ECOLOGICAL LAND CLASSIFICATION AND VEGETATION DESCRIPTION OF UPPER BOB CREEK ECOLOGICAL RESERVE

Alberta
ENVIRONMENTAL PROTECTION

ECOLOGICAL LAND CLASSIFICATION

AND

VEGETATION DESCRIPTION

OF

UPPER BOB CREEK

ECOLOGICAL RESERVE

Beth Cornish
Resource Data Division
Alberta Environmental Protection
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1.0 INTRODUCTION

The Upper Bob Creek Ecological Reserve (Fig. 1) was formally designated in 1987 under the Wilderness Areas, Ecological Reserves and Natural Areas Act. It includes representative montane landscapes which support a diverse biota, including a number of rare and uncommon plants and animals. The area includes important elk wintering grounds (O'Leary et al 1989), has a long history of cattle grazing and is a popular recreation area.

To facilitate resource management in the Ecological Reserve, Alberta Land and Forest Service requested a study to gather baseline information on vegetation resources and their relation to landscape characteristics. This information would be used as an aid in evaluating the condition of the natural resource, and for wildlife habitat management and domestic grazing management.

Objectives of the study were to:

1. Prepare an ecological land classification map, showing vegetation types matched to physical land classification units.

2. Prepare a description of the plant communities that occur in the study area based on the 1994 and 1995 field work, with reference to previously defined vegetation types or ecosite phases (Willoughby et al 1996, and Archibald et al 1996).

3. Prepare a map and list of significant vegetation features.

2.0 STUDY AREA DESCRIPTION

2.1 Location

The study area was limited to the Upper Bob Creek Ecological Reserve, located in southwest Alberta, about 70 km north of the town of Pincher Creek (Fig. 1). It is situated in the foothills east of the Livingstone Range, north of the Oldman River. Most of the eastern and all of the western boundaries of the Reserve are defined by the watershed of the upper reaches of Bob Creek. The watershed divide on the top of the north-south trending Whaleback Ridge forms the eastern boundary, and the western boundary similarly follows the watershed divide. The south end of Township 12 forms the southern boundary of the Reserve. The northern boundary is irregular, following legal survey gridlines, the watershed divide between Chaffen Creek and Bob Creek, and the watercourse of an unnamed creek.

The Upper Bob Creek Ecological Reserve covers approximately 2600 ha (6427 acres) and includes the following land areas:

-in Twp 12 Rge 2 W5M: Sections 4-8, and 17; and parts of Sections 9, 16, 18-21, 28, 29;
-in Twp 12 Rge 3 W5M: small portions of Sections 1, 12 and 13, east of the height of land.

