FLORISTIC, RARE PLANT, AND VEGETATION SURVEY

OF THE

BLACKFOOT PROVINCIAL RECREATION AREA UPLANDS

(1997-1998)

by
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ABSTRACT

There were 509 plant taxa documented for the study area. By group, there were 18 liverworts (3.5%), 50 lichens (9.8%), 92 mosses (18.1%), 36 native vascular plants of disturbed habitats (ruderal species) (7.1%), 270 vascular plants of undisturbed habitats (53.0%), and 43 non-native vascular plants (8.4% of total). Of the 349 vascular taxa, 10.3% were native plants of weedy habit, 77.4% were non-weedy native plants, and 12.3% were non-native plants. Thus, 22.6% of the vascular flora are plants of disturbed habitats.

We found 11 provincially rare species of plants classified as S1 or S2 (or S3 if on the ANHIC "watch" list, or unclassified for lichens): 5 mosses, 3 lichens, and 3 vascular plants. Adding those 15 provincially rare plant species found by Griffiths et al. (1997) not in common with this study, brings the total known provincially rare flora of the Blackfoot to 26 species. By plant group, there are 11 rare mosses, 3 lichens, and 12 vascular plants.

Nine (primarily upland) plant associations were identified:(1) black spruce / labrador tea / cloudberry / *Sphagnum* bog; (2) aspen / beaked hazelnut young deciduous forest; (3) aspen - white spruce / sarsaparilla / bunchberry modal upland forest; (4) aspen - balsam poplar +/- white spruce / wild red raspberry mature and old-growth mixedwood forests typical of the moister end of the upland forest gradient; (5) Kentucky bluegrass - prairie sagewort - northern bedstraw grassland; (6) bluejoint reedgrass wet meadow; (7) slender salt-meadow grass - creeping spike rush salt meadow; (8) prickly rose - wild red raspberry / purple peavine beaver-dependent shrubland; (9) dandelion - white clover - bluegrass weed association.

Site or community types that are uncommon or rare in the Blackfoot area are saline meadows; dry grassland and dry shrubland; old-growth forests; and riparian zones. Those that are characteristic of the Blackfoot are beaver-controlled landscapes; landscape units influenced by insects and disease; and weed disclimaxes.

A salient feature of the study area is the predominance of non-native plants. This condition is attributable to a multiple mandate of habitat protection, domestic cattle grazing, oil and gas development, equestrian activities, and general recreation.

We conclude with management recommendations.

Color Plates (**a**) Fine example of linkage between beavers, flooding, Fungi, vegetation change, and habitat in poorly-drained awned sedge - bluejoint reedgrass / *Drepanocladus aduncus* meadow succeeding after death of balsam poplar trees (plot bf82, 7 Sept. 97). Note the abundant high quality snags and animal cavities; (**b**) *Impatiens noli-tangere* in flower in heterogeneous flood-affected Bebb's willow / bluejoint reedgrass and aspen / bluejoint community along creek, imperfectly- to poorly-drained, with *Impatiens capensis* (plot bf75, 12 Aug 97); (**c**) Kentucky bluegrass - prairie sagewort - northern bedstraw grassland remnant on isthmus between Blackfoot and Crooked Lakes (plot bf64, 10 July 97) with green needlegrass, bergamot, common blue lettuce, plains cinquefoil, junegrass, bastard toadflax, slender wheatgrass, and dragonwort; (**d**) yellow form of spotted coralroot (*Corallorhiza maculata* forma *flavida*) in fruit in subhygric, young climatic climax aspen - balsam poplar / saskatoon - beaked hazelnut / sarsaparilla forest with *Campylium polygamum* (plot bf67, 11 July 97); note last year's fruiting stalk; (**e**) SE-facing weed disclimax currently dominated by Canada thistle, Kentucky bluegrass with white clover and buckbrush; site was probably dominated by slender wheatgrass in the past (plot bf77, 12 Aug 97); (**f**) young climatic climax aspen - balsam poplar / white spruce / sarsaparilla forest succeeding to spruce dominance, north-facing slope base, well-drained; probably protected from fire in part by the bordering wetland (plot bf56, 7 July 97), habitat of *Physciella melanchra* and *Campylium polygamum*; (**g**) well-drained mature aspen / beaked hazelnut forest modal upland type showing canopy breakup (plot bf72, 15 July 97), habitat of *Physcia dimidiata* and *Brachythecium campestre*; (**h**) bergamot in flower in grassland (plot bf64, 10 July 97); (**i**) wire rush - Kentucky bluegrass - graceful sedge - foxtail barley salt meadow (plot bf66, 11 July 97), habitat of alkali cordgrass and three-square rush; (**j**) example of disease-caused diversity in wild red raspberry - beaked hazelnut shrub with prickly rose and fireweed, characterized by abundant snags in a former aspen forest (plot bf79, 13 Aug 97), habitat of *Physcia dimidiata*; (**k**) high species diversity (many non-native) in a "pioneer" short-awned foxtail / *Barbula unguiculata* open habitat along "Neon Lake Creek" (plot bf73, 11 Aug 97), habitat of *Bryum cyclophyllum* and *Lycopus uniflorus*; note the breached beaver dam and the tansy in the background; (**l**) creeping spikerush salt meadow at the Baker Springs mineral lick (plot bf49, 2 July 97); note the paucity of vegetation due to intense use by ungulates; habitat of slender salt-meadow grass.

1. INTRODUCTION

1.1 Project Purpose

The purpose of this project was to conduct a floristic and plant community survey in order to document the occurrence and location of rare or otherwise significant plant species and communities of the Blackfoot Provincial Recreation Area uplands. Site conditions are described for significant plant species and communities. The information presented in this report and the accompanying map should assist managers to protect and enhance the biodiversity of the Blackfoot.

1.2 Objectives

The project objectives were to:(1) conduct floristic and vegetation surveys in landscape positions with the greatest potential for locating significant occurrences of plant species and vegetation types; (2) identify and confirm plant species and document their locations on the ground, on airphotos, and on the accompanying map; (3) map the location of all survey sites and all provincially rare native plants found during the survey; and (4) produce a summary report and a map according to specifications in the Alberta Environmental Protection contract #980098 Terms of Reference.

2. STUDY AREA

2.1 Location

The study area is located in the County of Beaver about 40 km east of Edmonton in the Cooking Lake Moraine of east-central Alberta (Figure 1), within a disjunct portion of the Dry Mixedwood subregion of the Boreal Forest Natural Region of Alberta.

The Blackfoot was designated as a provincial recreation area in 1988. The recreation area encompasses about 9,930 ha, including some 4,060 ha of fenced pastures excluded from the study. The area surveyed in this study spanned approximately 5,170 ha (5,870 lying outside the pastures minus 700 ha excluded from this study for budgetary considerations), and includes extensive uplands of native aspen, balsam poplar, and mixedwood forests, trails, ponds, and small lakes. In 1996-1997, a floristic and rare plant survey was conducted of the wetlands, ponds, and lakes lying outside the pastures (Griffiths et al. 1997) and these were excluded, for the most part, from this study.

The following overview of climate, parent materials, wildlife, and vegetation is based on Achuff (1994), field observations, and references cited therein.

2.2 Climate

The climate of the dry mixedwood subregion is subhumid continental with short, cool summers and long, cold winters. The mean May-September temperature is about 13°C; mean annual temperature is 2.1°C (Environment Canada 1993, based on Edmonton International Airport); the growing season is about 90 days. Annual precipitation averages about 350 mm; June and July are the wettest months. Winters are relatively dry; precipitation averages about 60 mm.

2.3 Parent Materials, Landforms, and Soils

Dominant parent materials in the dry mixedwood subregion are level to undulating ground moraine and hummocky moraine, with lesser amounts of eolian dunes and sandy outwash plains. Specific to the study area, parent materials and landforms are a clay loam hummocky (stagnation) moraine of uneven thickness (up to 30 m thick) with local water-sorted materials. The hummocky topography of the area is strongly developed, with well-defined knobs and kettles; local relief is 5

Figure 1. Location of the study area.

to 20 m (Shetsen 1990). Elevations range from about 704 to 770 m. Drainage is into the North Saskatchewan River via Beaverhill Lake or into numerous closed depressions. Soils are Gray Luvisols on the upland tills and Organic and Gleysolic soils in poorly-drained areas; Regosols are found along some streams.

According to the provincial classification system of Strong and Thompson (1995), the study area lies within the Cooking Lake Upland ecodistrict of the Dry Mixedwood subregion of the Boreal Forest natural region, characterized by a moderately well-drained, hummocky morainal plain of 3-30% slopes, Gray Luvisols, and a vegetation cover of cleared land and closed deciduous forest. Within the national ecoclimatic classification system, the study area lies within the Transitional Grassland Ecoclimatic Region of the Grassland Ecoclimatic Province (Ecoregions Working Group 1989), but the study area is atypical of the region due to the influence of the Cooking Lake Moraine.

2.4 Wildlife

Birds characteristic of the deciduous forests of the dry mixedwood subregion include least flycatcher, house wren, ovenbird, red-eyed vireo, northern oriole, and rose-breasted grosbeak. Birds characteristic of the mixedwood forests are yellow-bellied sapsucker, Swainson's thrush, solitary vireo, magnolia warbler, white-throated sparrow, pileated woodpecker, and northern goshawk. Double-crested cormorants, American white pelicans, great blue herons, and trumpeter swans can be seen regularly in the Blackfoot (Griffiths et al. 1997). Approximately 211 bird species have been found in the area (Alberta Environmental Protection 1997). Typical mammals are little brown bats, masked shrews, red squirrels, northern flying squirrels, northern pocket gophers, deer mice, meadow voles, boreal ("southern") red-backed voles, beavers, muskrats, moose, white-tailed deer, elk, snowshoe hares, red foxes, coyotes, and ermines (Smith 1993).

2.5 Vegetation

The vegetation of this disjunct portion of the dry mixedwood subregion holds much in common with that of the central parkland subregion which surrounds the Blackfoot. Note that in this description, and throughout the report, plant common and scientific names follow Alberta Environmental Protection (1993). Aspen forests predominate on the uplands with aspen and balsam poplar forests on moister sites. White spruce mixedwood forests with aspen and balsam poplar occupy cool, moist sites, or those that have escaped fire for some time. Alaska birch is typical along wetland margins and in depressions; paper birch is sporadic on well-drained uplands. Currently, most old-growth forests are found along streams, on islands, or in or surrounded by wetlands.

Understories in upland deciduous forests include low-bush cranberry, beaked hazelnut, prickly rose, red-osier dogwood, bluejoint reedgrass, wild sarsaparilla, dewberry, cream-colored vetchling, pink wintergreen, and twinflower. Cow parsnip is characteristic of rich, moist sites.

Wet meadows and marshes are dominated by bluejoint reedgrass and awned sedge, along with narrow reed grass, cattail, bulrushes, and various sedges. Shrub communities (usually with a bluejoint reedgrass or awned sedge matrix) are dominated by many species of willows, including pussy, flat-leaved, Bebb's, and basket willows. Peatlands of the dry mixedwood are dominated by non-patterned, wooded, shrubby, and open fens (Vitt et al. 1996). Quiet ponds are dominated by common duckweed, along with common bladderwort and coontail, while more open ponds may support extensive beds of various pondweeds (*Potamogeton* spp.).

2.6 Land Use

Prior to Euro-Canadian settlement, the area was used by various native bands for hunting. Camps were established near the study area on Cooking and Beaverhill Lakes. In the 1880's, the area was part of the Beaverhills Timber Reserve established by the federal government. In the mid-1890s,

fires lit by homesteaders escaped on several occasions and burned the white spruce forests of the area. In 1899, the Beaverhills Timber Reserve was reduced in size and renamed the Cooking Lake Forest Preserve (Alberta Environmental Protection 1997). Domestic grazing began in the area in the 1920s. More forest fires burned through the area early in this century, particularly in 1924 and 1929. In 1931, the federal government turned the area over to the province of Alberta. After World War II, logging of the spruce forests declined, in large measure because little spruce forest remained. The last logging permit was granted in 1967 (Griffiths et al. 1997).

The Blackfoot Grazing Association was formed in 1948. The Alberta government came to view the area as grazing land and began clearing the upland deciduous forests in the 1950s. Conflicts later arose between grazing interests and other people as cattle ranged widely in the absence of fences (Griffiths et al. 1997). The grazing association recognized the "need for improved grazing within the area"... and that "a grazing association lacks the authority to deal with the pressures of recreational land use" and "requested that the provincial government develop and operate Blackfoot as a provincial grazing reserve" (Alberta Energy and Natural Resources 1983). The major fenced pasture development took place in 1987 with clearing of thousands of hectares of forests and development of pastures seeded with agricultural species.

The Blackfoot is currently managed under a multiple mandate for recreation, trapping, sport and aboriginal hunting, heritage appreciation, wildlife habitat, domestic grazing, and petroleum extraction (Map 1, in pocket). There are nine producing natural gas wells (22 wells have been drilled in the area), over 16 km of pipeline, 25 km of access roads, and one compressor station. Recreation facilities include four staging areas that provide parking, picnic facilities, and access to the 170 km of maintained trails and backcountry shelters. The trails are used for hiking, cycling, horseback riding, cross-country skiing, snowmobiling, and dogsledding. There are approximately 4,060 ha of "improved" fenced pastures divided into seven fields to accommodate domestic grazing.

