginiana* (chokecherry) and *Rubus idaeus* (wild raspberry) in plot 22
26	August 10	close-up of flowerheads of *Agropyron subsecundum* (awned wheatgrass) on shrub slope (plot 22)
27	August 10	shrubs and herbs in plot 22, including *Lathyrus venosus* (purple peavine) and *Vicia americana* (American vetch)
28	August 10	the rare moss *Weissia controversa* from dry ground on shrub slope (plot 22), close-up taken in tray
29	August 10	interior of bog margin west of Elk Push Lake, showing *Betula neoalaskana* (Alaska birch) and *Salix pyrifolia* (balsam willow) codominant in the tree and tall shrub layers (plot 23)
30	August 10	*Ledum groenlandicum* (Labrador tea) on sphagnum mound beneath Alaska birch and balsam willow on bog margin (plot 23)
31	August 10	NW shore of Elk Push Lake, showing scattered sedges (mainly *Carex aquatilis*) and duckweed mat (mainly *Spirodela polyrhiza*) (plot 24)
32	July 30	beaver pond on NE side of Islet Lake Road (viewed from road), showing sedge fen and duckweed mat (plot 14 on near shore)
33	July 30	closer view of plot 14, showing sedges (mainly *Carex aquatilis*) and duckweed mat

	34	July 30	duckweed mat on beaver pond (near plot 14), with brighter green patches indicating concentrations of *Wolffia borealis* (northern ducksmeal)
	35	July 30	*Aster puniceus* (purple-stemmed aster) in sedge fen (near plot 14)
	36	July 30	bay in NE corner of South Boundary Lake on west side of Islet Lake Road (plot 15), showing quaking shoreline fen and submersed aquatic vegetation
	37	July 30	closer view of plot 15, showing *Typha latifolia* (cattail), *Sparganium eurycarpum* (giant burreed), *Eleocharis palustris* (creeping spikerush), *Sagittaria cuneata* (arrowhead), etc.
	38	July 30	the common water moss *Drepanocladus aduncus* (close-up taken in plot 15)
	39	July 30	the rare water moss *Drepanocladus crassicostatus* from relatively deep water in plot 15 (close-up taken in tray)
Roll 4,	01	August 8	sedge-willow fen NW of central Staging Area (plot 21), with *Salix planifolia* (flat-leaved willow) on its peripherae
	02	August 8	closer view of same, showing the dominant *Carex aquatilis* (water sedge), saplings of *Salix planifolia* (flat-leaved willow), etc. (plot 21)
	03	August 8	diverse herbs, including *Petasites sagittatus* (arrow-leaved coltsfoot), growing around hummocks created by *Salix planifolia* (flat-leaved willow) (plot 21)
	04	August 8	old beaver pond on west side of Central Staging Area (viewed from east shore with plot 19 in foreground), showing the lodge and patches of emergent vegetation dominated by *Glyceria grandis* (common manna grass); note the beaver-cleared slope on the far side

05	August 8	closer view of emergent vegetation in plot 19, including *Glyceria grandis* (common manna grass), *Calamagrostis canadensis* (bluejoint) and *Sium suave* (water parsnip)
06	August 8	closer view of open water in plot 19, showing the dominant submersed aquatics *Ceratophyllum demersum* (hornwort) and *Potamogeton pusillus* (small pondweed), with scattered *Spirodela polyrhiza* (larger duckweed) on the surface
07	August 20	quaking minerotrophic sedge-willow fen on east side of Central Staging Area (plot 38)
08	August 20	mound of *Sphagnum angustifolium* in plot 38, with *Carex aquatilis* (water sedge), *Rumex orbiculatus* (water dock), *Potentilla palustris* (marsh cinquefoil), etc.
09	August 20	close-up of fruiting inflorescence of *Rumex orbiculatus* (water dock) in plot 38
10	August 20	close-up of *Drosera rotundifolia* (round-leaved sundew) on mound of *Sphagnum angustifolium* (near plot 38)
11	August 20	*Oxycoccus quadripetalus* (large bog cranberry) and *Potentilla palustris* (marsh cinquefoil) on sphagnum mound (near plot 38)
12	August 20	*Salix pedicellaris* (bog willow) and *S. pyrifolia* (balsam willow) in sedge-willow fen (plot 38)
13	August 20	close-up of *Salix pedicellaris* (bog willow), showing late-retained catkins (plot 38)
14	August 20	young stems of *Salix pyrifolia* (balsam willow) in sedge-willow fen (plot 38)
15	August 20	larch-birch swamp on the west side of the depression containing plot 38 (viewed from the plot)
16	August 20	closer view of same larch-birch swamp, with willows in foreground (near plot 38)

17	August 20	close-up of lichens on larch twigs (*Usnea hirta, Parmelia sulcata*, etc.) (near plot 38)
18	August 20	interior of larch-birch swamp, with *Ledum groenlandicum* (Labrador tea), etc. (near plot 38)
19	August 8	interior of larch-black spruce swamp east of Central Staging Area towards West Sawmill Lake (plot 20)
20	August 8	closer view of same, showing extensive moss carpet (plot 20)
21	August 8	the locally rare *Moneses uniflora* (one-flowered wintergreen) growing with *Mitella nuda* (bishop's cap), *Smilacina trifolia* (three-leaved Solomon's seal) and sedges on sphagnum mount (plot 20)
22	August 8	close-up of *Moneses uniflora* (one-flowered wintergreen) in association with the same other species (plot 20)
23	August 8	*Gaultheria hispidula* (creeping snowberry) with fruit on moss mound (plot 20)
24	August 8	*Gaultheria hispidula* (creeping snowberry) on moss mound (especially *Ptilium crista-castrensis*), in association with *Orthilia secunda* (one-sided wintergreen), *Mitella nuda* (bishop's cap) and *Ledum groenlandicum* (Labrador tea) (plot 20)
25	August 8	densely shaded portion of larch-black spruce swamp, with small ponds between moss mounds, also squirrel middens and dens (plot 20)
26	August 8	the uncommon moss *Rhizomnium gracile* from larch-black spruce swamp (near plot 20), close-up taken in tray
27	August 8	the rare moss *Conardia compacta* from larch-black spruce swamp (near plot 20), close-up taken in tray