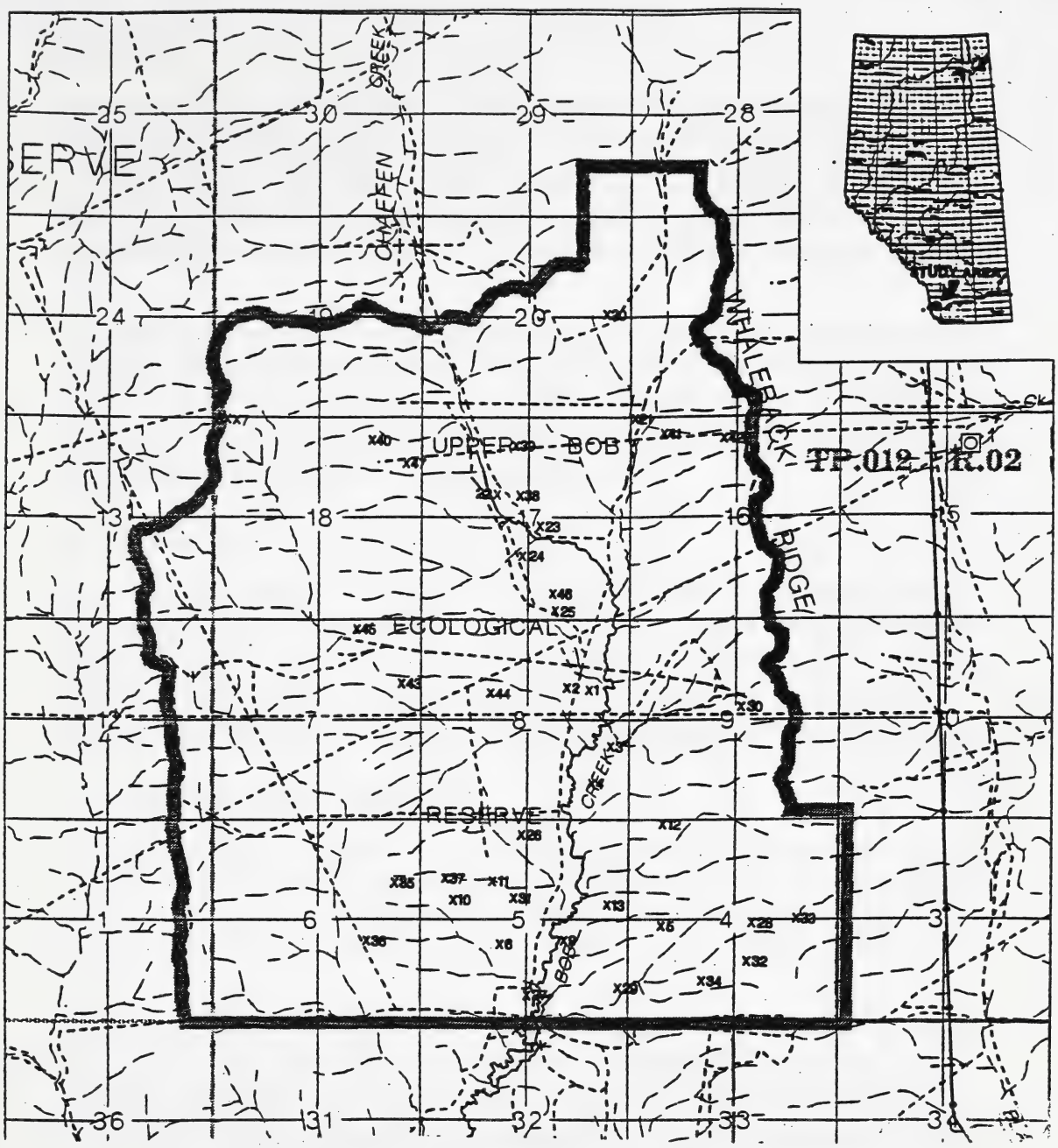

Fig. 1. Location of the Upper Bob Creek Ecological Reserve.

2.2 Climate

The Upper Bob Creek Ecological Reserve occurs in the Montane Natural Subregion within the Rocky Mountain Natural Region (Achuff 1994). Weather data collected in an area south of, and perhaps warmer than, the study area, indicated an average annual precipitation of about 600 mm (Coleman and Beaver Mines data - Environment Canada 1982; Achuff 1994). The area is characterized by fairly warm summers (mean temperature May to September of about 12° C) and cool winters (mean January temperature of -8° C) moderated by frequent chinooks (Achuff 1994).

Wind represents a significant climatic factor influencing vegetation. Fairly strong southwesterly to westerly winds occur more than 40% of the time (Strong 1979; Brown et al 1986). The west winds are especially prevalent from October to February. Chinook winds (with temperatures above 4 °C) occur an average of 25 or more days per year in the study area (Strong 1979). Strong winds affect vegetation primarily through physical damage, increased evapotranspiration and redistribution of snow to the lee sides of the hill crests.

2.3 Hydrography

Most of the Ecological Reserve is drained by the upper 5 km of Bob Creek, a perennial stream which flows to the south and eventually into the Oldman River. A small section of the north end of the study area drains into Chaffen Creek. The headwaters of Bob Creek are represented by several small tributaries which flow off the dissected ridges on the north, east and west sides of the Reserve. Flow in some of the tributary creeks may be intermittent during dry periods (Leskiw 1993). Seepage areas are scattered throughout the catchment basins of these tributaries.

2.4 Physiography and Bedrock Geology

The terrain includes many dissected ridges and a wide creek valley. Elevation ranges from about 1460 m in the valley bottom at the south end of the study area, to 1909 m at the highest ridgetops along the western boundary. The highest elevation along the eastern boundary is about 1750 m. Slopes vary from nearly flat, such as in poorly drained areas on the valley floor, to 70% or more on the upper slopes.

The Ecological Reserve occurs within the Southern Foothills District of the Rocky Mountain Foothills Region (Pettapiece 1986). A band of north-south trending ridges occurs in the study area, representing a transition zone between the Rocky Mountains and the rolling topography of the Porcupine Hills to the east. Bedrock formations represented in the study area are of Upper Cretaceous age. They include thick-bedded sandstones of the Brazeau Formation on the ridges, and a formation series called the Alberta Group in the valleys (Green 1972). Physiographic features of the Ecological Reserve are summarized in greater detail in Leskiw (1993).

2.5 Surficial Geology and Parent Materials

Colluvial veneers and residuum (weathered bedrock) occur on the ridges and upper slopes, overlying the Brazeau Formation bedrock. On the lower slopes, morainal blankets and veneers are dominant, along with lesser amounts of colluvial veneer over the inclined bedrock of the Alberta Group formations. In the bottomlands of the valleys of Bob Creek and its larger tributaries, undulating morainal blankets occur with a veneer of recent fluvial deposits (Leskiw 1993).