3. METHODS

Prior to fieldwork, a literature search was conducted. A selection of rare plants likely to occur in the study area was examined at the Northern Forestry Centre herbarium. Airphoto interpretation of the supplied 1:15,000 airphotos was used to search for potential rare plant sites. The study area was stratified into high, medium, and low priority sites based on (a) information supplied by the area ranger, (b) local knowledge, (c) reports and background information, and (d) airphoto interpretation. High priority sites were those with a high probability of containing rare plants or communities, such as salt springs, grassland and shrubland, and spruce forests. Potential sites were noted with erasable ink on the airphotos and in pencil on the supplied maps and formed the basis of the field sampling plan. Sampling effort focussed on high priority sites (70% of field time), with 20% of field time devoted to moderate priority sites. Low priority areas (10% of field time) were sampled in a stratified random pattern.

We examined two Alberta Vegetation Inventory 1:20,000 orthophotos interpreted by Richard Nesby (Alberta Environmental Protection, 1995, Twp 52, Ranges 19 and 20, W4) and accompanying polygon data. The data were used to assist in search of interesting communities. Fourteen old forest patches (those originating in or before 1900) were transferred from the orthophotos onto Map 1.

Thirty person days were devoted to fieldwork with a field crew of two people. Fieldwork took place from 1-11 July, 15 July, 11-13 August, and 7-8 September. Sites pre-plotted on airphotos were visited on foot and via mountain bike. Areas between plotted sites were also inspected en route. At each site, we tallied the presence and estimated the cover, by stratum, of all plants found within a 0.03 ha plot. Voucher collections were made as needed. Standard Alberta Environmental

Protection site description (LISD 15B, revised 1/97) and vegetation description (LISD 14B, revised 1/97) forms were completed following the procedures specified in Alberta Environmental Protection (1994).

At each site, a three foot long metal pigtail stake was placed at plot centre. The top of the pigtail was labelled with an aluminum tag with the plot number (e.g., "BF44"), and flagged with pink flagging. The geographic position of each plot was determined by GPS. Once near the site, the route to the site is pink flagged on trees and tall shrubs. A site diagram showing landmarks, directions, and distances from known points is provided on the site description sheet. The location of each plot and rare plant is pinpointed on an airphoto (supplied to the department), and on the enclosed map (Map 1, in pocket). A standard ANHIC (Alberta Natural Heritage Information Centre) rare plant data form was completed for rare plants. Rare plants not requiring a voucher specimen were not collected. If no rare plants were found at a survey site, the pigtail was removed after sampling. At some plots, we noted that the pigtail or flagging had been removed soon after our sampling (this may make relocation of some plots difficult).

Plant common and scientific nomenclature follows Alberta Environmental Protection (1993), which was used as a master species list. Where unique common names exist they are used in place of scientific names. For keys and syntaxonomic questions for vascular plants, we used Moss (1983); for mosses, Ireland et al. (1987); for lichens, Egan (1987); and for hepatics, Schuster (1977). Among the vascular plants there are two exceptions: *Carex utriculata* (=*C. rostrata* in Moss 1983); *Wolffia* nomenclature follows Scoggan (1979). Authorities on rarity are ANHIC (1996, 1997). An S1 status plant has </= 5 occurrences in Alberta, an S2 status plant has 6-20, and an S3 has 21-100 known occurrences in Alberta.

Voucher specimens were identified in the laboratory. Difficult or otherwise problematic specimens were shown to Dr. Derek Johnson (Northern Forestry Centre) and Dr. Dale Vitt (Univ. of Alberta). Some lichens were sent to Dr. Ted Esslinger (North Dakota State University).

When referring to species (and community) distributions, the term "locally" refers to the Cooking Lake Moraine; "regionally" refers to east-central Alberta. If no adverb is used, the entire province of Alberta is implied. Many plant species (or communities) are not provincially rare, yet are otherwise significant due to local or regional considerations. For those species (or communities), we have attempted to classify their degree of commonness based on the literature and our experience; "locally rare" would mean likely </=5 occurrences in the Cooking Lake Moraine; "locally uncommon" would mean ~6-20 occurrences in the Cooking Lake Moraine. The same categories apply to "regionally rare" and "regionally uncommon". A taxon "uncommon in Alberta" would generally have > 20 known occurrences in the province.

While the terms of reference required that we focus the fieldwork on uplands, the search for rare plants and communities necessitated some sampling in non-uplands. As a result, we established some study plots in saline and non-saline meadows and a few wooded bogs. For information on the remainder of the wetlands (marshes, bogs, open water, etc.), please see Griffiths et al. (1997).

4. RESULTS AND DISCUSSION

4.1 Vegetation Associations and Site Types

Dominant species, associated provincially rare species, vegetation classes, and selected site parameters are presented for the 44 plots in Table 1. These data were then summarized into nine vegetation associations whose names are based on the most frequently-occurring dominant species in a given vegetation class (Table 2).

4.1.1 Forest and Wooded Communities

(1) The black spruce/labrador tea/cloudberry/*Sphagnum* bog association is typical of mature closed depressions on Typic Fibrisols and Mesisols (plots 51, 54, 80). Drainage is poor; ecological moisture regime (EMR) is hygric; successionally they are young to mature edaphic climax communities which have been little-affected by fire and in which peat accumulation has created ombrotrophic nutrient conditions. Bogs that have been affected by fire typically have Alaska birch as their dominant tree rather than black spruce. The only rare species found associated with these bogs was *Brachythecium campestre* and creeping snowberry. Other characteristic species are bog cranberry and *Polytrichum strictum,* accompanied by *Sphagnum nemoreum, S. magellanicum, S. fuscum* and stairstep, big redstem, and Knight's plume mosses. The association is similar to "muskeg" stands described for the Cooking Lake area by Lewis and Dowding (1926), and is equivalent to the black spruce--peat moss association of Moss (1955).

(2) The aspen/beaked hazelnut young deciduous forest association is one of two modal upland associations in the Blackfoot (plots 60, 62, 71, 72 (color plate g), and 84). These are mesic, mature to old seral forests, typically on well-drained Orthic Gray Luvisols. Most of these forests would have originated after the 1920s. Generally these sites are somewhat drier and warmer than the following site type, typical of drier southerly aspects. Associated rare species are *Brachythecium campestre* and *Physcia dimidiata*. Common dominants are prickly rose and bunchberry. The association is equivalent to the aspen/beaked hazelnut/sarsaparilla association of Beckingham (1993).

(3) The aspen - (white spruce)/sarsaparilla/bunchberry association is a heterogeneous dominant upland group (plots 55, 56 (color plate f), 57, 67 (color plate d), 68, 70, 74). Tree dominance varies from pure aspen to white spruce - aspen; some plots may have significant cover of balsam poplar, paper birch, or Alaska birch. While generally mesic and well-drained, north-facing slopes and slope bases may be subhygric to hygric and moderately-well to imperfectly-drained. Soils are commonly Orthic Gray Luvisols. Fires in the 1920s have typically been responsible for stand origin in these young climatic climax forests. In the intervening decades, succession towards white spruce dominance has often occurred. Many of these forests are nearing old-growth status (see next type). Associated rare species are *Brachythecium campestre, Campylium polygamum, C. radicale*, the yellow form of spotted coralroot (*Corallorhiza maculata* forma *flavida,* color plate d), *Peltigera evansiana, Physcia dimidiata,* and *Physciella melanchra*. Common dominants are wild red raspberry, dewberry, beaked hazelnut, and low-bush cranberry. The association is similar to the aspen/green alder/bunchberry association of Beckingham (1993).

Table 1. Blackfoot plot locations and summary data. Vegetation classes: b=bog, f=forest, g=grassland, m=meadow, s=shrubland, w=weed disclimax; ecological moisture regime (EMR), Drainage, Successional Status, and Factors codes are standard Alberta Environmental Protection Site Description form codes. Species codes under Dominants, Rares, and Other Dominants use the standard seven letter codes of Alberta Environmental Protection (1993).

Plot	LSD-Sect-Twp-Rge-Meridian	Class	EMR	Drainage	Succ.	Factors	Dominant Species	Rare Species	Other Dominants	Comments
44	02-11-52-20-4	s	5	3	2	5	lathven, rosaaci, solican, calacan, sympocc	braccam	rubuida, poa sp.	
45	03-10-52-20-4	s	5	3	2	5	anemcan, lathven, rosaaci, solican, bromine		sympocc, prunvir	
46	09-09-52-20-4	s	5.5	3	2	5	poputre, corycor, rosaaci, lathven, popubal		calacan	artelud present
47	07-12-52-20-4	f	6	3	8	4	picegla, rubuida, poputre, betupap, aralnud		popubal, alnuten, heralan	old growth mixedwood
48	03-26-52-20-4	m	8	6	5	8	poteans, eleopal, juncbal, careprg, poa pra		taraoff, carelan, drepadu	weedy
49	03-26-52-20-4	m	8	6	5	8	planmaj, puccdis, eleopal, poa int			salt spring
50	14-23-52-20-4	m	8	6	5	8	eleopal, cicumac, glycgra, scirmic, puccdis		planmaj, trifrep, glycstr	salty riparian
51	02-19-52-20-4	b	7	6	6	6	picemar, ledugro, rubucha, sphanem, pleusch	braccam	hypophy, usnehir, vaccvit	near bog edge
52	16-18-52-20-4	s	5	3	2	5	loniinv, corycor, rosaaci, rubuida, calacan		parmsul, pylapol, physads	extreme Aw dieback
53	09-18-52-20-4	s	5	3	2	5	corycor, calacan, lathven, aralnud, rubuida		poputre, rosaaci, solican	intense shade and litter
54	10-18-52-20-4	b	7	6	6	6	picemar, ledugro, pleusch, sphamag, hylospl	gaulhis	ptilcri	incipient bog formation
55	04-19-52-20-4	f	7	5	7	8	picegla, poputre, astecon, corncan, rubuida	camprad, braccam, campol	rubupub, vibuedu	riparian, heterogeneous
56	14-18-52-20-4	f	5	3	7	4	picegla, poputre, popubal, corncan, aralnud	physmel, camppol	rubupub, vibuedu, maiacan	young climax, no fire due to wetland
57	01-12-52-20-4	f	5	3	7	4	betupap, poputre, aralnud, corncan, corycor		rubuida, rubupub	birch-aspen; clemocc
58	06-07-52-19-4	s	6	4	2	5	rubuida, cirsarv, salibeb, popubal, rosaaci		poa pra, dactglo, salipse	moistest, flattest beaver shrub
59	08-12-52-20-4	w	6	4	9	2	rubuida, equiarv, popubal, poputre, plagell	camppol	taraoff, phlepra	roadside
60	12-18-52-19-4	f	5	3	3	4	poputre, calacan, corycor, epilang, rosaaci	braccam	pyroasa, solican	on sand
61	06-18-52-19-4	f	5.5	3.5	8	8	poputre, popubal, rosaaci, rubuida, pyroasa	camppol, braccam	astecon, maiacan	old growth Aw with gap regen
62	04-18-52-19-4	f	5	3	3	4	poputre, corycor, aralnud, rubuida, rosaaci	braccam	corncan, pyroasa	arnicor; modal type
63	09-31-52-19-4	s	4	2	2	6	prunvir, agrotra, lathven, sympocc, soligig		rosaaci, poputre	nice shrubland; colluv.
64	02-31-52-19-4	g	4	2.5	5	6	artelud, galibor, viciame, poputre, poa pra		trifrep	significant site; grassland
65	15-30-52-19-4	w	5	3	9	2	poa pra, trifrep, galibor, phlepra, taraoff	braccam	agrotra, caresic	disturbed
66	02-31-52-19-4	m	7	6	5	8	juncbal, hordjub, taraoff, poa pra, careprg		puccdis	spargra; salt meadow
67	14-31-52-19-4	f	6	4	7	4	poputre, aralnud, corncan, corycor,	coramac, camppol,	rosaaci, vibuedu	lower slope rich site