28	August 8	close-up of the locally rare *Carex gynocrates* (northern bog sedge) with male flower spike, on moss mound in larch-black spruce swamp (near plot 20)
29	August 8	the rare orchid *Malaxis monophylla* (white adder's-mouth) in association with *Equisetum scirpoides* (dwarf scouring-rush) and *Linnaea borealis* (twinflower) in mossy depression in larch-black spruce swamp (near plot 20)
30	August 8	close-up of the locally rare *Equisetum scirpoides* (dwarf scouring-rush) in leaf litter in larch-black spruce swamp (near plot 20)
31	August 8	*Usnea hirta* and other lichens on low branch of black spruce (near plot 20)
32	August 20	beaver pond near NW end of West Sawmill Lake, showing duckweed mat and narrow band of emergent plants along shore (plot 36, viewed from the pipeline road)
33	August 20	close-up of inflorescences of the rare *Carex vulpinoidea* (fox sedge) on shore of beaver pond (plot 36)
34	August 20	close-up of duckweed mat in beaver pond (plot 36), showing *Wolffia borealis* (northern ducksmeal) and *Lemna turionifera* (common duckweed)
35	August 20	interior of alder swamp along intermittent stream flowing into West Sawmill Lake (plot 37)
36	August 20	large trunks of *Alnus tenuifolia* (river alder) (up to 16 cm dbh) in plot 37
37	August 20	herbs in alder swamp (plot 37), including *Epilobium ciliatum* (northern willowherb), *Petasites sagittatus* (arrow-leaved coltsfoot) and *Cinna latifolia* (drooping wood reed)
38	August 20	close-up of the dominant moss *Plagiomnium cuspidatum* in alder swamp (plot 37)

	39	August 20	stream channel (with reflections) through alder swamp, with *Ribes hudsonianum* (northern blackcurrant) on left (plot 37)
	40	August 20	regrowth of aspen poplar saplings after beaver cutting (on north-facing slope near plot 37)
	41	August 10	recently stabilized beaver pond with duckweed mat and *Carex aquatilis* (water sedge) beside road to Central Staging Area (plot 25)
	42	August 10	close-up of duckweed mat in same beaver pond (plot 25), showing the dominant *Wolffia borealis* (northern ducksmeal) and *Lemna turionifera* (common duckweed)
Roll 5,	01	August 12	shrubby sedge fen (quaking towards centre) in circular depression just over 1 km east of Blackfoot Lake Staging Area (looking eastward, with plot 26 in foreground)
	02	August 12	*Cicuta virosa* (narrow-leaved water-hemlock) growing with *Carex aquatilis* (water sedge) and *Potentilla palustris* (marsh cinquefoil) in sedge fen (plot 26)
	03	August 12	*Rumex orbiculatus* (water dock) growing with *Calamagrostis stricta* (narrow reedgrass) and sedges in sedge fen (plot 26)
	04	August 12	edge of black spruce bog (with larch and willows) immediately south of plot 26
	05	August 12	looking back (westward) from plot 26 into birch-dominated (*Betula neoalaskana*) swamp along the outlet channel from the depression
	06	August 12	interior of mature aspen poplar forest (up to 36 cm dbh) about 1 km east of Blackfoot Lake Staging Area (plot 27), showing *Corylus cornuta* (beaked hazel) and other shrubs
	07	August 12	close-up of bark of old aspen tree, showing lichens and moss around branch base (plot 27)

08	August 12	ground cover of mature aspen forest (plot 27), showing *Cornus canadensis* (bunchberry), *Rubus pubescens* (dewberry), *Equisetum sylvaticum* (woodland horsetail) and *Aralia nudicaulis* (wild sarsaparilla)
09	August 12	*Botrychium virginianum* (rattlesnake fern) growing with *Pyrola asarifolia* (common pink wintergreen) and *Cornus canadensis* (bunchberry) in mature poplar forest (plot 27)
10	August 12	interior of white spruce swamp (trees up to 53 cm dbh) on lower slope above fen south of Blackfoot Lake Staging Area (plot 28), with *Caltha palustris* (marsh marigold) in foreground
11	August 12	*Climacium dendroides* (tree moss), the dominant moss in white spruce swamp (plot 28), with *Viola palustris* (marsh violet) on right
12	August 14	moist black spruce bog north of Blackfoot Lake (looking northward from plot 31 in its untreed centre)
13	August 14	quaking sedge-reedgrass fen (plot 31) in centre of black spruce bog north of Blackfoot Lake (looking southward)
14	August 14	close-up of surface of plot 31, showing *Carex aquatilis* (water sedge), *C. paupercula* (bog sedge), *Calamagrostis stricta* (narrow reedgrass) and *Sphagnum squarrosum*
15	August 14	*Cicuta virosa* (narrow-leaved water-hemlock) in quaking sedge fen (plot 31)
16	August 14	close-up of fruiting inflorescence of *Rumex orbiculatus* (water dock) in plot 31
17	August 16	fen dominated by *Scolochloa festucacea* (spangletop) and *Carex atherodes* (awned sedge) at outlet of black spruce bog north of Blackfoot Lake (plot 33), looking SW
18	August 16	another view of plot 33, looking SSW into black spruce bog

19	August 16	closer view of plot 33, showing *Scolochloa festucacea* (spangletop) and *Carex atherodes* (awned sedge)
20	August 16	Norris Creek at its outflow from Blackfoot Lake (looking northward from bridge on Heron Hollow Trial)
21	August 14	moist saline meadow on foreshore of Blackfoot Lake (plot 29), with *Aster falcatus* (creeping white prairie aster) and *Hordeum jubatum* (foxtail barley)
22	August 14	closer view of *Aster falcatus* (creeping white prairie aster) and *Hordeum jubatum* (foxtail barley) in plot 29
23	August 14	*Juncus balticus* (wire rush) with *Aster falcatus* (creeping white prairie aster) and *Hordeum jubatum* (foxtail barley) in moist saline meadow (plot 29)
24	August 14	*Puccinellia nuttalliana* (Nuttall's alkali grass) and the shorter *P. distans* (slender alkali grass) both from plot 29 (close-up of collected specimens against white background)
25	August 14	the rare moss *Desmatodon heimii* from moist saline meadow (plot 29), close-up taken in tray
26	August 14	long-distance view (across lake) of native grassland on extreme S/SW-facing slope above NE shore of Crooked Lake (east of plot 32), with eroded patch caused by ungulates
27	August 14	another view of same, including part of plot 32
28	August 16	native grassland (plot 32) on extreme south-facing slope above Crooked Lake, showing the prominent *Elymus canadensis* (Canada wild rye) and *Glycyrrhiza lepidota* (wild licorice)
29	August 16	closer view of same (plot 32), showing nodding spikes of *Elymus canadensis* (Canada wild rye)