2.6 Soils

Rapidly drained shallow Lithic and Orthic Eutric Brunisols have developed on the weathered bedrock on the ridges, with some rapid to very rapidly drained Orthic Regosols on the most exposed ridgetops. On the upper slopes, well- to rapidly drained Orthic Eutric Brunisols predominate, with Orthic Gray Luvisols occurring less frequently. Orthic Black and, less commonly, Dark Gray Chernozems are found on the lower slopes. These medium-textured soils tend to be moderately well to well-drained. Black Chernozems have also formed on the fluvial and morainal deposits on the valley bottoms. Pockets of poorly drained to very poorly drained areas occur in seepage areas and along streams where Gleysols, most commonly Orthic Humic Gleysols, have developed.

2.7 Vegetation

The Montane Natural Subregion in Alberta is characterized by a mosaic of forest and grassland communities, and is distinguished from other subregions by the presence of Douglas fir (*Pseudotsuga menziesii)*, limber pine (*Pinus flexilis)* and lodgepole pine (*Pinus contorta)*(Achuff 1994). Complex topography, varying from gently undulating valley floor to ridged and dissected upland, has created variable ecological conditions, controlled by factors such as elevation, aspect, soils and parent materials. Therefore, many different vegetation community types can be found even across small areas. There is a large amount of overlap between the forest and grassland in the Reserve and some community types are recognized as being transitional from one to the other.

Aspect is one of the most important site factors controlling vegetation in the study area. However, differences in vegetation related to aspect are more obvious in some areas of the study area than in others. At lower elevations east and west of Bob Creek and on the lower slopes of Whaleback Ridge, the effects of aspect are very pronounced. South-facing slopes are characterized by grasslands, with coniferous forest (dominated most commonly by lodgepole pine or a mix of lodgepole pine and Douglas fir) occurring on the cooler, moister north-facing slopes. The west-central part of the Ecological Reserve is, in contrast, heavily forested, despite variable aspects. However, as elevation increases on the ridge at the western boundary, larger areas of grassland are again found.

3.0 METHODS

3.1 Field Survey

Site selection for the 1994 and 1995 range surveys was based on a pre-stratification of the area using landform and soil characteristics described by Leskiw (1993). Field data collection was conducted between June 14 and July 7 in 1994, and between August 1 and 13 in 1995. Twenty-three sites on primary and secondary range were surveyed in 1994 by crews from Resource Data Division and Alberta Forest Service (Fig. 1). In 1995, 18 forested sites were examined by a crew from Alberta Forest Service.

Vegetation surveys followed the procedure outlined in the Range Survey Manual (Alberta Forest Service 1990). At each site, a series of 15 microplots, 20 cm X 50 cm in size, was established along a 30 m transect in a representative part of the site. Within each microplot, all plant species were recorded and percent canopy cover estimated. Information was recorded on MF5 and MF6 Vegetation Inventory forms according to the guidelines in the Range Survey Manual. Physical site conditions were assessed at each site and recorded on LISD site forms, based on the methods in the Ecological Land Survey Site Description Manual (Alberta Environmental Protection 1994). At most sites, a soil pit was excavated in order to check parent material and classify local soil conditions.

3.2 Data Analysis

Vegetation data collected in 1994 and 1995 were analyzed using cluster analysis (SAS) and ordination (DECORANA, Gauch 1982) (Willoughby et al 1996). Sites were ranked based on their similarity to each other in terms of species cover values. Thus, sites of similar species composition were consolidated into derived groups or community types. Species composition of each newly identified community type was then described based on an average of the species cover values of the grouped sites.

Many of the vegetation community types found at the 41 sites examined in the study area corresponded to types described for the Montane Natural Subregion by other workers. These descriptions (Willoughby et al 1996) were based in part on the data collected in 1994 and 1995 in the Upper Bob Creek Ecological Reserve. Archibald et al (1996) outline Montane plant community types within a hierarchical ecological framework.

Common and scientific names for plant species are based on the Alberta Plants and Fungi Master Species List and Species Group Checklists (Alberta Environmental Protection 1993).

3.3 Ecological Land Classification and Mapping

A 1:15 000 scale ecological land classification map was created, matching existing physical land classification units to vegetation. This approach used a combination of landscape characteristics

(especially landform or parent material, soil type and slope) and vegetation composition to define map units. Thus, vegetation type information was overlaid on mapped landscape information.

The sources of information about landforms, slopes, parent materials and soil types in the Reserve were the physical land classification (PLC) completed on 1:20 000 scale aerial photographs (Leskiw 1993), and the site data collected in 1994 and 1995 (this study). Vegetation information was gained from two sources: the 1994 and 1995 field data, and, for forested polygons not visited in 1994 or 1995, from Alberta Vegetation Inventory (AVI). The AVI was based on interpretation of 1:20 000 scale aerial photography. This information was then synthesized to create mapped polygons representing ecological units.

Because of the variability in vegetation even across short distances in the study area, and the limitation of aerial photograph interpretation, it was often difficult to accurately predict a single vegetation community type in mapped polygons. For example, for areas not visited in the field, it was not possible to interpret forest understory forb species, nor to differentiate grazed from ungrazed grassland. These areas could not be described to vegetation community type level with sufficient accuracy based only on AVI information or aerial photograph interpretation. Therefore, predicted vegetation in each polygon was described to the somewhat more general Ecosite Phase level (Archibald et al 1996) for forested sites, and to a physiognomic type category (e.g. fescue grassland; wetland shrub) for non-forested sites.