Plot	LSD-Sect-Twp-Rge-Meridian	Class	EMR	Drainage	Succ.	Factors	Dominant Species	Rare Species	Other Dominants	Comments
							amelaln	braccam		
68	13-32-52-19-4	f	5	3	7	4	poputre, corycor, lathven, rosaaci, aralnud		corncan, rubupub	modal type; canopy breakup
69	08-02-52-20-4	f	7	4.5	7.5	6	popubal, rubuida, ribeoxy, cornsto, corycor	physdim, braccam	loniinv	uncommon site; Humic Gleysol
70	08-02-52-20-4	f	5	3	7	8	picegla, betuneo, aralnud, corncan, corycor	pelteva, braccam	rubuida, rubupub	uncommon site; diverse
71	08-02-52-20-4	f	5	3	4	6	betupap, corycor, popubal, rubupub, prunvir		flavfla	uncommon site; sand, Bw
72	06-01-52-20-4	f	5	3	4	4	poputre, corycor, aralnud, lathven, loniinv	physdim, braccam	corncan, rubupub	modal type; high shrub
73	04-19-52-20-4	m	7	5	1	8	alopaeq, epilcil, becksyz, barbung, pohlnut	bryucyc	leptpyr	rare site; diverse; riparian
74	11-17-52-20-4	f	5	3	7	6	rubuida, poputre, picegla, rubupub, aralnud	physdim	schipur, maiacan, pyroasa	uncommon type; adoxmos
75	12-30-52-20-4	m	7	5.5	2	8	calacan, salibeb, poputre, physads, parmsul		cornsto	impanol present
76	12-30-52-20-4	m	7	5	2	8	mattstr, calacan, poputre, corycor, salibeb		popubal, rubuida	riparian; impanol
77	02-29-52-20-4	w	4	2	9	2	agrotra, cirsarv, trifrep, poa pra, sympocc		galibor, taraoff	v. low diversity
78	12-09-52-20-4	w	5	3	9	2	calacan, rubuida, medisat, sonculi, bromine	braccam	poa pal	strange spp. assemblage
79	11-10-52-20-4	s	5	3	2	5	rubuida, corycor, rosaaci, epilang, physads	physdim	rubupub, corncan	disease/insect-caused diversity
80	03-16-52-20-4	b	7	6	5	6	ledugro, polystr, rubucha, sphanem, betuneo		vaccvit	open bog; diverse non-vasculars
81	03-19-52-19-4	f	6	3	8	6	poputre, picegla, rubuida, vibuedu, aralnud	pelteva, braccam, camppol	equipra, cornsto	nice old growth MX; survived fire
82	13-29-52-19-4	m	8	6	5	5	calacan, careath, phaeorb, drepadu, salibeb		epilcil	nice example of vegetation dynamics
83	06-29-52-19-4	w	5	4	9	2	planmaj, phlepra, trifrep, poa com, bromine	braccam	calacan, agrotra	weedy trail
84	15-19-52-19-4	f	5	3	4	4	poputre, corycor, rosaaci, rubuida, physads	braccam	corncan	younger than typical
85	07-13-52-20-4	w	5	3	9	2	bromine, cirsarv, taraoff, poa pra, rubuida		agrorep, achimil	old well site
86	16-15-52-20-4	s	5	3	2	5	poputre, amelaln, corycor, calacan, pyroasa		rubuida, corncan	succession back to Aw
87	13-01-52-20-4	f	7	5	8	8	popubal, calacan, rubuida, poputre, careath	camppol	rubupub, cornsto, rosaaci	heterogenous catchment site

Table 2. Blackfoot vegetation/site types. Ecological moisture regime (EMR), Drainage, Successional Status, and Factors codes are standard Alberta Environmental Protection Site Description form codes. Species codes under Dominants, Rares, and Other Dominants use standard seven letter codes.

Association	Vegetation Class	EMR	Drainage	Succ	Factors	Rare Species	Plots
Sb/Ledugro/Rubucha/Sphagnum	Bog	7	6	5-6	6	Braccam, Gaulhis	51,54,80
Aw/Corycor	Young Deciduous, modal upland	5	3	3-4	4,6	Braccam,Physdim	60,62,71,72,84

Association	Vegetation Class	EMR	Drainage	Succ	Factors	Rare Species	Plots
Aw-(Sw)/Aralnud/Corncan	Young Climatic Climax; +/- Betula	5(6,7)	3(4,5)	7	4(6,8)	Braccam,Camppol,Camprad,Coramac Pelteva,Physdim,Phymel	55,56,57,67,68,70,74
Aw-Bp+/-Sw/Rubuida	Mature and Old-Growth Decid. + MX	5.5-7	3-5	7.5-8	4,6,8	Braccam,Camppol,Pelteva,Physdim	47,61,69,81,87
Poa pra-Artelud-Galibor	Native Grassland	4	2.5	5	6		64
Calacan	Wet Grass (riparian) Meadow; +/- Alopaeq	7-8	5-6	1,2,5	8(5)	Bryucyc	73,75,76,82
Puccdis-Eleopal	Salt Meadow	7-8	6	5	8		48,49,50,66
Rosaaci-Rubuida/Lathven	Beaver Shrubland	5(4,6)	3(2,4)	2	5(6)	Braccam,Physdim	44-46,52,53,58,63,79,86
Taraoff-Trifrep-Poa	Weed Disclimax	4-6	2-4	9	2	Braccam,Camppol	59,65,77,78,83,85

(4) Aspen - balsam poplar +/- white spruce/wild red raspberry forest is typical of the moister end of the upland forest gradient (plots 47, 61, 69, 81, 87). These mesic-subhygric to hygric, mature and old-growth mixedwood forests are occasional on well to imperfectly-drained sites. Soils range from Orthic Gray Luvisols to Humic and Luvic Gleysols. Canopy heights are the greatest found in the Blackfoot, reaching 21, 22, 23, 24, and 28 m in the plots examined. These forests typically have both high structural and species diversity. Associated rare species are *Brachythecium campestre, Campylium polygamum, Peltigera evansiana,* and *Physcia dimidiata*. Red-osier dogwood is a common dominant. The association is similar to the aspen--balsam poplar/rose--raspberry/pink wintergreen and aspen/red-osier dogwood associations of Beckingham (1993).

Old-growth forests in the Blackfoot are most commonly found as small patches that have escaped fire (or previous logging), either by chance, or due to proximity of a wetland, pond, or lake firebreak. The largest contiguous old-growth white spruce mixedwood forest found in the Blackfoot is on the island in Islet Lake. A basal age of a dominant aspen in plot 87 was >90 years; a dominant white spruce in plot 81 had a basal age of ~114 years. The Alberta Vegetation Inventory origin date for this site is 1889 (~109 years). The characteristic high biodiversity of old-growth forests, from structural-functional to biotic (Meslow et al. 1981; Maser 1990; Hammond 1991; Stelfox 1995; Timoney and Robinson 1996), coupled with their limited cover in Blackfoot, makes these forests a protection priority for management.

4.1.2 Non-Forest Communities

(5) The Kentucky bluegrass - prairie sagewort - northern bedstraw association represents the only true grassland we documented in the Blackfoot (plot 64, color plates c and h). It was found on a rapidly to well-drained south-facing morainal slope. The soil was likely a Dark Gray Luvisol (a well-developed ~10 cm Ah). The community was classified as a submesic, young edaphic climax on the basis of the influence of south aspect and its successional relationship to dry aspen forest. While there were no rare plants found at the site, the plot (and area immediately nearby) contained many significant species rare within the Blackfoot, such as green needlegrass, junegrass, slender blue beardtongue, bergamot, bastard toadflax, Sprengel's sedge, dragonwort, common blue lettuce, and plains cinquefoil.

The association is likely a variant of the Peace River Prairie *Agropyron - Stipa* association of Moss (1955) rather than related to a plains rough fescue (*Festuca hallii*) association. It is interesting that the grassland is contiguous with a salt meadow (plot bf66, color plate i) on the NE foreshore of Blackfoot Lake. About 200 m east of plot 64, on a SW-facing slope of Crooked Lake, Griffiths et al. (1997) found a grassland dominated by Kentucky bluegrass and Canada wild rye (their plot 32). Griffiths et al. (1997) found a similar site (plot 22) dominated by slender wheatgrass and Kentucky bluegrass with saskatoon and chokecherry "below a headland west of Elk Push Lake" which they classified as "dryland shrubbery" ("dryland shrub" of Looman 1983). It is possible that soil salinity plays a role in the presence of the plot 64 grassland, although no halophytes were found at the site. The plot 64 grassland is restricted to an area of about 10 by 30 m on the south and SE-facing slope of the isthmus between Crooked and Blackfoot Lakes. Its high cover of Kentucky bluegrass indicates past disturbance. The remainder of the isthmus, while appearing identical to the grassland on airphotos, is a weedy disclimax. Clearly there was some major human disturbance of the isthmus in the past.

(6) The bluejoint reedgrass wet meadow association is found in imperfectly to poorly-drained sites bordering water bodies (ponds, lakes, drainages) or in seasonally-inundated depressions (plots 73,75 (color plate b),76,82 (color plate a)). Moisture regime is typically hygric to subhydric, and successional status varies widely depending on site history, ranging from pioneer and young seral in recently-exposed sites to young edaphic climax at sites characterized by persistent water level fluctuations. Soils vary from Rego to Humic Gleysols. The only rare plant found associated with the

wet meadow type was *Bryum cyclophyllum*. That site (plot 73, color plate k) was an unusual recently-exposed, incised valley bottom where primary succession was taking place on the valley bottom sediments. Common associates of the bluejoint reedgrass Bebb's willow, northern willowherb, awned sedge, and *Drepanocladus aduncus*. Succession is toward willow carrs (=shrub-dominated communities) and balsam poplar forest. Dieback of forest due to beaver flooding or to disease can result in retrograde succession to bluejoint reedgrass meadow. The association lies approximately midway in a typical wetland succession in central and northern Alberta described by Moss (1955) as: "*Potamogeton* > *Nuphar--Sagitarria--Myriophyllum* mixtures > *Scirpus--Typha--Glyceria--Eleocharis* mixtures > *Carex rostrata (C. utriculata)* or *Carex atherodes* > *Calamagrostis* > *Salix planifolia* > *Salix--Alnus--Populus* mixtures > *Picea glauca*". It is similar to the low moor (reed swamps and marshes) type of Lewis et al. (1928).

(7) The slender salt-meadow grass - creeping spike rush salt meadow association is rare in the Blackfoot and is restricted to wetlands with appreciable salt contents (plots 48, 49 (color plate l), 50, 66, color plate i). *Hordeum jubatum* (foxtail barley) is characteristic on less salty soils. Drainage is poor and moisture regime is hygric to subhydric. Soils are Rego Gleysols. Topography is level to depressional. These are edaphic climax communities in which salty groundwater is the overriding factor shaping the vegetation. While we found no rare plants at these sites, the site/vegetation type is significant due to its rarity and its importance as a source of minerals for wildlife (e.g., Baker Springs area mineral lick). Some interesting plant species are associated with this type, including alkali cordgrass, three-square rush, plains cinquefoil, and spear-leaved goosefoot. The rare moss *Desmatodon heimii* (S2 status) was found in a saline meadow by Griffiths et al. (1997). Saline meadows were found in only two areas: Baker Springs and the NE foreshore of Blackfoot Lake. The salt meadow site type is clearly rare in the study area as the extensive wetland investigations of Griffiths et al. (1997) found only one occurrence (also on Blackfoot Lake). The association is similar to vegetation of saline depressions noted for southeastern Alberta (Moss 1995).

(8) The prickly rose - wild red raspberry / purple peavine association is a beaver-dependent shrubland community typical of well-drained (ranging from rapidly to moderately well-drained) slopes near beaver ponds (plots 44, 45, 46, 52, 53, 58, 63, 79 (color plate j), 86). Moisture regime is typically mesic (ranging from submesic to subhygric). Soils are Orthic Gray Luvisols. These young seral communities form when beavers remove all or most of the canopy from aspen and aspen - balsam poplar forests (types 2,3,4 above) resulting in a lush growth of shrubs. Succession by aspen is continuous, leading to reestablishment of forest if beaver feeding ceases. This association also includes shrublands caused by dieback due to the combined pressures of fungal pathogens and defoliating insects such as tent caterpillars (e.g., plots 52, 79). Rare plants associated with this type are *Brachythecium campestre* and *Physcia dimidiata*. Common dominants include buckbrush, beaked hazelnut, saskatoon, chokecherry, bebb's willow, and bluejoint reedgrass. Considerable effort was spent in studying sites identified on airphotos in hopes of finding "true" (i.e., climatically/edaphically controlled) grasslands and shrublands. These beaver-created shrublands, because they are the outcome of a combination of hummocky ground moraine (knob and kettle topography), kettle ponds, aspen forests, and beaver, characterize the Blackfoot more than any other type. Ant populations are high in these shrublands. The association is seral to the upland forest associations (items 2, 3, and 4, above).

(9) The dandelion - white clover - bluegrass association is a widespread, variable weed disclimax (plots 59,65,77(color plate e),78,83,85). Soil drainage and moisture regime range widely: drainage, from rapidly to moderately well; and moisture regime from submesic to subhygric. Disturbance, rather than physical site conditions, is responsible for the character of this type. Disclimaxes are found along roads, the extensive trail systems, and cutlines bordering fences and boundaries; in staging areas, picnic areas and shelters, and borrow pits; near agricultural development zones and wetlands subjected to dam removal/reflooding cycles; and extend into the

adjoining native plant communities. Rare species found in this type are *Brachythecium campestre,* and *Campylium polygamum*. Common associated dominants are Kentucky bluegrass, Canada bluegrass, smooth brome, timothy, Canada thistle, smooth perennial sow thistle, wild red raspberry, slender wheatgrass, and in wetter areas, bluejoint reedgrass, tickle grass, Canada thistle, silverweed, duckweed, and nodding beggarticks. The species assemblages and cover values vary widely in concert with moisture regime and disturbance history.