30	August 16	close-up of *Glycyrrhiza lepidota* (wild licorice) and *Elymus canadensis* (Canada wild rye), with the low shrub *Symphoricarpos occidentalis* (buckbrush) (plot 32)
31	August 16	*Monarda fistulosa* (wild bergamot) in native grassland (plot 32)
32	August 16	ripe seeds on dead plants of the spring annual *Monolepis nuttalliana* (spear-leaved goosefoot) on anthill in native grassland (plot 32)
33	August 16	*Chenopodium leptophyllum* (narrow-leaved goosefoot) from plot 32 (close-up of collected specimens against white background)
34	August 16	the rare moss *Phascum cuspidatum* from native grassland (plot 32), close-up taken in tray
35	August 16	*Cirsium flodmanii* (Flodman's thistle) in native grassland (near plot 32)
36	August 16	*Agastache foeniculum* (giant hyssop) in native grassland (near plot 32)
37	August 16	*Aster falcatus* (creeping white prairie aster), *Symphoricarpos occidentalis* (buckbrush) and *Vicia americana* (American vetch) in native grassland (plot 32)
38	August 16	coyote den near top of grassland slope (near plot 32)
39	August 16	ungulate trail across grassland slope (near plot 32), with two aster species (*Aster falcatus* and *A. laevis*) in flower on right
40	August 16	saline seepage area trampled by ungulates on NE shore of Crooked Lake (below plot 32)
41	August 16	close-up of salt lick in same saline seepage area (near plot 32)

42	August 16	*Aster brachyactis* (rayless aster), *Scirpus pungens* (three-square rush) and *Ranunculus cymbalaria* (seaside buttercup), three species of salt-loving plants in the same saline seepage area (near plot 32)
43	August 14	water in small pond beside Whitetail Trail (plot 30), showing *Potamogeton foliosus* (leafy pondweed), *Utricularia vulgaris* (common bladderwort) and the submersed form of *Hippuris vulgaris* (mare's-tail)
44	August 14	*Potamogeton foliosus* (leafy pondweed) from pond beside Whitetail Trail (plot 30), close-up taken in tray
45	August 14	shallow water in pond beside Whitetail Trail (plot 30), showing *Typha latifolia* (cattail), *Ranunculus sceleratus* (celery-leaved buttercup), *Hippuris vulgaris* (mare'-tail) and *Potamogeton foliosus* (leafy pondweed)
46	August 24	overview of north bay of Crooked Lake containing plot 39 (looking NE from causeway)
47	August 24	*Potamogeton vaginatus* (large-sheath pondweed) from Crooked Lake (plot 39), close-up taken in tray
48	August 24	overview of NE bay of Blackfoot Lake containing plot 40 (looking NW from causeway)
49	August 24	*Potamogeton pectinatus* (sago pondweed) from Blackfoot Lake (plot 40), close-up taken in tray
50	August 24	overview of south end of Long Lake containing plot 41 (looking WSW from bridge on Whitetail Trail)
51	August 24	*Potamogeton pusillus* (small pondweed) from Long Lake (plot 41), close-up taken in tray

Appendix 3. Colour Photographs of Rare Plant Species and their Habitats

Plate 1 Neon Lake (east side) and the black spruce bogs draining into it, viewed from the north shore (July 22 1996)

Plate 2 (left) *Potamogeton zosteriformis* (grass-wrack), a large pondweed found on the Cooking Lake Moraine only in Neon Lake (close-up in tray, August 5 1996)

Plate 3 (right) *Potamogeton obtusifolius* (blunt-leaved pondweed), the dominant pondweed in the watershed lakes (close-up in tray of specimens from Neon Lake, August 5 1996)

Plate 4 (left) *Carex trisperma* (three-seeded sedge) at edge of pool in black spruce bog forest (plot 9) on north side of Spruce Hollow Trail (July 26 1996)

Plate 5 (right) *Andromeda polifolia* (bog rosemary) on moss mound (*Sphagnum magellanicum* and *Polytrichum strictum* in opening in same black spruce bog (July 24 1996)

Plate 6 Floor of black spruce bog forest northeast of Waskahegan Staging Area (plot 35), showing abundant *Gaultheria hispidula* (creeping snowberry) with *Ledum groenlandicum* (Labrador tea), *Rubus chamaemorus* (cloudberry) and feathermosses (August 18 1996). Inset: ripe *Gaultheria* fruit