Dominant overstory tree species define Ecosite Phases, which, with local environmental conditions, control species composition of the understory (Archibald et al 1996). Thus, vegetation described to the Ecosite Phase level can more easily be correlated to both AVI information and to site environmental conditions. An example of an Ecosite Phase found in the study area is "thimbleberry/pine grass Aw". This describes a site where the dominant overstory tree species is aspen (Aw). The characteristic understory species, thimbleberry and pine grass, are an expression of the site environmental conditions, namely a mesic moisture regime and a rich nutrient regime. Details of specific Ecosite Phases, including plant species composition, are provided in Archibald et al (1996).

3.4 Polygon Database and Legend

A tabular polygon database was constructed, which serves as a map polygon legend. It describes the dominant vegetation, as well as certain landscape and soils characteristics for each polygon. Thus map polygon numbers were related to the following list of parameters, each of which was included as a separate field in the database:

Landform and surficial materials
Soil types = Soil1, Soil2
Moisture regime
Nutrient regime
Vegetation description - Ecosite Phase or physiognomic type

3.5 Special Features Map

A second map, illustrating the location of populations of rare or uncommon plant species, was also produced at a scale of 1:15 000.

4.0 RESULTS

4.1 Ecological Land Classification

Map 1 shows the delineation of ecological units in the study area. Appendix A represents the polygon database, describing the vegetation and physical land characteristics (Appendix B) of each numbered polygon. The map legend includes vegetation type codes, based on ecosite phase or physiognomic type, and land unit codes, based on the predominant parent material in the polygon.

4.2 Vegetation Community Types

Field data from the 41 sites were classified into 15 different vegetation community types, which can be grouped into the following major categories: five grassland types, one shrubland type, two deciduous forest types, two mixed forest types, and five coniferous forest types. Other vegetation community types which may occur in the Ecological Reserve but were not sampled in this study are described in Willoughby et al (1996) and Archibald et al (1996).

The plant community types sampled in the Ecological Reserve are described below. Scientific names of plant species discussed in the text are found in the accompanying species composition tables. A summary of vegetation community type, ecosite phase (for forested sites), parent materials and soils information from each site is given in Appendix C.

Grassland community types

Grassland communities are found on recent fluvial deposits in the Bob Creek valley, till or colluvial deposits on the south-facing lower and middle slopes of ridges, and thin rocky soils of the upper slopes. Five grassland community types were differentiated in the study area and their composition is governed by environmental conditions and grazing pressure. Transitional communities are also common, where types grade into each other or towards forest communities, as environmental conditions change.

These community types were found at specific locations in the Reserve. However, because the different grassland types could not be separated on aerial photographs, the distribution of the individual grassland communities could not be outlined in detail on Map 1. Field mapping of these communities is necessary.

4.2.1 Rough fescue-Idaho fescue-Parry oatgrass

This community type was found at 13 sites examined in this study. It is the modal, or normal climax, grassland community type on undisturbed Black Chernozemic soils in the southern Alberta foothills (Willoughby et al 1996). In this study, it occurred primarily on Black Chernozems on the till and fluvial deposits at lower elevations. However, less commonly it was found on shallow Eutric Brunisols, on south-facing slopes at higher elevations. Rough fescue (*Festuca scabrella)*, Parry oat grass (*Danthonia parryi)* and Idaho fescue (*Festuca idahoensis)* are the dominant grass species on modal sites not heavily grazed.There is a highly diverse forb layer, and important forb species include old man's whiskers (*Geum triflorum)*, cut-leaved anemone (*Anemone multifida)* and sticky purple geranium (*Geranium viscossisimum)*. With light grazing in this community, cover of Parry oat grass will increase (Johnston 1961; Moss and Campbell 1947). Rough fescue grasslands occur at elevations as high as 2121 m in southwest Alberta (Willoughby et al 1996), but in the Porcupine Hills, east of the study area, Jaques (1979) found that fescue grasslands occurred most extensively at elevations of 1500 m or less.