4.2 Provincially Rare Plant Species (Map 1, in pocket)

There are currently 509 plant taxa documented for the study area (Appendix 1). By group, there were 18 liverworts (3.5%), 50 lichens (9.8%), 92 mosses (18.1%), 36 native vascular plants of disturbed habitats (ruderal species) (7.1%), 270 vascular plants of undisturbed habitats (53.0%), and 43 non-native vascular plants (8.4% of total). Of the 349 vascular taxa, 10.3% were native ruderals, 77.4% were non-weedy native plants, and 12.3% were non-native plants. Thus, 22.6% of the vascular flora are plants of disturbed habitats.

Overall for the province of Alberta, approximately 15% of the vascular plant flora is non-native (J. Gould, pers. comm. 1998). The somewhat lower non-native percentage for the Blackfoot may be due in part to the exclusion of the agricultural zones from this and the Griffiths et al. (1997) studies.

We found 11 provincially rare species of plants classified as S1 or S2 (or S3 if on the "watch list", or unclassified for lichens); 5 mosses, 3 lichens, and 3 vasculars) (Table 3). Adding those 15 provincially rare (S1 or S2) plant species found by Griffiths et al. (1997) not in common with this study, brings the total known provincially rare flora of the Blackfoot to 26 species. Those species found by Griffiths et al. (1997) and not found in this study were: *Weissia controversa, Phascum cuspidatum, Desmatodon heimii, Physcomitrium pyriforme, Drepanocladus crassicocostatus,* and *Conardia compacta* (6 mosses), and *Potamogeton foliosus, P. obtusifolius, Carex trisperma, C. vulpinoidea, Eriophorum chamissonis, Wolffia columbiana, Malaxis monophylla, Rumex orbiculatus,* and *Cicuta virosa* (9 vasculars). By rare plant group, there are 11 mosses, 3 lichens, and 12 vasculars. We discuss the 11 provincially rare species that we found, below.

Brachythecium albicans ("S2?" status) was found once (plot bf75, color plate b). This is probably a European species that was introduced to Eastern North America (Crum and Anderson 1981). It is common in eastern Canada and may be more common in Alberta than records show (R. Belland, pers. comm. 1997). The genus *Brachythecium* needs a complete revision. *B. albicans* occurs in fairly weedy situations, often in disturbed grassy roadsides.

Brachythecium campestre (S2 status) was found 15 times (bf44, 51, 55, 60, 61, 62, 65, 67, 69, 70, 72, 78, 81, 83, 84). While classified as rare, it is in our experience common in Alberta. The moss is characteristic of mixedwood forests on tree bases, soil, and logs.

Bryum cyclophyllum (S1 status) was found once (bf73, color plate k). It occurs rarely and sporadically across Canada on wet soil.

Campylium polygamum (S3 status, watch list) was found 7 times (bf55, 56 (color plate f), 59, 61,67, 81, 87). This species is probably not rare in Alberta (it is probably under-identified). It occurs all across Canada, and is usually found along creeks and in wet meadows and fens.

Campylium radicale (S1 status) was found once (bf55). It is fairly widespread across Canada but uncommon and probably overlooked. It is found on decaying leaves, twigs, humus, and mucky soils in wet habitats. It may be present in plots bf62 and 65 also, but could not be independently

verified due perhaps to difficulty finding a small specimen amongst other mosses in the herbarium packet.

Corallorhiza maculata forma *flavida* (yellow form of spotted coralroot, watch list status) was found once (bf67). Its status requires study. Also referred to as variety *flavida* in some accounts, this taxon may be the equivalent of an albino variant (Hitchcock et al. 1969). The species, as a whole, occurs sporadically in "moist to fairly dry woods" across temperate North America (Hitchcock et al. 1969). The spotted purple (forma *maculata*), yellow (forma *flavida*), unspotted (var. *immaculata*), and other segregates of the species apparently grow on similar sites (i.e., they are morphological rather than ecological variants), as we have observed on our land (Twp 51, Range 21, NW Section 31, W4) where the yellow and spotted purple forms grow near one another.

Gaultheria hispidula (creeping snowberry, status "S2S3") was found in the black spruce / labrador tea / cloudberry / *Sphagnum* association (bf54); it was found twice (plots 20 and 35) by Griffiths et al. (1997). It is regionally rare.

Peltigera evansiana (rare, ANHIC status undetermined) was found twice-- once on the island in Islet Lake (bf70) and once near a pond along the Roundup Trail (bf81)-- in both cases in mature to old-growth white spruce mixedwood forest. Goffinet and Hastings (1994) report that in Alberta this species is locally common around Edmonton and rare elsewhere, and that it grows on rotten wood or tree roots in aspen, balsam poplar, or mixedwood forests. Griffiths et al. (1997) found this species once, also on the island in Islet Lake.

Physcia dimidiata (rare, ANHIC status undetermined) was found 4 times (bf51,69,72 (color plate g),74). It occurs on aspen and poplar bark.

Physciella melanchra (rare, may be new to province) was found once (bf56, color plate f). It occurs on bark in the upper plains of North Dakota and Montana (T. Esslinger, pers. comm. 1997), and while Esslinger has never seen a specimen from Alberta, he states that he would expect it to be fairly widely distributed in southern Canada, especially east of the Continental Divide.

Wolffia punctata (= *W. borealis,* northern ducksmeal, S3 status, on watch list) was found once (@53° 29' 29", 112° 49' 50"; T52, Rge 20, W5, Sect 14, LSD 9) in a beaver pond with *Lemna minor*. It is noteworthy that three wood ducks were noted at this pond, the only wood ducks we observed in the study area. Griffiths et al. (1997), who focussed on the wetlands of the Blackfoot, found *Wolffia punctata* seven times, generally in beaver ponds in association with *Lemna minor*. The habitat and range of *Wolffia punctata*, after Wayne P. Armstrong, Oregon State University (see: www.orst.edu / dept / botany / herbarium / projects / lemn /) are: "Floating at surface of quiet streams and ponds, often mixed with other Lemnaceae and aquatic plants... Occurring in widely separated disjunct populations throughout the Pacific, midwestern and Eastern United States, and southern Canada (Ontario and British Columbia); possibly introduced by migratory waterfowl into southern California (San Diego County)." Northern ducksmeal is known only from central Alberta (J. Gould, pers. comm. 1998).

Table 3. Provincially rare plants of the Blackfoot PRA found during this study.

Species	Common Name	Sites and ANHIC Status
Brachythecium albicans		bf75; "S2?"
Brachythecium campestre		bf44,51,55,60,61,62,65,67,69,70,72,78,81,83,84; S2
Bryum cyclophyllum		bf73; S1
Campylium polygamum		bf55,56,59,61,67,81,87; S3
Campylium radicale		bf55; S1
Corallorhiza maculata forma *flavida*	Spotted Coralroot, Yellow Form	bf67; watch list; S3 status uncertain
Gaultheria hispidula	Creeping Snowberry	bf54; S2S3
Peltigera evansiana		bf70,81; status uncertain
Physcia dimidiata		bf51,69,72,74; status uncertain
Physciella melanchra		bf56; rare; new to province?
Wolffia punctata	Northern Ducksmeal	@53° 29' 29'', 112° 49' 50''; S3, watch list (S2 by Griffiths et al. 1997); = *W. borealis*

4.3 Other Significant Plant Species (Table 4)

Adoxa moschatellina (moschatel) was found once (in plot bf74); it is a locally uncommon plant of moist white spruce and mixedwood forests.

Arnica cordifolia (heart-leaved arnica) was found once (bf62), surprisingly, in an aspen/beaked hazelnut young deciduous modal upland forest. It is a regionally rare western plant at the eastern edge of its range.

Artemisia ludoviciana (prairie sagewort) was found in the Kentucky bluegrass - prairie sagewort - northern bedstraw grassland plot (bf64, color plate c), and sporadically elsewhere in dry open areas; it is locally uncommon.

Caltha natans (floating marsh-marigold) was found on recently-exposed riparian silt in the creek valley that drains Neon Lake (bf55, 73, color plate k); it is locally uncommon.

Carex backii (Back's sedge) was found in an aspen - white spruce / sarsaparilla / bunchberry forest young climatic climax association (bf74); it is uncommon in Alberta.

Carex sprengelii (Sprengel's sedge) was found in grassland outside of plot bf64; it is uncommon in Alberta.

Carex sychnocephala (long-beaked sedge) was found on recently-exposed riparian silt and sand (in bf73); it is uncommon in Alberta, but appears to be widespread in the Blackfoot.

Carex torreyi (Torrey's sedge) was found in prickly rose - wild red raspberry / purple peavine beaver shrubland (bf63); it is uncommon in Alberta.

Cerastium nutans (long-stalked mouse-ear chickweed) was found three times on sparsely-vegetated, salt spring (bf49, color plate l) or riparian (bf55, 73) mud or silt. This species is near its southern limit at Blackfoot; it is infrequent across the southern boreal forest (Johnson et al. 1995).

Circaea alpina (small enchanter's nightshade) was found in an aspen - balsam poplar - white spruce / wild red raspberry old-growth forest association (bf81); it is a plant of shady white spruce and mixedwood forests that is locally uncommon.

Clematis occidentalis (purple clematis) was found in a paper birch - aspen / sarsaparilla bunchberry young climatic climax forest (Aw-Sw/Aralnud/Corncan association, bf57); this species is near its eastern limit in Alberta.

Dactylis glomerata (orchard grass) is an uncommon weed in Alberta, yet is common on trails and roadsides in the Blackfoot.

Dracocephalum parviflorum (American dragonhead) was found @53° 30' 58", 112° 54' 12", about 3 m from the Cutoff Trail in a slender wheatgrass / Lindley's aster weedy shrub-"grassland". Other dominants in this community were Kentucky bluegrass, Canada thistle, giant hyssop, buckbrush, prickly rose, and red clover. It was also found near bf77 @53° 30' 50", 112° 54' 33", in a disclimax dominated by Kentucky bluegrass and Canada thistle. American dragonhead is regionally uncommon. Both areas may have been native slender wheatgrass grasslands in the past.

Erigeron annuus (whitetop) was found in a weed disclimax (dandelion - white clover - bluegrass association, bf77, color plate e); it is locally uncommon.

Geranium richardsonii (wild white geranium) was found in weedy communities (e.g., bf59). It is sporadic in the Blackfoot along trails and open areas. This western species is locally uncommon and at the eastern edge of its range.

Gnaphalium palustre (marsh cudweed) was found on the riparian silt and sand of bf73. Occurrences of cudweed elsewhere in wet spots on trails may be ascribable to *G. uliginosum* (low cudweed), found by Griffiths et al. (1997). Marsh cudweed is uncommon and at the edge of its range.

Gratiola neglecta (clammy hedge-hyssop) was found once (bf73) with *Gnaphalium palustre, Bryum cyclophyllum, Carex sychnocephala, Caltha natans,* and others; it is uncommon.

Habenaria viridis (bracted bog orchid) was found once in an aspen / beaked hazelnut / bluejoint reedgrass - fireweed forest on sand (bf60); it is locally uncommon. Griffiths et al. (1997) also found this orchid once in a poplar forest (their plot 27).

Impatiens noli-tangere (western jewelweed) was found twice (bf75, color plate b, bf76), both times in a bluejoint reedgrass wet meadow association with spotted touch-me-not; it is locally rare.

Koeleria macrantha (June grass) was found once in grassland (bf64); it is locally rare.

Lactuca pulchella (common blue lettuce) was also found once in grassland (bf64); it is locally rare.

Table 4. Non-provincially rare plants that are otherwise significant in the Blackfoot.

Species		Comments
Adoxa moschatellina	moschatel	bf74; locally uncommon
Arnica cordifolia	heart-leaved arnica	bf62; regionally rare; western, at e. edge of range
Artemisia ludoviciana	prairie sagewort	bf64 and sporadic in dry open areas; locally uncommon
Caltha natans	floating marsh-marigold	bf55, 73; locally uncommon
Carex backii	Back's sedge	bf74; uncommon in AB
Carex sprengelii	Sprengel's sedge	outside of bf64; uncommon
Carex sychnocephala	long-beaked sedge	bf73; uncommon in AB, common in BF
Carex torreyi	Torrey's sedge	bf63; uncommon
Cerastium nutans	long-stalked mouse-ear chickweed	bf49, 55, 73; at southern limit
Circaea alpina	small enchanter's nightshade	bf81; locally uncommon
Clematis occidentalis	purple clematis	bf57; uncommon, at e. edge of range in AB
Dactylis glomerata	orchard grass	common on trails, roadsides in bf; uncommon weed in AB
Dracocephalum parviflorum	American dragonhead	found twice: @53° 30' 58", 112° 54' 12" and near bf77
Erigeron annuus	whitetop	bf77; locally uncommon
Gaultheria hispidula	creeping snowberry	bf54; regionally rare
Geranium richardsonii	wild white geranium	bf59, sporadic in bf; locally uncommon;western, at e. edge of range
Gnaphalium palustre	marsh cudweed	bf73; sporadic elsewhere on trails; uncommon, edge of range
Gratiola neglecta	clammy hedge-hyssop	bf73; uncommon
Habenaria viridis	bracted bog orchid	bf60; locally uncommon
Impatiens noli-tangere	western jewelweed	bf75, 76; locally rare
Koeleria macrantha	June grass	bf64; locally rare
Lactuca pulchella	common blue lettuce	bf64; locally rare
Lycopus uniflorus	northern water-horehound	bf55, 87; locally rare
Lysimachia ciliata	fringed loosestrife	bf63; uncommon; at northern limit
Matricaria perforata	scentless chamomile	aggressive weed; scentless chamomile; Blackfoot Staging Area parking lot
Matteucia struthiopteris	ostrich fern	bf76; uncommon in AB
Monarda fistulosa	wild bergamot	bf64; regionally uncommon;
Muhlenbergia glomerata	bog muhly	uncommon in Blackfoot; w. of Griffiths plot 22; beaver shrubland
Penstemon procerus	slender blue beardtongue	bf64; locally uncommon, at northern limit
Potentilla bipinnatifida	plains cinquefoil	bf64, 66; uncommon
Puccinellia distans	slender salt-meadow grass	bf49, 50, 66; uncommon
Pyrola elliptica	white wintergreen	bf61; common in bf, regionally common; otherwise uncommon
Ribes americanum	wild black currant	locally uncommon, but common in Blackfoot
Scirpus pungens	three-square rush	bf66; at northern limit
Spartina gracilis	alkali cordgrass	bf66; locally uncommon
Stipa viridula	green needle grass	bf64; regionally uncommon

Lycopus uniflorus (northern water-horehound) was found in imperfectly-drained, riparian and catchment margins periodically-disturbed by flooding/drawdown (bf55, 87, and near bf73, color plate k); it is locally rare.