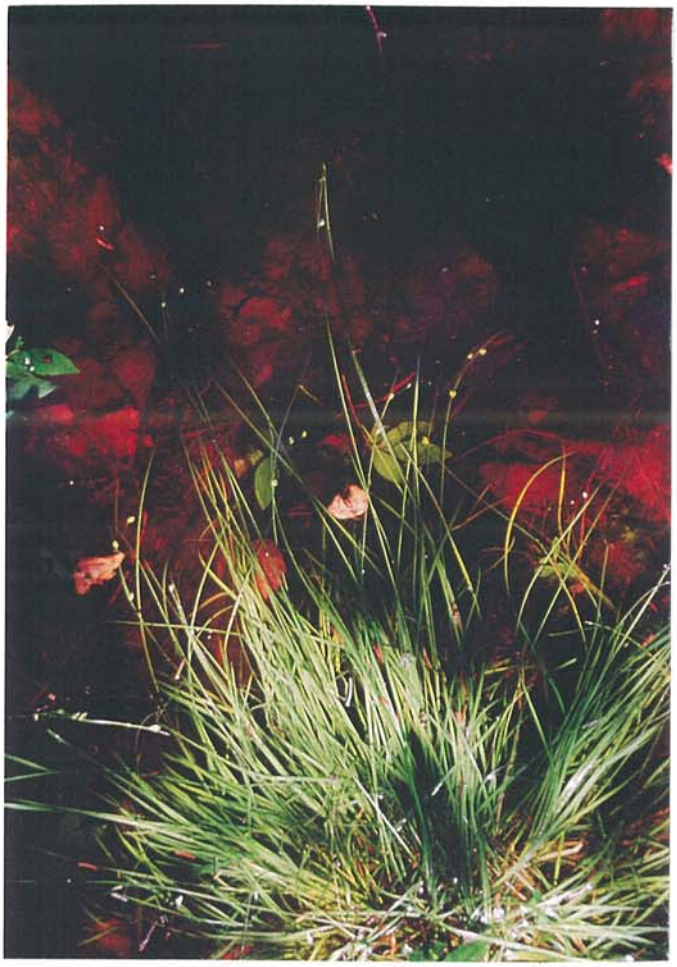


Plate 7 Dryland shrubbery on slope below headland west of Elk Push Lake (looking west across plot 22), showing flowerheads of the dominant grass *Agropyron subsecundum* (awned wheatgrass) above the shrubs (August 10 1996)

Plate 8 Old-growth mixed forest on the large island in Islet Lake, viewed from the east shore of the lake (July 30 1996)

Plate 9 The rare lichen *Peltigera evansiana* growing among mosses on a fallen log in old-growth forest on the large island in Islet Lake (plot 16) (August 1 1996)

Plate 10 The recently discovered water moss *Drepanocladus crassicostatus* from relatively deep water (plot 15) in South Boundary Lake on the west side of the Islet Lake Road (close-up in tray, July 30 1996)

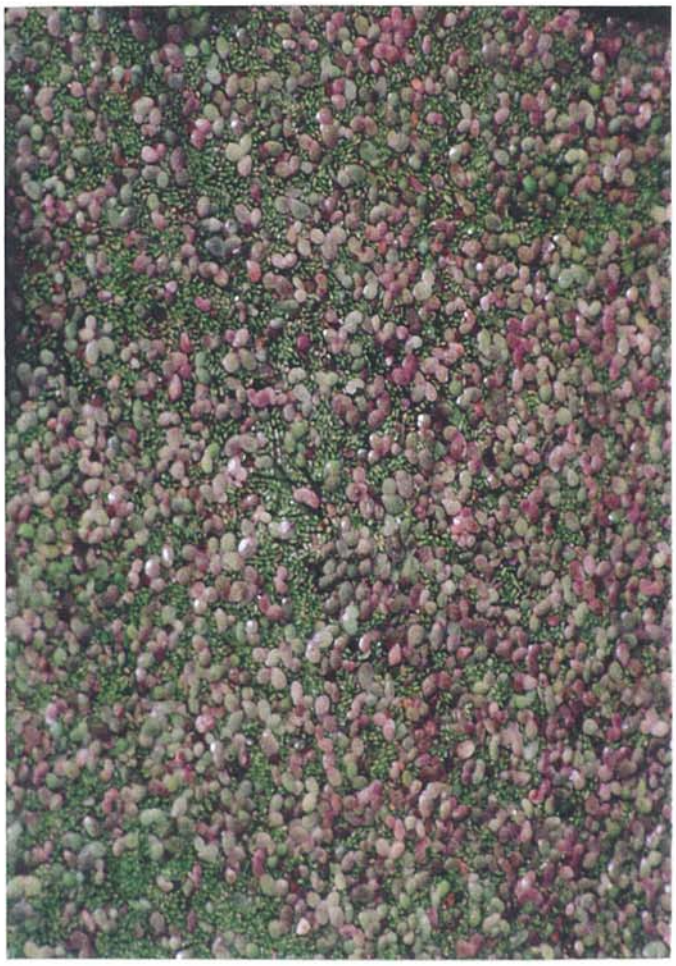
Plate 11 (left) *Drosera rotundifolia* (round-leaved sundew) on mound of *Sphagnum angustifolium* in quaking fen on east side of Central Staging Area (just outside plot 38, August 20 1996)

Plate 12 (right) The rare orchid *Malaxis monophylla* (white adder's-mouth) and *Equisetum scirpoides* (dwarf scouring-rush) in mossy depression in larch-black spruce swamp towards West Sawmill Lake (near plot 20, August 8 1996)

Plate 13 Beaver pond near northwest end of West Sawmill Lake, the habitat of both species of *Wolffia* and of the rare sedge *Carex vulpinoidea* (fox sedge), viewed from the pipeline road (plot 36, August 20 1996)

Plate 14 (left) Duckweed mat in same beaver pond, showing *Wolffia borealis* (northern ducksmeal) and *Lemna turionifera* (common duckweed) (August 20 1996)

Plate 15 (right) Fruiting inflorescences of *Carex vulpinoidea* (fox sedge) at edge of same beaver pond, the only location for this species on the Cooking Lake Moraine (August 20 1996)