Upper Bob Creek Community Type: Rough fescue - Idaho fescue - Parry oatgrass	
Sites: 1,3,5,6,8,10,12,13,20,23,24,26,28	Range classification: primary
Moisture regime: submesic to mesic	Soil drainage: well to moderately well
Nutrient regime: mesotrophic (submesotrophic to permesotrophic)	Soil subgroup: O.BL; O.EB
Slope (range): 0-60%	Aspect: south

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Graminoids:	*Festuca scabrella*	Rough fescue	29
	Festuca idahoensis	Idaho fescue	11
	Danthonia parryi	Parry oat grass	11
	Carex obtusata	Blunt sedge	8
Forbs:	*Geum triflorum*	Old man's whiskers	4
	Penstemon confertus	Yellow beardtongue	4
	Anemone multifida	Cut-leaved anemone	2
	Geranium viscossisimum	Sticky purple geranium	2
	Dodecatheon conjugens	Mountain shooting star	1
Shrubs:	*Potentilla fruticosa*	Shrubby cinquefoil	3

4.2.2 Idaho fescue - Parry oatgrass - Rough fescue

This community type was found at two lower slope sites in the study area. Compared to type #1 above, cover values of Idaho fescue and Parry oatgrass have increased in proportion to a decrease in rough fescue cover. Development of this community can be attributed to drier soil conditions or to grazing pressure, or a combination of both. Rough fescue is a decreaser (Wroe et al 1988), and cover values are reduced with grazing. In contrast, light grazing favours Idaho fescue and Parry oatgrass (Johnston 1961), as well as dryland sedge species such as blunt sedge (Moss and Campbell 1947). Soil conditions on grazed sites are often slightly warmer and drier than similar ungrazed sites, according to a study in the Porcupine Hills (Johnston 1961).

Upper Bob Creek Community Type: Idaho fescue - Parry oatgrass - Rough fescue	
Sites: 2, 27	Range classification: Primary
Moisture regime: subxeric - submesic	Soil drainage: rapidly to well
Nutrient regime: mesotrophic	Soil subgroup: O.EB; O.BL
Slope % (range): 21 (0-36)	Aspect: south

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Graminoids:	*Festuca idahoensis*	Idaho fescue	18
	Festuca scabrella	Rough fescue	10
	Danthonia parryi	Parry oat grass	16
	Carex obtusata	Blunt sedge	3
	Koeleria macrantha	June grass	4
Forbs:	*Achillea millefolium*	Yarrow	2
	Geum triflorum	Old man's whiskers	3
	Lupinus sericeus	Silky perennial lupine	4
	Lithospermum ruderale	Woolly gromwell	1
Shrubs:	*Potentilla fruticosa*	Shrubby cinquefoil	2
	Rosa acicularis	Prickly rose	1

4.2.3 Rough fescue - Kentucky bluegrass - Timothy

This site represents a rough fescue grassland which has been invaded by non-native species. It occurred on a lower slope just east of Bob Creek, in an area well utilized by cattle. The non-native species Kentucky bluegrass does well once it becomes established. The rhizomatous growth habit often allows it to eventually dominate the site. Timothy has been planted as a hay

crop outside the study area, and reproduces prolifically by seed.

Upper Bob Creek Community Type: Rough fescue - Kentucky bluegrass - Timothy			
Sites: #29		Range classification: Primary	
Moisture regime: mesic		Soil drainage: well	
Nutrient regime: mesotrophic		Soil subgroup: O.BL	
Slope % (range): 5%		Aspect: west	
Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Graminoids:	*Festuca scabrella*	Rough fescue	16
	Poa pratensis	Kentucky bluegrass	12
	Phleum pratense	Timothy	10
	Festuca idahoensis	Idaho fescue	15
	Danthonia parryi	Parry oat grass	5
Forbs:	*Achillea millefolium*	Yarrow	4
	Geum triflorum	Old man's whiskers	20
	Taraxacum officinale	Dandelion	6
	Dodecatheon conjugens	Shooting star	12
Shrubs:	*Potentilla fruticosa*	Shrubby cinquefoil	4

4.2.4 Kentucky bluegrass - Rough fescue

This community type also represents a rough fescue grassland modified by the effects of long-term heavy grazing. Kentucky bluegrass has become the dominant grass in this community. With continued heavy grazing pressure, rough fescue can disappear altogether (Moss and Campbell 1947). The presence of common dandelion is also indicative of past grazing pressure. Recovery of these sites to rough fescue will be slow, and could take 20-30 years (Willoughby et al 1996).

Upper Bob Creek Community Type: Kentucky bluegrass - Rough fescue	
Sites: 9, 25	Range classification: primary

Upper Bob Creek Community Type: Kentucky bluegrass - Rough fescue	
Moisture regime: submesic to mesic	Soil drainage: well
Nutrient regime: mesotrophic	Soil subgroup: O.BL; O.EB
Slope % (range): 12 (0-55)	Aspect: south

Upper Bob Creek Community Type: Kentucky bluegrass - Rough fescue			
Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Graminoids:	*Poa pratensis*	Kentucky bluegrass	29
	Festuca scabrella	Rough fescue	7
	Festuca idahoensis	Idaho fescue	6
	Danthonia parryi	Parry oat grass	3
	Carex obtusata	Blunt sedge	2
Forbs:	*Achillea millefolium*	Yarrow	6
	Geum triflorum	Old man's whiskers	5
	Taraxacum officinale	Dandelion	5
	Potentilla gracilis	Graceful cinquefoil	3
Shrubs:	*Potentilla fruticosa*	Shrubby cinquefoil	2

4.2.5 Pine grass - Hairy wild rye / Wild strawberry

On moist open upper slopes where grassland begins to grade to forest, the dominant grasses are two species which are common understory species in woodlands, pine grass (*Calamagrostis rubescens)* and hairy wild rye (*Elymus innovatus)*. This community type is transitional to forest. It was found on a steep east-facing upper slope, amid scattered lodgepole pine and spruce. The more favourable moisture regime may be due to the leeward position of the site, which would favour snow accumulation. Plant species characteristic of favourable moisture regimes were present, such as showy aster, as well as some species, such as hairy wild rye, often found on drier sites.