Lysimachia ciliata (fringed loosestrife) was found occasionally in shrub communities (e.g., bf63); it is "widespread but not abundant" (Johnson et al. 1995).

Matricaria perforata (scentless chamomile) is an agricultural weed found once in the Blackfoot Staging Area parking lot.

Matteucia struthiopteris (ostrich fern) was found once (bf76) in a riparian bluejoint reedgrass wet meadow. The plot and vicinity supports the largest population of ostrich fern we have observed in Alberta, extending about 100 m southward from plot bf76. Ostrich fern is an uncommon plant of moist to wet riparian forests and "swamps" in Alberta.

Monarda fistulosa (bergamot) was found once in grassland (bf64, color plate h); it is regionally uncommon.

Muhlenbergia glomerata (bog muhly) is uncommon in Blackfoot. It was found on an ant hill in beaver shrubland, west of Griffiths et al. (1997) plot 22; it is a "widespread but rarely abundant" species more typical of elevated ant mounds in fens (Johnson et al. 1995).

Penstemon procerus (slender blue beardtongue) was found twice: in grassland (bf64) and in a nearby weedy Kentucky bluegrass - white clover - northern bedstraw disclimax (bf65) that was likely native grassland in the past; it is locally uncommon and near its northern limit.

Potentilla bipinnatifida (plains cinquefoil) was found twice: in grassland (bf64), and in a saline meadow (bf66, color plate i); it is widespread but not abundant in Alberta.

Puccinellia distans (slender salt-meadow grass) was found in three saline communities (bf49 (color plate l), 50, 66, color plate i); it is uncommon in Alberta.

Pyrola elliptica (white wintergreen) was found in a number of sites (e.g., bf61); it is common in the Blackfoot, regionally common, but otherwise uncommon in Alberta (see range map in Moss 1983).

Ribes americanum (wild black currant) is locally uncommon, but is common in the Blackfoot in moist forests.

Scirpus pungens (three-square rush) was found once: in the bf66 (color plate i) saline meadow; it is near its northern limit.

Spartina gracilis (alkali cordgrass) was found once: in the bf66 (color plate i) saline meadow; it is locally uncommon.

Stipa viridula (green needle grass) was found once in grassland (bf64); it is regionally uncommon.

4.4 Plant and Community Diversity and Disturbance Regime

Spatial differences in temperature, moisture, elevation, slope, aspect, soils, etc. create physical niches which beget biodiversity. Conversely, temporal variability in temperature, moisture, etc. at a site creates stress, which may limit the occupants of a site to those adapted to widely varying physical conditions-- thereby limiting biodiversity. In many cases, sites which are commonly disturbed/highly stressed are open habitats characterized by ruderal native species or non-native weeds. Repeated disturbance through heavy horse traffic on trails, maintenance of roads, oil/gas activities, and agricultural practices within the Blackfoot landscape creates conditions conducive to spread and dominance of weeds and decline of rare native plants and communities. In other cases, however, disturbance may act to create native biodiversity (e.g., fire, beaver activities, forest insect outbreaks) by creating a mosaic of shifting dominance relationships and sites characterized by low competition. Clearly, disturbance is a complex phenomenon. The type, frequency, and intensity of disturbance are important controls of biodiversity. If management wishes to maximize biodiversity, it needs to understand that different communities are adapted to different types, frequencies, and intensities of disturbance.

Blackfoot, as a whole, has fairly low spatial diversity, expressed as repetitive knob and kettle units. The area is dominated by hummocky ground moraine with relatively low relief knobs and kettles, clay loam Luvisolic soils, and mature aspen forests and beaver ponds, while at the same time there is fairly high temporal variability due to a northern continental climate. Thus, Blackfoot would be expected to have a relatively low plant species and community biodiversity at the scale of the study area. This is largely the case with two provisos: (1) while community diversity is fairly low, community richness is not-- mesic mature aspen forests dominate the uplands, but there are many other community types in the area that occur generally as small patches in the dominant matrix; these communities are important to management; (2) similarly, while plant species diversity is fairly low at the plot and study area scales, species richness is not; indeed, the combined species lists of Griffiths et al. (1997) and this study indicate a flora of circa 509 taxa-- far from depauperate (Appendix 1).

4.5 Uncommon or Characteristic Community and Site Types

4.5.1 Riparian Zones

Riparian zones (areas adjacent to and affected by flowing water) are rare in the study area as the Blackfoot is an upland watershed divide characterized by generally closed kettle depressions in hummocky moraine. Old-growth forests are often associated with the riparian zones. Watercourses are usually small, first-order streams that may carry flowing water only in the spring. Secondly, many valleys that might act as streams are instead submerged beneath beaver ponds. One *current* exception is the stream that drains Neon Lake (plots 55 and 73, color plate k).The creek flows in an incised valley of high physical diversity-- ranging from sunny dry slopes to shady alluvial silts, supporting the highest species richness (many ephemeral) observed in one 0.03 ha plot (112 taxa in plot 55) and rare or uncommon plants such as *Bryum cyclophyllum, Gratiola neglecta*, and *Lycopus uniflorus*. The valley in question was once under a pond behind a high beaver dam which was recently breached.

4.5.2 Beaver-Influenced Landscape Units

Prior to human settlement and, in particular, the establishment of the Blackfoot Provincial Recreation Area, fire and beavers would have been the two primary natural disturbance agents shaping the landscape. With human settlement of the area came fragmentation of forests in the form of roads and agricultural fields, which, combined with a policy of total fire suppression, have acted to eliminate fire as the prime landscape disturbance. With establishment of the Blackfoot PRA, and its multiple mandate of habitat protection, recreation, agriculture, and industry, human activities

supplanted fire as a primary agent of disturbance. Currently, it is human activity (see section 4.5.4) and beavers that shape the landscapes of the Blackfoot. Forest insects and disease are secondary forces (see section 4.5.3).

The importance of beavers in the Blackfoot landscape cannot be overstated. Through their dam-building and tree cutting they act to increase spatial variation in moisture, temperature, and vegetation cover. In the absence of beavers, an area of the Cooking Lake Moraine tends to be dominated by aspen forest on mesic uplands and hygric willow carrs in the lowlands. In the presence of beavers, some low-lying areas are converted to ponds with associated wet meadows, while some slopes near beaver ponds (particularly south-facing) are converted to beaver shrublands (see section 4.1.2(8)), while aspen forests and willow carrs continue to cover other areas. Moisture conditions on a beaver-influenced landscape range from aquatic to subxeric, and from cold and shady to warm and sunny. The increase in physical variability is expressed in a more diverse suite of communities and the life forms that inhabit them. With occasional natural breakage of dams or pond/dam abandonment, temporal variability in moisture conditions and communities is favored by the presence of beavers.

4.5.3 Landscape Units Influenced by Insects and Disease

In the past, forest insects and tree diseases were often viewed as detrimental agents to be eradicated or controlled. A more enlightened paradigm is emerging that views insects and disease as elements of biodiversity that act to shape landscapes, elements that are important and valuable in and of themselves. Of the more than 250 species of Fungi that are associated with decay of aspen in North America (Lindsey and Gilbertson 1978), most are saprophytes of standing dead trees or logs. There are at least 17 species of Fungi that are known to attack live aspen in Alberta (Thomas et al. 1960), and these organisms can be divided into three main categories: trunk rot and stain; root and butt rot; and sapwood decay and stain in stored logs (Hiratsuka et al. 1990).

The most common cause of aspen trunk rot in Alberta is *Phellinus tremulae*, followed by *Peniophora polygonia*; on balsam poplar, *Phellinus tremulae* is the most important agent causing trunk rot, followed by *Pholiota destruens* (Peterson and Peterson 1992). Three species of *Armillaria* (*A. ostoyae, A. sinapina*, and *A. calvescens*) are the major causes of butt rot on aspen and balsam poplar in Alberta (Peterson and Peterson 1992).

Over 300 species of insects have been recorded from aspen in Canada (Peterson and Peterson 1992). The largest group of insects attacking live aspen are the defoliators belonging to the Lepidoptera (moths and butterflies) and the Coleoptera (beetles). Of the Lepidoptera, the four main species that attack aspen are the tent caterpillar (aspen's primary defoliator), large aspen tortrix, Bruce spanworm, and aspen leaf miner. The main beetles are the aspen leaf beetle, American aspen beetle, poplar borer, poplar and willow borer, bronze poplar borer, and aspen agrilus. Outbreaks of the tent caterpillar typically last 4-5 years on a 10-year cycle. Evidence suggests that tent caterpillars by themselves, even after repeated years of severe defoliation, cause little direct mortality; their effects on aspen seem to be expressed primarily in a transient decline in growth rates (Ives and Wong 1988; Peterson and Peterson 1992, among others).

Few species and processes act in isolation. While a pathogen or an herbivore may not cause direct tree mortality, together in concert with drought stress, beaver-flooding, acid rain, pollution, climatic change, etc., they may act to cause significant mortality. This process is observable in the Blackfoot where there are forest stands in various stages of dieback and regrowth (e.g., plots bf52, 79 (color plate j), and 82 (color plate a)). Snags are abundant in these stands, providing excellent habitat for insects, insect-eating birds, and cavity-requiring birds and mammals, and their predators. Release of understory (due to loss of the canopy) typically leads to a lush shrub layer, providing excellent browse for moose, elk, and deer. The important conclusion is that uncontrolled forest insects and diseases act to maintain biodiversity.

Under the Blackfoot management plan (Alberta Environmental Protection 1997), however, action to control insects or diseases "may be taken where insect or disease problems could affect pasture areas within the Blackfoot, or have significant adverse affects on surrounding lands." It is difficult to envision how such control would be justified in that forest insects and diseases are fairly irrelevant in pastures, and claiming "significant adverse affects on surrounding lands" is more a matter of values and public education than science.

4.5.4 Weed Disclimaxes

One of the striking features of the plant communities and flora of the Blackfoot is the prevalence of weeds (plots 59, 65, 77, 78, 83, 85; see section 4.1.2(8)).

The Alberta Weed Control Act was written by and for agricultural interests in an effort to have legislative control over plants that grow adventively in agricultural fields. As such, the act's designations of "restricted", "noxious", and "nuisance" weeds are mute on the identification and classification of weeds of native habitats. Their presence, however, is an indicator of the degree of agricultural activity in an area. Weeds designated under the act that are present in the Blackfoot are: spiked (Eurasian) water-milfoil (*Myriophyllum exalbescens*) ("restricted" weed); perennial sow thistle (*Sonchus arvensis*), Canada thistle (*Cirsium arvense*), scentless chamomile (*Matricaria perforata*), and common tansy (*Tanacetum vulgare*) ("noxious" weeds); and common chickweed (*Stellaria media*), rough cinquefoil (*Potentilla norvegica*), quack grass (*Agropyron repens*), annual hawksbeard (*Crepis tectorum*), hemp-nettle (*Galeopsis tetrahit*), and dandelion (*Taraxacum officinale*) ("nuisance" weeds). Under the Blackfoot management plan (Alberta Environmental Protection 1997), weeds classified as restricted or noxious under the act will be subject to weed control, and herbicides may be used.

Many of the most serious weeds of native habitats, however, are missing from the Alberta Weed Control Act: they are agricultural plants themselves (e.g., smooth brome, Kentucky bluegrass, crested wheatgrass, the sweet clovers). The spread of these and other weeds across the landscape is a direct result of crop agriculture (which maintains open, invadable habitats characterized by high soil nutrient concentrations and much bare ground) and use of "tame" seed mixtures, aided by repeated soil and vegetation disturbances along roadsides, utility corridors, dugouts, and industrial, commercial, residential, and recreational sites, etc.