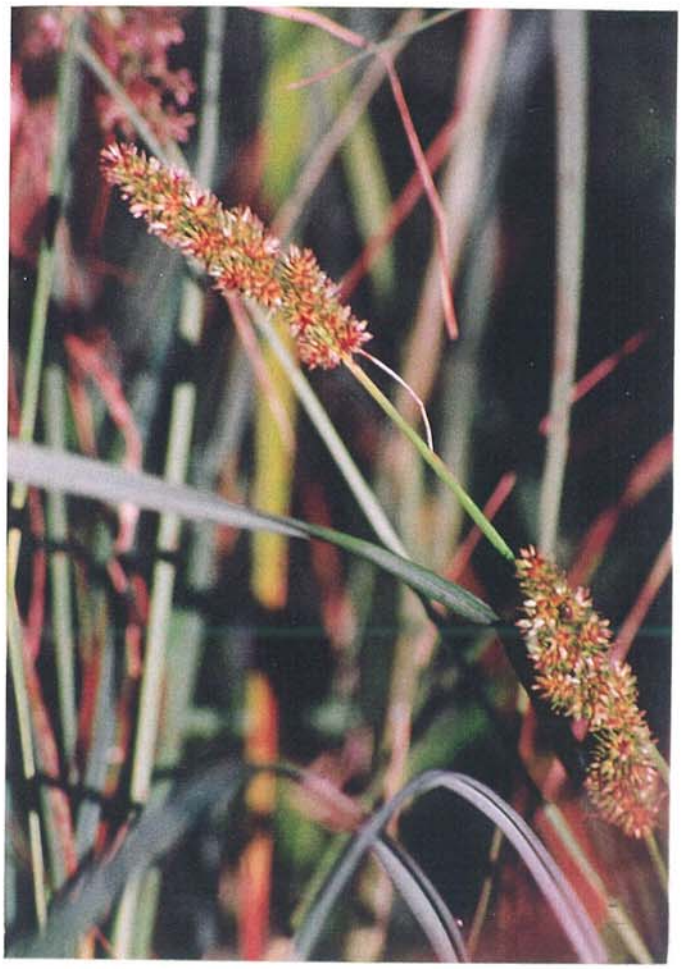


Plate 16 Native grassland on extreme south-facing slope above Crooked Lake (plot 32), showing *Elymus canadensis* (Canada wild rye) and *Glycyrrhiza lepidota* (wild licorice) (August 16 1996)

Plate 17 (left) Close-up of plot 32, showing the locally rare *Elymus canadensis* (Canada wild rye) and *Glycyrrhiza lepidota* (wild licorice) together with the low shrub *Symphoricarpos occidentalis* (buckbrush) (August 16 1996)

Plate 18 (right) *Potamogeton foliosus* (leafy pondweed) from pond beside Whitetail Trail (plot 30) (close-up in tray, August 14 1996)

Appendix 4. Map Legend

Blackfoot Floristic and Rare Plant Survey (1996): Map Legend

Plot #	Location	Legal	Landform	Vegetation	Rare Plants	Status (July 1996)	Rare Plant Survey Form #	Comments
1. First Priority List: Plots in communities containing species rare in the Province (S1 or S2) or locally rare (LR) on the Cooking Lake Moraine								
07	Arrowhead Lake in shallow water (mostly 0.2-0.5 m deep) along shore near SE outlet	07-17-52-20-W4	watershed lake (760 masl)	shoreline marsh (*Sparganium eurycarpum - Carex aquatilis - Spirodela polyrhiza*)	*Potamogeton obtusifolius* (blunt-leaved pondweed)	S1	RP.002	In beaver canal 0.8 1.0 m deep, presumably also growing offshore in water of this depth
09	on north side of Spruce Hollow Trail	10-18-52-20-W4	perched morainal depression (770 masl)	old black spruce bog forest (*Picea mariana - Ledum groenlandicum - Sphagnum* spp. - feathermosses	*Carex trisperma* (three-seeded sedge)	S2	RP.003	found on intermittently flooded mossy ground, especially along edges of bog
					Andromeda polifolia (bog rosemary)	LR	—	one patch in opening near the plot on mounds of *Sphagnum magellanicum*
12,17	Islet Lake, plot 12 on exposed east shore (water depth 0-1 m), plot 17 offshore on east side of the large island (water depth ± 0.6 m)	06-01-52-20-W4 (plot 12) and 05-01-52-20-W4 (plot 17)	watershed lake (740 masl)	submersed aquatic communities: *Myriophyllum exalbescens - ceratophyllum demersum - Lemna trisulca* along shore (plot 12), *Potamogeton obtusifolius* dominant offshore (plot 17)	*Potamogeton obtusifolius* (blunt-leaved pondweed)	S1	RP.005 RP.008	dominant offshore in water of suitable depth (0.5-1 m) throughout lake, scarcer close to shore
15	bay of South Boundary Lake on west side of Islet Lake Road (water depth 0-1 m)	01-01-52-20-W4	watershed lake (740 masl)	submersed aquatic community (*Myriophyllum exalbescens - Lemna trisulca*) and quaking shoreline marsh (*Drepanocladus aduncus - Bidens cernua*)	*Potamogeton obtusifolius* (blunt-leaved pondweed)	S1	RP.007	in water 0.5-1 m deep, presumably also growing offshore in water of this depth
					Drepanocladus crassicostatus	S1	RP.029	in water about 1 m deep beyond floating mats of *Drepanocladus aduncus*

16	on summit of large island in Islet Lake (towards north end)	05-01-52-20-W4	morainal knob (750 masl), forming island in watershed lake	old mixed forest (*Picea glauca - Aralia nudicaulis*)	*Peltigera evansiana*	S1	RP.035	on fallen log with mosses (*Platygyrium repens*, etc.)
18	Neon Lake, offshore in water about 1 m deep	06-19-52-20-W4	watershed lake (760 masl)	submersed aquatic community (*Potamogeton obtusifolius - P. zosteriformis*)	*Potamogeton obtusifolius* (blunt-leaved pondweed)	S1	RP.009	dominant throughout this lake
					Potamogeton zosteriformis (grass-wrack)	LR	—	subdominant, growing among the dominant *P. obtusifolius*
20	east of Central Staging Area on south side of pipeline road	16-07-52-19-W4	wet morainal depression (720 masl)	larch-black spruce swamp (*Picea mariana - Larix laricina - Sphagnum warnstorfii*)	*Gaultheria hispidula* (creeping snowberry)	S2	RP.010	locally abundant on mounds of sphagnum and other mosses
					Moneses uniflora (one-flowered wintergreen)	LR	—	locally numerous among mosses in shade of black spruce
					Carex gynocrates (northern bog sedge)	LR	—	abundant on mounds of sphagnum and other mosses
					Malaxis monophylla (white adder's-mouth)	S2	RP.011	±20 plants seen among mosses in narrow western end of swamp (outside the plot)
					Equisetum scirpoides (dwarf scouring-rush)	LR	—	among mosses and in leaf litter in narrow western end of swamp (outside the plot), with the preceding species
					Conardia compacta	S2	RP.028	in narrow western end of swamp (outside the plot) with *Helodium blandowii*, *Tomenthypnum nitens* and *Sphagnum* spp.
22	below headland on east side of Elk Push Lake Trail	15-02-52-20-W4	strong (30%) SW-facing dry slope of morainal knob (760 masl)	dryland shrubbery (*Amelanchier alnifolia - Prunus virginiana - Agropyron subsecundum - Poa pratensis*)	*Phascum cuspidatum*	S2	RP.033	on dry soil
					Weissia controversa	S1	RP.031	on dry soil