Upper Bob Creek Community Type: Pine grass - Hairy wild rye/ Wild strawberry	
Sites: #7	Range classification: Secondary
Moisture regime: mesic	Soil drainage: moderately well
Nutrient regime: mesotrophic	Soil subgroup: O.EB

Upper Bob Creek Community Type: Pine grass - Hairy wild rye/ Wild strawberry			
Slope % (range): 20 (0-46)		Aspect: north; east	
Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Graminoids:	*Calamagrostis rubescens* *Elymus innovatus* *Bromus inermis var. pumpellianus*	Pine grass Hairy wild rye Awnless brome	24 3 1
Forbs:	*Fragaria virginiana* *Lathyrus ochroleucus* *Lupinus sericeus* *Aster conspicuus*	Strawberry Peavine Silky perennial lupine Showy aster	14 3 4 3
Shrubs:	*Vaccinium caespitosum* *Symphoricarpos occidentalis* *Rosa acicularis* *Spiraea betulifolia*	Dwarf bilberry Buckbrush Prickly rose White meadowsweet	1 2 1 2

Shrubland community types

One lowland shrubland community type was sampled and it is described in detail below. However, small patches of other shrubs can also be found bordering aspen copses, as well as on the grassy slopes of smaller coulees and moister swales and nivation hollows within grassland areas. Common shrub species in these areas include prickly rose (*Rosa acicularis)*, saskatoon (*Amelanchier alnifolia)*, beaked willow (*Salix bebbiana)* and buckbrush or snowberry (*Symphoricarpos sp.)*. Willoughby et al (1996) describe a snowberry - rose - saskatoon community occurring on south-facing slopes in transition from rough fescue grassland to forest, and O'Leary et al (1989) found a similar community on well-drained south- and southwest-facing slopes. A beaked willow / hairy wild rye community (Willoughby et al 1996) likely occurs on north-facing slopes and other areas with suitable soil moisture conditions. Shrublands provide excellent browse for wildlife (Jaques and Corbin 1981).

4.2.6 Bog birch - Basket willow - Myrtle-leaved willow

Extensive areas of bog birch- willow shrubland cover the wide Upper Bob Creek valley. The willow stands are heavily utilized by moose (this study; O'Leary et al 1989). This community type occurs on gently inclined and undulating recent fluvial deposits in the bottom of Bob Creek valley, especially on fluvial terraces and other areas associated with older creek channels. Soils are primarily Orthic Humic Gleysols. Soil drainage is often impeded, as these sites usually occur on seepage zones, with a water table close to the surface. The variability in drainage is expressed

in the species composition of the shrub layer. Myrtle-leaved willow predominates in the central damp areas, where soil drainage is poorest, whereas basket willow is more common on the slightly drier portions of sites. Likewise, water-loving species such as beaked sedge and wire rush are found in areas with prolonged flooding. Where temporary flooding is of shorter duration, the forbs purple avens and veiny meadow rue, and grasses bluejoint and tufted hair grass occur.

Upper Bob Creek Community Type: Bog birch - Basket willow - Myrtle-leaved willow	
Sites: 4,11, 21, 22	Range classification: Secondary
Moisture regime: subhydric	Soil drainage: poorly
Nutrient regime: permesotrophic	Soil subgroup: O.HG; T.M
Slope % (range): 0-6	Aspect: northerly; level

Key and indicator species:

	Scientific name	Common name	Canopy cover (%)
Shrubs:	*Salix petiolaris*	Basket willow	26
	Betula glandulosa	Bog birch	11
	Salix myrtillifolia	Myrtle-leaved willow	9
	Potentilla fruticosa	Shrubby cinquefoil	2
	Salix candida	Hoary willow	5
	Salix glauca	Smooth willow	4
Graminoids:	*Juncus balticus*	Wire rush	5
	Carex rostrata	Beaked sedge	5
	Carex praegracilis	Graceful sedge	3
	Agropyron trachycaulum	Slender wheat grass	2
	Calamagrostis canadensis	Bluejoint	1
	Deschampsia cespitosa	Tufted hair grass	1
Forbs:	*Thalictrum venulosum*	Veiny meadow rue	3
	Epilobium angustifolium	Fireweed	2
	Geum rivale	Purple avens	2
	Aster laevis	Smooth aster	3

Deciduous forest community types

Two aspen community types were sampled in this study, representing two fairly different ecological units. One type was a transitional community on a dry site, representing an invasion of aspen into grassland, and the other was found where both moisture and nutrient conditions

were more favourable. Understory of the aspen communities reflected the differences in moisture and nutrient regimes. Bearberry was predominant at the dry nutrient-poor site, whereas prickly rose was characteristic of the moister and richer site.