In addition to the expected roadsides, oil/gas developments, picnic areas, shelters, and parking lots, weed communities or populations occupy wetlands, lake foreshores, areas adjacent to agricultural fences and developments (and of course, the seeded pastures themselves), boundary fencelines, and most significantly, the 170 km of maintained trails which provide corridors for dispersal of weed propagules, and extend into many "native" upland plant communities. The dominance of smooth brome, along with Kentucky bluegrass, timothy, orchard grass, etc., indicates that tame seed mixtures may have been used on the trails.

There are two relevant life history characteristics of weeds: invasiveness (the ability to spread) and persistence (the ability to persist after establishment). Invasive and persistent weeds are aggressive. White et al. (1993) have classified the major invasive plants of natural habitats in Canada. Those that occur in the Blackfoot uplands are: Canada thistle (*Cirsium arvense*), smooth brome (*Bromus inermis*), and yellow sweet clover (*Melilotus officinalis*) (moderately invasive aliens), and absinth (*Artemisia absinthium*), alfalfa (*Medicago sativa*), Canada bluegrass (*Poa compressa*), crested wheatgrass *(Agropyron pectiniforme*), European mountain ash (*Sorbus aucuparia*), hemp-nettle (*Galeopsis tetrahit*), Kentucky bluegrass (*Poa pratensis*), and yellow rocket (*Barbarea vulgaris*) (minor invasive aliens). Invasive wetland plants of the Blackfoot are: Eurasian water-milfoil (*Myriophyllum exalbescens*) and reed canary grass (*Phalaris arundinacea*) (principal invasive aliens).

Some weeds, such as smooth brome, Kentucky bluegrass, Canada thistle, and dandelion, have

replaced native vegetation entirely in some areas, or extend many meters from trailsides into native communities. Smooth brome is a concern because it is easily dispersed by wind, water, and animals (evidence suggests its seeds survive passage through digestive tracts), and spreads vigorously via rhizomes; there is no known effective control (White et al. 1993). Canada thistle can outcompete native plants, decreasing species diversity, and changing the structure and function of communities (Hutchison 1992). Kentucky bluegrass is similar to brome in its ease of spread and persistence.

The aggressive nature of some of the weeds, and the widespread distribution of the disclimaxes are of concern to the long-term maintenance of ecological integrity and represent a management challenge. A key point for management to consider is the persistent nature of these communities-- many dominated by Canada thistle, smooth brome, Kentucky bluegrass, for example, are truly disclimaxes-- they can persist for decades. Without a change in management practices, the weed cover is likely to increase for the following reasons: (1) the aggressiveness of many species; (2) the continual disturbance in the form of road and trail maintenance, ATVs, bicycles, borrow pits, native ungulate traffic, and human foot traffic; (3) the widespread use of horses which act to create weed microsites in their hoof prints and in their nutrient-rich feces; and to introduce weed propagules in their droppings and on their pelages, and (4) the presence of weed refugia (pastures, dugouts, roadsides, etc.) from which weed propagules may be dispersed; (5) the use of tame seed mixtures at well, pipeline, battery sites, staging areas, in the pastures, etc.

4.6 Vegetation of the Blackfoot in Overview

In this section we provide a summary of the vegetation of the Blackfoot that merges Griffiths et al. (1997) with this study. One of the chief difficulties of describing vegetation is the great variety of descriptive names (e.g., swamps, carrs, thickets, sloughs, moors, mires, muskegs) that may mean different things to different people. This nomenclature problem is especially troubling with wetlands and for that reason we use, wherever possible, the standard wetland types described in National Wetlands Working Group (1988) and Zoltai and Vitt (1995). Our purpose below is to provide a quick overview of the vegetation dominants of the non-agricultural portion of the Blackfoot.

4.6.1 Uplands

A.Forests

1. Deciduous Forest
    a. Aspen: the most common forest type in the area on well-drained ridgetops and mid-slopes with the characteristic plants beaked hazelnut, prickly rose, and bunchberry
    b. Aspen - Balsam Poplar: a common variant of moist slopes, slope bases and wetland margins; red-osier dogwood and low-bush cranberry are characteristic
    c. Balsam Poplar: a variant of the above in which aspen is absent, restricted to imperfectly to moderately well-drained slope bases, creek valleys, and wetland margins; the shrub layer is usually lush; high-bush cranberry often replaces low-bush cranberry in these forests
2. Mixedwood Forest: admixtures of typically aspen, balsam poplar, and white spruce with or without paper birch or Alaska birch; characteristic plants are wild red raspberry, dewberry, beaked hazelnut, red-osier dogwood and low-bush cranberry; successional status varies from mature to old-growth
3. White Spruce Forest: like the above, a rare type that exists only in small patches, often on sites with lower fire probabilities; feather

mosses are typical

B.Grasslands and Dry Shrublands: a few occurrences of these types are found on the driest slopes, with the characteristic dominants Kentucky bluegrass, slender wheatgrass, prairie sagewort, northern bedstraw, Canada wild rye, saskatoon, or chokecherry.

C.Beaver Shrublands: a seral shrub community dependent on beaver activities found on slopes near beaver ponds with the characteristic prickly rose, wild red raspberry, purple peavine, accompanied by buckbrush, beaked hazelnut, saskatoon, chokecherry, bebb's willow, and bluejoint reedgrass; succession to deciduous forest takes place in the absence of beavers

D.Weed Disclimaxes: non-native assemblage disturbance communities characterized by dandelion, white clover, Kentucky and Canada bluegrass, smooth brome, timothy, Canada thistle, smooth perennial sow thistle, wild red raspberry, slender wheatgrass, and in wetter areas, bluejoint reedgrass, tickle grass, Canada thistle, silverweed, duckweed, and nodding beggarticks

4.6.2 Non-Organic Wetlands

E. Swamps (wooded wetland communities characterized by little peat accumulation, extreme seasonal water level fluctuation, presence of trees or tall shrubs, and a poorly-developed bryophyte layer; Zoltai and Vitt 1995)

1. White spruce: (e.g., Griffiths plot 28) with red-osier dogwood and the moss *Climacium dendroides*; this may be a wooded fen but soil information is needed
2. Deciduous: Griffiths et al. (1997) described a variety of communities dominated by river alder, balsam willow, flat-leaved willow, or mixed willows, sometimes with Alaska birch that are transitional to willow-sedge fens

F. Meadows and Marshes (treeless, nutrient-rich, graminoid-dominated wetlands with high primary production, high decomposition, sparse bryophytes, little peat accumulation, and large seasonal water level fluctuations; Zoltai and Vitt 1995)

1. Fresh (water chemistry dominated by calcium and bicarbonate), typically on the margins of water bodies, along streams, and in depressions
   a. Bluejoint Reedgrass wet meadow; the most common type; common in older drained beaver ponds and seasonally flooded flats; *Drepanocladus aduncus* is a characteristic moss; in the absence of high floods or during a prolonged drying trend, this type succeeds the following sedge types
   b. Awned Sedge, typical of frequently flooded depressions on somewhat higher ground than the following...
   c. Water Sedge, with small bottle sedge, in wet depressions and along shores
   d. Other: narrow reed grass may occur in the above communities; beds of cattails, bulrushes, and burreeds are common shore communities, often in partially-floating stands with sedges; short-awned foxtail communities are found on recently-exposed muds
2. Saline (water chemistry dominated by sodium and sulphate; Zoltai and Vitt 1995)
   a. Slender salt-meadow grass and creeping spike rush is a rare type of soils with the highest salt contents in the area

b. Foxtail barley, wire rush, Kentucky bluegrass, and graceful sedge, along with creeping white prairie aster, alkali cordgrass and three-square rush is another rare type, this types occurs on less salty soils than the slender salt-meadow grass and creeping spike rush

4.6.3 Peatlands

G. Bogs

1. Wooded: Black Spruce Bogs with an understory of labrador tea, cloudberry, bog cranberry, feather and *Sphagnum* mosses commonly occupy closed depressions; bogs that have burned in previous decades are often covered by Alaska birch; the bogs are transitional to wooded poor fens

H. Fens

1. Wooded: Larch - Black Spruce Poor Fens are characteristic of wooded peatlands still in contact with groundwater

4.6.4 Aquatic

I. Common Duckweed Mats occupy quiet ponds, often in association with *Wolffia* or larger duckweed (*Spirodela polyrhiza*)

J. Pondweed Beds composed of various species, sometimes accompanied by coontail or spiked water-milfoil, may be found in some larger ponds and lakes

4.7 Old Forest Patches as Revealed by Alberta Vegetation Inventory

The overwhelming majority of vegetation patches (n~661 polygons) in the Blackfoot originated after 1900. Of those patches with origin dates (n=287), 204 (71%) originated in the 1920s, a time of widespread fires. Fourteen patches (4.9% of dated patches) originated in or before 1900 (these are indicated on Map 1 with stippling); 13 of which are black spruce-dominated wetlands; 12 originated circa 1900. All 14 of the oldest forest patches occupy sites that discourage firespread--e.g., bogs, often with moats, and the island in Islet Lake. Most of the oldest dated forests in the Blackfoot are in the Neon -- Arrowhead Lakes area. The white spruce forest on the island in Islet Lake originated circa 1889. The oldest dated patch is a black spruce - white spruce forest between Round and Burn Lakes in Field 1A (circa 1890, technically outside the study area).

5. MANAGEMENT RECOMMENDATIONS

Many elements (both community and species) of biodiversity exist in the study area in trace amounts-- a single occurrence, a single patch. It is important for management to know the kinds of communities and sites that support elements of native biodiversity so that these areas can be protected and managed wisely. Management of special areas is far more practical than attempting to manage individual populations. The Blackfoot management objective (Alberta Environmental Protection 1997:17) for preservation stipulates that the area will be managed to "ensure the long term viability and health of the natural ecosystem... protect rare, threatened, and endangered wildlife and vegetation species... protect undisturbed portions of the upland landscape... and wetlands... (and) maintain sustainable and healthy populations of ungulates and furbearing wildlife species." Such an ambitious program requires a clear understanding of the present state of the Blackfoot and a re-assessment of management practices.

5.1 Saline Meadows

Soil disturbance and heavy grazing pressure in saline meadows (starred on Map 1) can lead to dominance of foxtail barley, silverweed, Canada thistle, tickle grass, and other ruderals/weeds, a process observed along the cattle-grazed shores of Beaverhill Lake (Griffiths et al. 1996, foxtail barley/alkali grass zone), on bison-impacted summer range in the Sweetgrass area of the Peace-Athabasca Delta (Timoney 1996), and due to repeated haying at Hay Camp, Wood Buffalo National Park (Raup 1935). Both human soil disturbance and grazing by horses should be avoided in the salt meadows.

5.2 Grasslands and Dry Shrublands

This rare landscape type is fire-dependent in the boreal mixedwood region of Alberta. Three occurrences are known from the Blackfoot: NE shore of Blackfoot Lake (plot 64, starred on Map 1), NE shore of Crooked Lake (Griffiths plot 32), and below a headland west of Elk Push Lake (Griffiths plot 22). Continued absence of fire will likely result in loss of dry grasslands from the Blackfoot. A prescribed burning program should be developed to maintain and enhance their cover.

5.3 Old-Growth Forests

Management priorities for old-growth forests should focus on avoidance of human disturbance resulting from oil/gas and agricultural activities, trail maintenance, and facility development. Those found in this study are starred on Map 1; old forests found in the Alberta Vegetation Inventory are stippled on Map 1. The areally dominant community of the Blackfoot uplands is a mature aspen forest that originated after fire in the 1920s (~75 years ago). As many aspen forests reach old-growth status sometime between 85-130 years (Timoney 1998), a large portion of the Blackfoot will, in the coming decades, be old-growth. Such a transition will result in an increase in biodiversity of flowering plants, mosses, lichens, Fungi, arthropods and other invertebrates, birds, mammals, etc.

5.4 Riparian Zones

The judicious removal of some beaver dams in selected valleys might be considered as a means to increase biodiversity for species that require streamside habitats. More investigations for rare plants and communities should be conducted in selected creek valleys, such as between Blackfoot and Norris Lakes and between Running Dog and the Geese and Bog Lakes. Management of riparian zones and water bodies in general should include fencing to eliminate domestic grazing (both horse and cattle), where applicable, and to prevent domestic animal runoff from reaching surface waters. Elimination of snow machine use in riparian/wetland areas and on ice surfaces would help to prevent both riparian/wetland damage and degradation of water quality (Adams 1975; Timoney 1993; Sheppard undated).

5.5 Beaver-Influenced Landscape

It is interesting to speculate what the Blackfoot landscape might become if all beaver control were eliminated. It is likely that uncontrolled beaver would cause a net decline in forest cover, an increase in water cover and shrublands, a desiccation of uplands (due to removal of forest canopies), and a paludification of lowlands. Larger, less fluctuating water bodies would be favored whose waters would be deeper, clearer, and less eutrophic than typical ponds. The weedy condition of many beaver ponds and wetlands in the Blackfoot is an outcome of frequent large and sudden changes in water level (cycle of dam removal/reflooding) in a multiple use landscape in which weed propagules are abundant. A decrease in the frequency and severity of water level fluctuations might help to favor less weedy communities. Survival of rare species ill-adapted to fluctuating conditions, such as *Wolffia, Carex vulpinoidea*, and *Potamogeton foliosus* might also be improved (Griffiths et al. 1997).