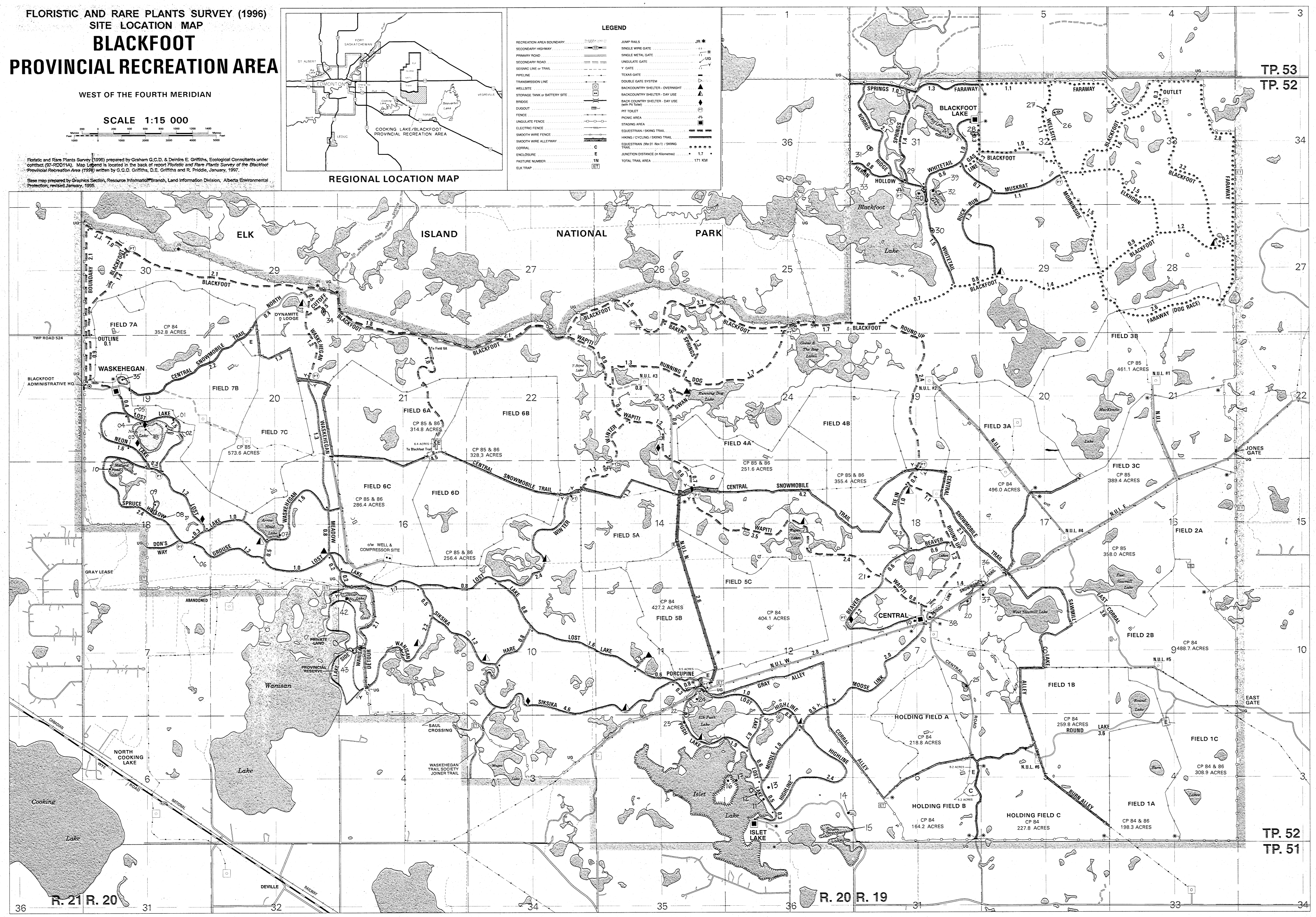
28	on west side of Blackfoot Trail just south of Blackfoot Lake Staging Area	09-31-52-19-W4	moist lower slope of morainal depression (715 masl)	white spruce swamp (*Picea glauca - Cornus stolonigera - Climacium dendroides*)	*Moneses uniflora* (one-flowered wintergreen)	LR	—	patch beneath white spruce near the plot
29	on east shore of Blackfoot Lake	02-31-52-19-W4	moist foreshore (with saline seepage) of morainal lake (710 masl)	moist saline meadow (*Hordeum jubatum - Juncus balticus - Aster falcatus*)	*Desmatodon heimii*	S2	RP.032	on saline soil
30	below beaver dam on east side of Whitetail Trail	15-30-52-19-W4	deep pond separated from neighbouring larger waterbodies by trail and beaverdam (710 masl, water 0.1-1.5 m deep)	submersed aquatic community (*Potamogeton foliosus - Utricularia vulgaris - Hippuris vulgaris*)	*Potamogeton foliosus* (leafy pondweed)	S2	RP.016	dominant in water 0.3-1.0 m deep
32	on east side of Crooked Lake	02-31-52-19-W4	extreme (55%) S/SW-facing dry slope above lakeshore (715 masl)	dry grassland (*Elymus canadensis - Poa pratensis - Glycyrrhiza lepidota*)	*Elymus canadensis* (Canada wild rye)	LR	—	codominant grass (with *Poa pratensis*)
					Glycyrrhiza lepidota (wild licorice)	LR	—	dominant forb
					Phascum cuspidatum	S2	RP.034	on dry soil
34	in ravine SE of Dynamite Lodge	01-29-52-20-W4	recently deposited moist silty alluvium beside stream (730 masl)	pioneering (seral) community (*Poa annua - Agrostis scabra - Physcomitrium pyriforme*)	*Physcomitrium pyriforme*	S1	RP.030	ephemeral species abundant on moist silty alluvium in this temporary habitat
35	NE of Waskahegan Staging Area	11-19-52-20-W4	perched mesic morainal depression (760 masl)	black spruce bog forest (*Picea mariana - Ledum groenlandicum - Sphagnum spp. - feathermosses*)	*Gaultheria hispidula* (creeping snowberry)	S2	RP.020	locally abundant on mounds of sphagnum and other mosses
36	on north side of pipeline road near NW end of West Sawmill Lake	04-17-52-19-W4	beaver pond in perched morainal depression (720 masl, water 0.2-1.5 m deep)	duckweed mat (*Wolffia borealis - Lemna turionifera*), partly on open waer, partly in shoreline marsh (*Carex aquatilis - Scirpus microcarpus*)	*Carex vulpinoidea* (fox sedge)	S2	RP.022	±10 plants seen in shoreline emergent zone
					Wolffia borealis (northern ducksmeal)	S2	RP.021	codominant in duckweed mat with *Lemna turionifera*
					Wolffia columbiana (Columbian ducksmeal)	S1	RP.023	much less abundant than the preceding species