4.2.7 Aspen / Bearberry / Rough fescue

In upper slope areas, small groves of aspen occur on warm, protected and not too dry sites such as southeast-facing slopes protected from desiccating winds. Here aspen is growing at the edge of its ecological niche (Willoughby et al 1996) Associated species in these drier areas include bearberry, forb species such as wild white geranium (*Geranium richardsonii)*, and the grasses rough fescue and hairy wild rye. It is not known to what extent aspen is invading grasslands in the Ecological Reserve. In a study in the nearby Porcupine Hills in the 1970's, aspen invasion occurred most commonly on north-facing slopes, and in some areas aspen woods were succeeding to Douglas fir (Fredrickson 1975).

The aspen/bearberry/rough fescue community type described below occurs on colluvial and morainal materials in the study area. Because of the presence of bearberry, this community type is included in the 'bearberry Aw' ecosite phase of Archibald et al (1996), defined by moisture/nutrient regimes that are submesic/poor. The presence of rough fescue, however, indicates that soils at these sites are better developed and somewhat richer than in the modal bearberry communities. This community type may represent aspen invasion into a rough fescue - sedge/bearberry community type, described by Willoughby et al (1996) and characteristic of dry grass meadows on hilltops in the Montane.

Upper Bob Creek Community Type: Aspen/Bearberry/Rough fescue	
Sites: #46	Range classification: secondary
Moisture regime: submesic	Soil drainage: well
Nutrient regime: mesotrophic	Soil subgroup: O.EB; O.DG
Slope% (range): 5 (0-10)	Aspect: hilltop; south

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Trees:	*Populus tremuloides*	Aspen	12
Shrubs:	*Arctostaphylos uva-ursi* *Rosa acicularis* *Potentilla fruticosa*	Common bearberry Prickly rose Shrubby cinquefoil	13 1 2

Forbs:	*Aster ciliolatus*	Lindley's aster	10
	Fragaria virginiana	Wild strawberry	5
	Achillea millefolium	Yarrow	4
	Taraxacum officinale	Dandelion	5
Graminoids:	*Festuca scabrella*	Rough fescue	15
	Festuca idahoensis	Idaho fescue	12
	Calamagrostis rubescens	Pine grass	11

4.2.8 Aspen / Rose / Pine grass

This community type was found at 4 sites during the study, located on a variety of aspects except south-facing slopes, usually on lower slope positions. It occurred most commonly on moderately well to well-drained Orthic Black Chernozems developed on morainal parent materials. These lower slope aspen stands occur on mesic, well-drained sites with medium to rich nutrient regimes. The most common understory shrubs in these areas are prickly rose, saskatoon and snowberry (*Symphoricarpos albus)*. Characteristic forbs include showy aster (*Aster conspicuus)*, cream-coloured vetchling (*Lathyrus ochroleucus)* and wild strawberry (*Fragaria virginiana)*, while the most common grass species is pine grass. A similar aspen/ pine grass community type was described by Archibald et al (1996), and included in their 'thimbleberry / pine grass' (mesic / rich) Aw (aspen) ecosite phase. Succession in this community is towards white spruce (*Picea glauca*).

Upper Bob Creek Community Type: Aspen/Rose/Pine grass	
Sites: 31, 34, 38, 47	Range classification: Secondary
Moisture regime: mesic	Soil drainage: well
Nutrient regime: permesotrophic to mesotrophic	Soil subgroup: O.BL; O.EB
Slope(range): 5-20%	Aspect: north, west, east

Key and indicator species:			
Scientific name		**Common name**	**Canopy cover (%)**
Trees:	*Populus tremuloides*	Aspen	41
	Populus balsamifera	Balsam poplar	3
Shrubs:	*Rosa acicularis*	Prickly rose	8
	Amelanchier alnifolia	Saskatoon	2
	Spiraea betulifolia	White meadowsweet	1

Forbs:	*Fragaria virginiana*	Wild strawberry	8
	Aster ciliolatus	Lindley's aster	7
	Aster conspicuus	Showy aster	7
	Lathyrus ochroleucus	Cream-coloured vetchling	5
	Galium boreale	Northern bedstraw	2
	Vicia americana	Vetch	3
Graminoids:	*Calamagrostis rubescens*	Pine grass	16
	Elymus innovatus	Hairy wild rye	6