Clearly, with Blackfoot's multiple mandate, a "no beaver control" policy is currently not

feasible. We suggest, however, that management considers a pilot study area isolated from conflicting land uses where no beaver control be studied. The minimal costs of occasional photographs and monitoring would be offset by avoidance of expenses for beaver control. The direct benefits of increased landscape diversity would help to fulfill the Blackfoot's mandate of habitat protection. A natural history/education theme could be developed and presented along relevant portions of the trail system.

5.6 Landscape Units Influenced by Insects and Disease

The processes of dieback and regrowth create an ever-changing spatial and temporal mosaic important to the maintenance of biodiversity-- all the more important in a landscape in which fire no longer plays a dominant role. There should be no attempts to "control" insect and disease outbreaks.

5.7 Weed Disclimaxes

Since the weeds have established themselves throughout the Blackfoot, their control presents management with great challenges. The *status quo* can only lead to further spread of weeds and their disclimaxes and a concomitant decline of native biodiversity. At the same time, the multiple mandate of the Blackfoot limits the potential scope of control activities. The following management guidelines might help: (1) Exposure of bare soil by machinery should be prevented (e.g., borrow pits along trails); (2) wherever possible, if vegetation mats are stripped from a site (e.g., a well site), they should be stockpiled and replaced if the disturbance is short-term (e.g., if a well proves dry); (3) tame seed mixtures should not be used for revegetation anywhere outside the pastures; the "suggested native seed" mixes for revegetation identified in the Blackfoot management plan (Alberta Environmental Protection 1997) should be updated; (4) equestrian trails should be closed whenever they are wet; (5) blade height during mowing of trails should be at a "high"setting; (6) hiking trails should be narrowed to 2 m; (7) periodic rotational resting of trails (closure for one year, during which no mowing or traffic is allowed on the trail) would help to suppress non-native plants (especially grasses) in favor of forest forbs and shrubs encroaching onto the trails; (8) beaver control should be minimized (this would necessitate rerouting or periodic closure of trails-- which would dovetail with trail resting (item 7)); (9) rehabilitation of old, abandoned well sites should focus on establishment of trees present in the surrounding forest; for aspen and balsam poplar, suckers can be used; for white spruce, local genotype seedlings should be planted; the reestablishment of a tree canopy will suppress exotic cover and encourage reestablishment of native understory plants.

5.8 Monitoring Program

A multiple mandate places multiple pressures on the Blackfoot. It is important to know if and how the Blackfoot is changing over time. Retrospective studies of change, using a time series of imagery or sediment cores are not well-suited to some of the problems faced by Blackfoot (e.g., spread of weeds) because of scale mismatch and insensitivity on the time scales of interest. Shrinking grassland and dry shrubland might be difficult to monitor with aerial imagery since beaver shrubland and weed disclimaxes closely resemble true grassland and dry shrubland. Similarly, assessments of saline meadows and riparian zones or of water quality require on site monitoring.

The distribution of selected weed species should be periodically studied to monitor changes in Blackfoot's weed status. This might be done best at specific plots or along transects. Areal extent and composition should be periodically assessed in the salt meadows, the grasslands and dry shrublands, and in selected old-growth forests. Permanent plots should be used. Those established in this study provide a starting point. Rehabilitation of abandoned well sites with native species should also be monitored. If presribed burning is used to maintain or enhance grasslands, monitoring will be required to assess changes.

5.9 Revegetation After Disturbance

Revegetation after disturbances such as oil and gas developments presents Blackfoot management with challenges. The mandate of habitat protection cannot be met if standard "revegetation mixes" are used, as these often contain aggressive non-native plants, or native plants of unknown or distant provenance. The primary goal of a revegetation program in a habitat protection area should be to reestablish the vegetation that was present before disturbance. Toward that end, photographs should be taken of a site to be disturbed. The organic horizon with its topsoil should be carefully stockpiled in the event that the disturbance is short-lived. In that event, pre-disturbance contours should be reestablished and the vegetation mat and topsoil should be returned to its former position.

Revegetation following longer-term disturbances should focus on establishment of dominant native trees and shrubs. Only competitively robust trees and shrubs can be relied upon to establish and achieve dominance on disturbed sites in the face of competition from awnless brome, Canada thistle, Kentucky bluegrass, etc.

On uplands, aspen, balsam poplar, and white spruce trees should be used, with black spruce, white spruce, larch (tamarack), and Alaska birch in bogs and fens. On moister uplands, red-osier dogwood, low-bush cranberry, river alder, and willows (e.g., Bebb's willow, pussy willow) can be added to the trees. On average "mesic" sites, prickly rose, saskatoon, and wild red raspberry can be used, and on the drier forest sites, beaked hazelnut, snowberry and buckbrush may prove useful.

On wet mineral soils where reestablishment of trees and shrubs is proving difficult, bluejoint reedgrass (*Calamagrostis canadensis*), awned sedge (*Carex atherodes*), basket willow (*Salix petiolaris*) and plane-leaved willow (*S. planifolia*) may be used.

In all cases, root fragments or crowns and rhizomes would be the propagules of choice-- and these can be collected as needed from areas being disturbed for borrow pits, etc., or cooperatively from other agencies or companies stripping vegetation outside the Blackfoot. One salvaged shrub or small tree can be divided into several pieces and planted in the organic horizon or topsoil. Lacking these plant parts, seedlings can be used, either gathered during a disturbance, or purchased. While tree and shrub seed may appeal due to an appearance of low cost, successful establishment may prove difficult.

On the driest sites (e.g., south-facing slopes), management may wish to add native grass seeds to the mixture. Awned wheatgrass (*Agropyron trachycaulum* var. *subsecundum*), June grass (*Koeleria macrantha*), green needle grass (*Stipa viridula*), and Canada wild rye (*Elymus canadensis*) can be used; on dry, open sand (if any such sites exposed), sand dropseed (*Sporobolus cryptandrus*) may be useful.

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Appendix 1. Plant species observed at the Blackfoot Provincial Recreation Area. Bolded species found in this study are significant and are discussed in the text. Plants classified as rare in Alberta are marked by a ^ symbol. Plants followed by an * were found by Griffiths et al. (1997) and were not found in this study. Combined species observations of Griffiths et al. (1997) and this study total circa 509 taxa. The letter code on the left (the group column) indicates the plant group: h=liverwort; l=lichen; m=moss; r=native vascular plant of weedy habit in Alberta (i.e., ruderal); v=native vascular plant of non-weedy habit in Alberta; w=vascular weed non-native to Alberta. Presently, it is not possible to classify the non-vascular plants as to ruderal and native vs. non-native status. The decision as to r, v, or w status for vascular plants was based on Moss (1983), Looman and Best (1979), Gleason and Cronquist (1963), and Scoggan (1979).

Grp	Species	Comments
v	*Achillea millefolium*	
r	*Achillea sibirica*	
v	*Actaea rubra*	
v	***Adoxa moschatellina***	bf74; locally uncommon
v	*Agastache foeniculum*	
r	*Agrimonia striata*	
v	*Agrohordeum macounii*	
w	*Agropyron pectiniforme**	
w	*Agropyron repens*	
v	*Agropyron trachycaulum*	typically as var. subsecundum
r	*Agrostis scabra*	
v	*Alnus crispa**	
v	*Alnus tenuifolia*	
r	*Alopecurus aequalis*	
m	*Amblystegium serpens*	
m	*Amblystegium tenax*	
v	*Amelanchier alnifolia*	
v	*Andromeda polifolia**	
r	*Androsace septentrionalis**	
v	*Anemone canadensis*	
v	*Anemone riparia*	bf63; locally uncommon
h	*Aneura pinguis**	
v	*Antennaria parvifolia**	
v	*Apocynum androsaemifolium*	
v	*Aralia nudicaulis*	
v	***Arnica cordifolia***	bf62; regionally rare; western, at e. edge of range
w	*Artemisia absinthium**	
r	*Artemisia dracunculus*	
v	***Artemisia ludoviciana***	bf64 and sporadic in dry open areas; locally uncommon
r	*Aster brachyactis**	
v	*Aster ciliolatus*	
v	*Aster conspicuus*	
v	*Aster falcatus**	
v	*Aster hesperius*	
v	*Aster laevis*	
v	*Aster modestus**	
v	*Aster puniceus*	
v	*Astragalus americana*	
v	*Astragalus bisulcatus*	
v	*Astragalus dasyglottis**	
v	*Astragalus striatus*	
m	*Aulacomnium palustre*	

*w Axyris amaranthoides**
w Barbarea vulgaris
m Barbula convoluta
m Barbula unguiculata
r Beckmannia syzigachne
v Betula neoalaskana
v Betula papyrifera
r Bidens cernua
v Botrychium virginianum
m Brachythecium acuminatum
m *Brachythecium albicans*^ bf75;
m Brachythecium campestre^ bf44, 51, 55, 60, 61, 62, 65, 67, 69, 70, 78, 81,83, 84; S2
m Brachythecium cf. plumosum^ bf65; S2; possible, according to Dale Vitt; needs confirmation
m Brachythecium rivulare
m Brachythecium salebrosum
m Brachythecium starkei
v Bromus ciliatus
w Bromus inermis
*m Bryoerythrophyllum recurvirostre**
m Bryum argenteum
*m Bryum caespiticium**
m Bryum capillare
***m Bryum cyclophyllum*^** bf73;
m Bryum pseudotriquetrum
*m Bryum weigelii**
v Calamagrostis canadensis
v Calamagrostis stricta
v Calla palustris
m Calliergon cordifolium
*m Calliergon stramineum**
v Callitriche verna
l Caloplaca cerina
l Caloplaca holocarpa
v Caltha natans bf55, 73; locally uncommon
*v Caltha palustris**
*h Calypogeia sp.**
v Campanula rotundifolia
m Campylium hispidulum
***m Campylium polygamum*^** bf55, 56, 59, 61, 67, 81,87;
***m Campylium radicale*^** bf55;
m Campylium stellatum
l Candelaria concolor
l Candelariella vitellina
v Cardamine pensylvanica
v Carex aquatilis
v Carex atherodes
v Carex aurea
v Carex backii bf74; uncommon
v Carex bebbii
v Carex brunnescens
*v Carex capillaris**
v Carex cf. crawfordii
*v Carex curta**

v	*Carex deweyana*	
v	*Carex diandra**	
v	*Carex disperma*	
v	*Carex gynocrates**	
v	*Carex lanuginosa*	
v	*Carex norvegica*	
v	*Carex paupercula**	
v	*Carex peckii*	
v	*Carex praegracilis*	
v	*Carex praticola**	
v	*Carex sartwellii**	
v	*Carex siccata*	
v	***Carex sprengelii***	outside of bf64; uncommon
v	*Carex stipata*	
v	***Carex sychnocephala***	bf73; uncommon in AB, common in bf
v	***Carex torreyi***	bf63; uncommon
v	*Carex trisperma**	
v	*Carex utriculata*	
v	*Carex vulpinoidea**	
v	*Castilleja miniata*	
h	*Cephalozia connivens**	
h	*Cephaloziella sp.*	
v	***Cerastium nutans***	bf49, 55, 73; at southern limit
m	*Ceratodon purpureus*	
v	*Ceratophyllum demersum**	
w	*Chenopodium album*	
r	*Chenopodium leptophyllumn **	
l	*Chiloscyphus pallescens**	
w	*Chrysanthemum leucanthemum*	
v	*Chrysosplenium iowense**	
v	*Cicuta maculata*	
v	*Cicuta virosa**	
v	*Cinna latifolia*	
v	***Circaea alpina***	bf81; locally uncommon
w	*Cirsium arvense*	
r	*Cirsium flodmanii**	
l	*Cladonia bacillaris*	
l	*Cladonia carneola**	
l	*Cladonia cervicornis**	
l	*Cladonia chlorophaea*	
l	*Cladonia cornuta*	
l	*Cladonia deformis*	
l	*Cladonia fimbriata*	
l	*Cladonia gracilis*	
l	*Cladonia mitis*	
l	*Cladonia rangiferina*	
l	*Cladonia squamosa**	
l	*Cladonia subulata*	
v	***Clematis occidentalis***	bf57; uncommon, at e. edge of range in AB
m	*Climacium dendroides*	
v	*Comandra umbellata*	
m	*Conardia compacta**	
v	*Corallorhiza trifida**	