38	on east side of Central Staging Area	15-07-52-19-W4	quaking centre of wet morainal depression (715 masl)	sedge fen with scattered willows (*Carex aquatilis - Sphagnum angustifolium - Potentilla palustris - Salix planifolia*)	*Rumex orbiculatus* (water dock)	S2	RP.024	prominent (about 30 plants seen)
					Drosera rotundifolia (round-leaved sundew)	LR	—	a few plants seen on a sphagnum mound just outside the plot
41	Long Lake, in shallow water (±0.5 m deep) at south end	09-31-52-19-W4	watershed lake (715 masl)	submersed aquatic community (*Myriophyllum exalbescens - Lemna trisulca*, with *Potamogeton obtusifolius* in band along shore)	*Potamogeton obtusifolius* (blunt-leaved pondweed)	S1	RP.025	locally codominant
42	Detour Lake, on south shore (water 0.3-1.0 m deep)	13-09-52-20-W4	small lake (deepened by beaver) in glacial meltwater channel (750 masl)	submersed aquatic community with duckweed mat (*Ceratophyllum demersum - Wolffia borealis*)	*Potamogeton foliosus* (leafy pondweed)	S2	RP.026	growing mixed with the dominant *Ceratophyllum demersum*
					Wolffia borealis (northern ducksmeal)	S2	RP.027	dominant in the extensive duckweed mat (with lesser quantities of *Spirodela polyrhiza* and *Lemna turionifera*)
2. Second Priority List: Plots in Communities containing only species whose S2 status (as of July, 1996) needs review								
02,04	marshes around Neon Lake	07-19-52-20-W4 (plot 02) and 06-19-52-20-W4 (plot 04)	flooded (partly quaking) shores of watershed lake (760 masl)	shoreline marshes with *Calamagrostis canadensis* dominant (plot 02) or codominant with *Carex atherodes* and *C. utriculata* (plot 04), with scattered willows (*Salix planifolia*, etc.)	*Rumex orbiculatus* (water dock)	S2	RP.019	prominent throughout these marshes (in both plots)
					Cicuta virosa (narrow-leaved water-hemlock)	S2	RP.001	common in plot 4

10	SW corner of Mallard Pond	13-18-52-20-W4	beaver pond in perched morainal depression (760 masl)	duckweed mat (*Wolffia borealis - Lemna turionifera*), partly on open water, partly in shoreline marsh (*Carex atherodes* dominant)	*Wolffia borealis* (northern ducksmeal)	S2	RP.004	codominant in duckweed mat
14	on NE side of road to Islet Lake	01-01-52-20-W4	beaver pond in perched morainal depression (740 masl)	shoreline marsh (*Carex aquatilis* dominant) with duckweed mat (*Lemna turionifera - L. trisulca*)	*Wolffia borealis* (northern ducksmeal)	S2	RP.006	about 20% coverage of water surface (in 1:4 ratio with *Lemna turionifera*)
25	on west side of road to Central Staging Area	01-07-52-19-W4	beaver pond in morainal depression (720 masl)	duckweed mat (*Wolffia borealis - Lemna trisulca*), partly on open water, partly in shoreline marsh (*Carex aquatilis* dominant)	*Wolffia borealis* (northern ducksmeal)	S2	RP.012	dominant on water surface
26	>1 km east of Blackfoot Lake Staging Area (east of Wellsite Trail)	10-32-52-19-W4	quaking centre of morainal depression (720 masl)	sedge-reedgrass fen (*Carex utriculata - Calamagrostis stricta - Drepanocladus aduncus*) with scattered birch and willows	*Cicuta virosa* (narrow-leaved water-hemlock)	S2	RP.013	frequent
					Rumex orbiculatus (water dock)	S2	RP.014	frequent
					Eriophorum chamissonis (russet cottongrass)	S2	RP.015	frequent
31	on west side of Norris Ridge Trail	12-31-52-19-W4	quaking centre of morainal depression (720 masl)	sedge-reedgrass fen (*Carex aquatilis - Calamagrostis stricta - Sphagnum squarrosum*)	*Cicuta virosa* (narrow-leaved water-hemlock)	S2	RP.018	frequent
					Rumex orbiculatus (water dock)	S2	RP.017	frequent
43	on east side of Lakeside Trail	12-09-52-20-W4	new beaver pond on stream channel (745 masl)	duckweed mat (*Wolffia borealis - Lemna turionifera*)	*Wolffia borealis* (northern ducksmeal)	S2	EO Form PMLEMO3 060024AB	site colonized after 1992 (not present in that year)
3. Plots not containing rare species								
01	on east side of Neon Lake	07-19-52-20-W4	lower slope of morainal depression (760 masl)	black spruce bog forest (*Picea mariana - Ledum groenlandicum* - feathermosses)				