v	***Corallorhza maculata f. flavida^***	bf67
v	*Corallorhza maculata* f. *puniceus*	
v	*Cornus canadensis*	
v	*Cornus stolonifera*	
v	*Corylus cornuta*	
m	*Cratoneuron filicinum*	
w	*Crepis tectorum*	
w	***Dactylis glomerata***	common on trails, roadsides in bf; uncommon weed in AB
v	*Deschampia cespitosa*	
w	*Descurainia sophia**	
m	*Desmatodon heimii**	
m	*Desmatodon obtusifolius*	
m	*Dicranella sp.*	
m	*Dicranella varia*	
m	*Dicranum flagellare**	
m	*Dicranum fragilifolium*	
m	*Dicranum fuscescens**	
m	*Dicranum polysetum*	
m	*Dicranum scoparium**	
m	*Dicranum undulatum*	
m	*Didymodon sp.*	
v	*Disporum trachycarpum*	
v	*Draba nemorosa**	
r	***Dracocephalum parviflorum***	near bf77,and @53° 30' 58", 112° 54' 12"; uncommon
m	*Drepanocladus aduncus*	
m	*Drepanocladus crassicostatus**	
m	*Drepanocladus uncinatus*	
m	*Drepanocladus vernicosus**	
v	*Drosera rotundifolia**	
v	*Dryopteris assimilis**	
v	*Dryopteris carthusiana*	
v	*Eleocharis palustris*	
v	*Elymus canadensis**	
v	*Elymus innovatus*	
v	*Epilobium angustifolium*	
v	*Epilobium ciliatum*	
v	*Epilobium leptophyllum**	
v	*Epilobium palustre**	
r	*Equisetum arvense*	
v	*Equisetum fluviatile**	
v	*Equisetum pratense*	
v	*Equisetum scirpoides*	
v	*Equisetum sylvaticum*	
r	***Erigeron annuus***	bf77; locally uncommon
v	*Erigeron glabellus**	
v	*Erigeron lonchophyllus**	
v	*Erigeron philadelphicus*	
v	*Eriophorum chamissonis**	
v	*Eriophorum polystachion**	
v	*Eriophorum vaginatum**	
w	*Erysimum cheiranthoides*	
m	*Eurhynchium pulchellum*	
l	*Evernia mesomorpha*	

w	*Festuca pratensis*	
w	*Festuca rubra*	
l	*Flavopunctelia flaventior*	
v	*Fragaria vesca*	
v	*Fragaria virginiana*	
m	*Funaria hygrometrica*	
w	*Galeopsis tetrahit*	
v	*Galium boreale*	
v	*Galium trifidum*	
v	*Galium triflorum*	
v	***Gaultheria hispidula****	bf54; regionally rare
v	*Gentianella amarella*	
r	*Geranium bicknellii*	
v	***Geranium richardsonii***	bf59, sporadic in bf; locally uncommon; western, e. edge of range
v	*Geum aleppicum*	
v	*Geum macrophyllum*	
v	*Glyceria grandis*	
v	*Glyceria pulchella**	
v	*Glyceria striata*	
v	*Glycyrrhiza lepidota**	
r	***Gnaphalium palustre***	bf73, sporadic elsewhere on trails; uncommon, edge of range
w	*Gnaphalium uliginosum**	
r	***Gratiola neglecta***	bf73; uncommon
v	*Gymnocarpium dryopteris**	
v	*Habenaria hyperborea**	
v	***Habenaria viridis***	bf60; locally uncommon
v	*Halenia deflexa*	
m	*Haplocladium microphyllum*	
m	*Helodium blandowii*	
v	*Heracleum lanatum*	
r	*Hieracium umbellatum*	
v	*Hippuris vulgaris*	
w	*Hordeum jubatum*	
m	*Hylocomium splendens*	
m	*Hypnum cupressiforme*	
m	*Hypnum lindbergii*	
m	*Hypnum pratense*	
m	*Hypnum sp.*	
l	*Hypogymnia physodes*	
v	*Impatiens capensis*	
v	***Impatiens noli-tangere***	bf75, 76; locally rare
l	*Imshaugia aleurites*	
h	*Jamesoniella autumnalis**	
v	*Juncus balticus*	
r	*Juncus bufonius*	
r	*Juncus tenuis*	
h	*Jungermannia lanceolata**	
v	***Koeleria macrantha***	bf64; locally rare
v	***Lactuca pulchella***	bf64; locally rare
v	*Larix laricina**	
v	*Lathyrus ochroleucus*	
v	*Lathyrus venosus*	
v	*Ledum groenlandicum*	

v	*Lemna minor*	
v	*Lemna trisulca*	
r	*Lepidium densiflorum*	
h	*Lepidozia reptans**	
m	*Leptobryum pyriforme*	
v	*Limosella aquatica**	
v	*Linnaea borealis*	
v	*Lonicera dioica*	
v	*Lonicera involucrata*	
h	*Lophocolea heterophylla**	
h	*Lophocolea minor**	
h	*Lophozia ventricosa**	
v	*Lycopodium annotinum**	
v	*Lycopus asper**	
v	***Lycopus uniflorus***	bf55, 87; locally rare
v	***Lysimachia ciliata***	bf63*;* uncommon; at northern limit
v	*Lysimachia thyrsiflora**	
v	*Maianthemum canadense*	
v	*Malaxis monophylla**	
h	*Marchantia polymorpha*	
w	*Matricaria matricarioides*	
w	***Matricaria perforata***	Blackfoot Staging Area parking lot
v	***Matteucia struthiopteris***	bf76; uncommon in AB
w	*Medicago falcata*	
w	*Medicato sativa*	
l	*Melanelia albertana*	
l	*Melanelia exasperatula*	
l	*Melanelia subaurifera*	
l	*Melanelia subolivacea*	
w	*Melilotus officinalis*	
v	*Mentha arvensis*	
v	*Mertensia paniculata*	
v	*Mitella nuda*	
v	*Moehringia lateriflora*	
v	***Monarda fistulosa***	bf64; regionally uncommon
v	*Moneses uniflora**	
v	*Monolepis nuttalliana*	seen once in bf66; could not find again (but found by Griffiths et al.)
v	***Muhlenbergia glomerata***	uncommon in bf; w. of Griffiths plot 22; beaver shrubland
h	*Mylia anomola**	
w	*Myriophyllum exalbescens**	
l	*Ochroclechia arborea*	
m	*Oncophorus virens**	
m	*Oncophorus wahlenbergii*	
v	*Orthilia secunda*	
m	*Orthotrichum obtusifolium*	
m	*Orthotrichum speciosum*	
v	*Oryzopsis asperifolia**	
v	*Osmorhiza depauperata*	
v	*Oxycoccus microcarpus*	
v	*Oxycoccus quadripetalus**	
v	*Oxytropis deflexa*	
v	*Oxytropis monticola**	
l	*Parmelia sulcata*	

l	*Parmeliopsis ambigua*	
l	*Parmeliopsis hyperopta*	
v	*Parnassia palustris**	
l	*Peltigera canina*	
l	*Peltigera didactyla*	
l	*Peltigera elisabethae**	
l	***Peltigera evansiana^***	bf70, 81; rare
l	*Peltigera membranacea**	
l	*Peltigera praetextata**	
v	***Penstemon procerus***	bf64, 65; locally uncommon, at northern limit
v	*Petasites palmatus*	
v	*Petasites sagittatus**	
v	*Petasites vitifolius*	
l	*Phaeophyscia orbicularis*	
w	*Phalaris arundinacea*	
m	*Phascum cuspidatum**	
w	*Phleum pratense*	
r	*Phragmites australis**	
l	*Physcia adscendens*	
l	*Physcia aipolia*	
l	***Physcia dimidiata^***	bf69, 74;
l	***Physciella melanchra^***	bf56; new to province?
m	*Physcomitrium pyriforme**	
l	*Physconia detersa*	
v	*Picea glauca*	
v	*Picea mariana*	
h	*Plagiochila asplenioides**	
m	*Plagiomnium cuspidatum*	
m	*Plagiomnium ellipticum*	
m	*Plagiomnium medium*	
m	*Plagiothecium denticulatum**	
m	*Plagiothecium laetum*	
w	*Plantago major*	
m	*Platydictya jungermannioides*	
m	*Platygyrium repens*	
m	*Pleurozium schreberi*	
w	*Poa annua**	
w	*Poa compressa*	
v	*Poa interior*	
v	*Poa palustris*	
w	*Poa pratensis*	
m	*Pohlia cf. lescuriana*	
m	*Pohlia cruda*	
m	*Pohlia nutans*	
m	*Pohlia sphagnicola**	
m	*Pohlia wahlenbergii*	
v	*Polygonum amphibium*	
w	*Polygonum arenastrum*	
r	*Polygonum erectum**	
r	*Polygonum lapathifolium*	
r	*Polygonum ramosissimum **	
m	*Polytrichum juniperinum*	
m	*Polytrichum strictum*	

v *Populus balsamifera*
v *Populus tremuloides*
v *Potamogeton foliosus**
v *Potamogeton friesii**
v *Potamogeton obtusifolius**
v *Potamogeton pectinatus**
v *Potamogeton pusillus**
v *Potamogeton richardsonii**
v *Potamogeton vaginatus**
v *Potamogeton zosteriformis**
r *Potentilla anserina*
v ***Potentilla bipinnatifida*** bf64, 66; widespread but not abundant in AB
v *Potentilla gracilis*
r *Potentilla norvegica*
v *Potentilla palustris**
v *Potentilla pensylvanica**
v *Prunus pensylvanica*
v *Prunus virginiana*
h *Ptilidium pulcherrimum*
m *Ptilium crista-castrensis*
v ***Puccinellia distans*** bf49, 50, 66; uncommon
v *Puccinellia nuttalliana**
l *Punctelia subrudecta*
m *Pylaisiella polyantha*
v *Pyrola asarifolia*
v ***Pyrola elliptica*** bf61; common in bf, regionally common, otherwise uncommon
l *Ramalina dilacerata*
l *Ramalina pollinaria*
v *Ranunculus abortivus*
r *Ranunculus cymbalaria*
r *Ranunculus gmelinii**
v *Ranunculus macounii*
r *Ranunculus scleratus*
m *Rhizomnium gracile**
m *Rhizomnium pseudopunctatum**
v ***Ribes americanum*** locally uncommon, but common in bf
v *Ribes glandulosum**
v *Ribes hudsonianum **
v *Ribes lacustre*
v *Ribes oxyacanthoides*
v *Ribes triste*
h *Riccia fluitans**
h *Ricciocarpus natans*
r *Rorippa palustris**
v *Rosa acicularis*
v *Rosa woodsii*
v *Rubus arcticus**
v *Rubus chamaemorus*
v *Rubus idaeus*
v *Rubus pubescens*
v *Rumex britannica**
w *Rumex crispus*
r *Rumex maritimus**

*v Rumex occidentalis**
*r Rumex triangulivalvis**
v Sagittaria cuneata
v Salix bebbiana
*v Salix candida**
v Salix discolor
*v Salix lucida**
*v Salix maccalliana**
v Salix myrtillifolia
*v Salix pedicellaris**
*v Salix petiolaris**
*v Salix planifolia**
v Salix prolixa
v Salix pseudomonticola
*v Salix pyrifolia **
*v Salix serissima**
v Sanicula marilandica
*h Scapania glaucocephala**
v Schizachne purpurascens
v Scirpus acutus
v Scirpus microcarpus
v Scirpus pungens bf66; at northern limit
*v Scirpus validus**
*v Scolochloa festucacea**
v Scutellaria galericulata
r Senecio congestus
*r Senecio eremophilus**
v Senecio pauperculus
v Shepherdia canadensis
v Sisyrinchium montanum
v Sium suave
v Smilacina stellata
v Smilacina trifolia
v Solidago canadensis
v Solidago gigantea
w Sonchus arvensis
w Sonchus uliginosus
*w Sorbus aucuparia**
*v Sparganium eurycarpum**
v Spartina gracilis bf66; locally uncommon
*m Sphagnum angustifolium**
m Sphagnum fuscum
m Sphagnum magellanicum
m Sphagnum nemoreum
*m Sphagnum riparium**
*m Sphagnum squarrosum**
*m Sphagnum warnstorfii**
v Spirodela polyrhiza
v Stachys palustris
v Stellaria calycantha
v Stellaria longifolia
*v Stellaria longipes**
*w Stellaria media**

v* *Stipa viridula bf64; regionally uncommon
v *Symphoricarpos albus*
v *Symphoricarpos occidentalis*
w *Tanacetum vulgare*
w *Taraxacum officinale*
m *Tetraphis pellucida**
m *Tetraplodon angustatus**
v *Thalictrum venulosum*
w *Thlaspi arvense*
m *Thuidium recognitum*
m *Tortula mucronifolia*
m *Tortula ruralis**
w *Tragopogon dubius*
w *Trifolium hybridum*
w *Trifolium pratense*
w *Trifolium repens*
v *Triglochin maritima*
v *Triglochin palustre*
v *Typha latifolia*
r *Urtica dioica*
l *Usnea glabrata*
l *Usnea hirta*
l *Usnea scabrata*
l *Usnea subfloridana*
v *Utricularia vulgaris**
v *Vaccinium myrtilloides*
v *Vaccinium uliginosum*
v *Vaccinium vitis-idaea*
v *Veronica americana*
v *Veronica peregrina*
v *Viburnum edule*
v *Viburnum trilobum*
v *Vicia americana*
v *Viola adunca*
v *Viola canadensis*
v *Viola cf. palustris*
v *Viola renifolia**
l *Vulpicida pinastri*
m *Weissia controversa**
v *Wolffia columbiana**
***v* *Wolffia punctata*^** @53 29 29, 112 49 50; S3*; =W. borealis;* status poorly known
l *Xanthoria fallax*
l *Xanthoria polycarpa*