03	on south side of Neon Lake Trail	03-19-52-20-W4	NE-facing slope of morainal depression (765 masl)	white spruce stand (*Picea glauca - Aralia nudicaulis*)
05	between Waskahegan Staging Area and Neon Lake	06-19-52-20-W4	east-facing morainal slope (765 masl)	aspen forest (*Populus tremuloides - Corylus cornuta - Aralia nudicaulis*)
06	on south side of Grouse Trail	08-18-52-20-W4	flooded perched morainal depression (765 masl)	mixed willow swamp (*Salix planifolia - S. petiolaris - S. pseudomonticola - S. novae-angliae*)
08	on north side of Spruce Hollow Trail	10-18-52-20-W4	perched morainal depression (770 masl)	open black spruce bog forest (*Picea mariana - Ledum groenlandicum* - feathermosses)
11	on inflow channel on east shore of Islet Lake	06-01-52-20-W4	alluvial fan with stream channel (740 masl)	sedge fen (*Carex atherodes - Drepanocladus aduncus*)
13	on NW side of Middle Trail above east side of Islet Lake	06-01-52-20-W4	strong (25%) west-facing morainal slope (760 masl)	aspen forest (*Populus tremuloides - Corylus cornuta - Aralia nudicaulis*)
19	on west side of Central Staging Area	11-07-52-19-W4	beaver pond in morainal depression (720 masl)	duckweed mat (*Spirodela polyrhiza* dominant), with patches of submersed (*Ceratophyllum demersum - Potamogeton pusillus*) and emergent vegetation (*Glyceria grandis* dominant)
21	on south side of Wapiti Trail	04-18-52-19-W4	perched morainal depression (740 masl)	sedge fen (*Carex aquatilis* dominant) with scattered willows (*Salix planifolia*)
23	on west side of Elk Push Lake Trail	15-02-52-20-W4	perched morainal depression (745 masl)	balsam willow-birch carr on bog margin (*Salix pyrifolia - Betula neoalaskana - Ledum groenlandicum - Calamagrostis canadensis - Sphagnum warnstorfii*)

24	Elk Push Lake, in shallow water (0.1-1.0 m deep) on NW shore	01-11-52-20-W4	watershed lake (740 masl)	duckweed mat (*Spirodela polyrhiza* dominant), partly on open water (with *Ceratophyllum demersum* and *Lemna trisulca*), partly in shoreline marsh (with *Carex aquatilis* and *Calamagrostis canadensis*)
27	1 km east of Blackfoot Lake Staging Area on east side of Wellsite Trail	10-32-52-19-W4	moderate (10%) NW-facing morainal slope (720 masl)	aspen forest (*Populus tremuloides - Cornus canadensis - Aralia nudicaulis*)
33	on south side of Heron Hollow Trail	04-31-52-19-W4	outflow of morainal depression (720 masl)	sedge-spangletop fen (*Carex atherodes - Scolochloa festucacea*)
37	on south side of pipeline road near NW end of West Sawmill Lake	13-08-52-19-W4	alluvial floodplain of intermittent stream (715 masl)	alder swamp (*Alnus tenuifolia - Plagiomnium cuspidatum*)
39	Crooked Lake, in water ±0.5 m deep at entrance of north bay	02-31-52-19-W4	morainal lake (710 masl)	submersed aquatic community (*Potamogeton vaginatus - Myriophyllum exalbescens - Ceratophyllum demersum*)
40	Blackfoot Lake, in water ±1 m deep in NE bay	02-31-52-19-W4	morainal lake (710 masl)	submersed aquatic community (*Ceratophyllum demersum* dominant)


FLORISTIC AND RARE PLANTS SURVEY (1996)
SITE LOCATION MAP
BLACKFOOT
PROVINCIAL RECREATION AREA
WEST OF THE FOURTH MERIDIAN
SCALE 1:15 000
Floristic and Rare Plants Survey (1996) prepared by Graham G.C.D. & Deirdre E. Griffiths, Ecological Consultants under contract (97-RDD11A). Map Legend is located in the back of report Floristic and Rare Plants Survey of the Blackfoot Provincial Recreation Area (1996) written by G.C.D. Griffiths, D.E. Griffiths and R. Priddle, January, 1997.
Base map prepared by Graphics Section, Resource Information Branch, Land Information Division, Alberta Environmental Protection; revised January, 1995.
REGIONAL LOCATION MAP
COOKING LAKE/BLACKFOOT PROVINCIAL RECREATION AREA
LEGEND
ELK ISLAND NATIONAL PARK
TP. 53
TP. 52
TP. 51
R. 21 R. 20
R. 20 R. 19
BLACKFOOT LAKE
WASKEHEGAN
BLACKFOOT ADMINISTRATIVE HQ
CENTRAL
PORCUPINE
ISLET LAKE
JONES GATE
EAST GATE
NORTH COOKING LAKE
DEVILLE
SAUL CROSSING
WASKEHEGAN TRAIL SOCIETY JOINER TRAIL
GRAY LEASE
Cooking Lake
Wanisan Lake
Islet Lake
Blackfoot Lake
FIELD 7A
CP 84 352.8 ACRES
FIELD 7B
FIELD 7C
CP 85 573.6 ACRES
FIELD 6A
CP 85 & 86 314.8 ACRES
FIELD 6B
CP 85 & 86 328.3 ACRES
FIELD 6C
CP 85 & 86 286.4 ACRES
FIELD 6D
CP 85 & 86 256.4 ACRES
FIELD 5A
FIELD 5B
CP 84 427.2 ACRES
FIELD 5C
CP 84 404.1 ACRES
FIELD 4A
CP 85 & 86 251.6 ACRES
FIELD 4B
CP 85 & 86 355.4 ACRES
FIELD 3A
CP 84 496.0 ACRES
FIELD 3B
CP 85 461.1 ACRES
FIELD 3C
CP 85 389.4 ACRES
FIELD 2A
CP 85 358.0 ACRES
FIELD 2B
CP 84 488.7 ACRES
FIELD 1A
CP 84 & 86 198.3 ACRES
FIELD 1B
CP 84 259.8 ACRES
FIELD 1C
CP 84 & 86 308.9 ACRES
HOLDING FIELD A
CP 84 218.8 ACRES
HOLDING FIELD B
CP 84 164.2 ACRES
HOLDING FIELD C
CP 84 227.8 ACRES