Mixed forest community types

Mixed forest community types represent mid-successional stages towards conifer-dominated types. Two mixed forest community types were sampled, an aspen - spruce community and a spruce - balsam community. However, other mixed forest communities are no doubt present in the study area, especially on northeast or northwest facing slopes. Mixed spruce-balsam poplar forests occur on the most nutrient rich sites, usually in coulee bottoms or adjacent to the Bob Creek watercourse. Mixed stands of aspen and Douglas fir are often present on mid-slope positions with northwest or northeast exposures. Several mixed forest types are discussed by Willoughby et al (1996) including aspen - Douglas fir / white meadowsweet, aspen -lodgepole pine / buffaloberry / hairy wild rye, and aspen - Douglas fir / bearberry. O'Leary et al (1989) found an aspen - white spruce / rose / reed grass type on mid to lower slopes (aspects east, northeast and northwest). Archibald et al (1996) describe an aspen - spruce - lodgepole pine - Douglas fir mixed forest on mesic sites with mesotrophic nutrient regimes.

The two mixed forest community types sampled in this study are described below.

4.2.9 Aspen - White spruce/ Blueberry

This community type occurred on a north-facing lower slope area underlain by morainal and colluvial veneers over bedrock. Soils were moderately well to well-drained Orthic Dark Grey Chernozems, with a mesic moisture regime. Nutrient regime was mesotrophic, somewhat less rich than the aspen / rose / pine grass community type described above. The presence of grouseberry may indicate cooler conditions at this site, since this species is more frequent at higher elevations, in a subalpine environment. Succession is to a white spruce/moss community (Willoughby et al 1996). This community type would be classed within a 'white meadowsweet Sw' (white spruce) ecosite phase (mesic moisture and medium nutrient regimes) (Archibald et al 1996).

Upper Bob Creek Community Type: Aspen- White spruce/ Blueberry	
Sites: #37	Range classification: non-use
Moisture regime: mesic	Soil drainage: well

Upper Bob Creek Community Type: Aspen- White spruce/ Blueberry	
Nutrient regime: mesotrophic	Soil subgroup: O.DG
Slope: 2%	Aspect: north

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Trees:	*Populus tremuloides*	Aspen	33
	Picea glauca	White spruce	36
Shrubs:	*Vaccinium membranaceum*	Tall bilberry	6
	Vaccinium scoparium	Grouse-berry	7
	Rosa acicularis	Prickly rose	1
	Symphoricarpos occidentalis	Buckbrush	4
Forbs:	*Fragaria virginiana*	Wild strawberry	8
	Lathyrus ochroleucus	Cream-coloured vetchling	2
	Thalictrum occidentale	Western meadow rue	4
	Pyrola asarifolia	Common pink wintergreen	2
	Vicia americana	American vetch	1
	Galium boreale	Northern bedstraw	1
Graminoids:	*Calamagrostis rubescens*	Pine grass	3
	Melica smithii	Melic grass	12

4.2.10 Spruce - Balsam poplar / Snowberry

This community type occurred in a coulee bottom at a fairly high elevation (1569 m). In the coulees, Orthic Eutric Brunisolic soils are interspersed with Orthic Humic Gleysols on fluvial veneers over bedrock (Leskiw 1993). The characteristic subhygric moisture regime has allowed these sites to escape recent fire, allowing succession towards the white spruce climax. Archibald et al (1996) describe a similar balsam poplar / snowberry community, which is at an earlier successional stage. It grows on sites with subhygric/rich moisture/nutrient regimes.

Upper Bob Creek Community Type: White spruce - Balsam poplar/ Snowberry	
Sites: #45	Range classification: Secondary
Moisture regime: subhygric	Soil drainage: moderately well
Nutrient regime: mesotrophic to permesotrophic	Soil subgroup: O.EB
Slope: level	Aspect: level

Key and indicator species:	

Scientific name		Common name	Canopy cover (%)
Trees:	*Populus balsamifera*	Balsam poplar	30
	Picea glauca	White spruce	25
	Populus tremuloides	Aspen	5
Shrubs:	*Symphoricarpos albus*	Snowberry	6
	Rosa acicularis	Prickly rose	3
	Rubus idaeus	Raspberry	5
Forbs:	*Lathyrus ochroleucus*	Cream-coloured vetchling	3
	Geranium richardsonii	Wild white geranium	5
	Aster ciliolatus	Lindley's aster	6
	Viola canadensis	Western Canada violet	3
	Fragaria virginiana	Wild strawberry	4
	Epilobium angustifolium	Fireweed	4
Graminoids:	*Calamagrostis canadensis*	Bluejoint	7

Conifer forest community types

A variety of closed and open coniferous forest types, dominated by white spruce, Douglas fir, lodgepole pine and limber pine, occur in the Reserve. White spruce occurs on the most nutrient rich sites in the study area, usually in coulee bottoms or adjacent to the Bob Creek watercourse. Douglas fir is found on relatively dry, mid-slope to upper slope locations of varying aspects, which have escaped fire. Lodgepole pine is a fire successional species, and thus its presence is indicative of a local history of fire. It generally occurs on relatively dry sites at mid-slope or higher elevations in the study area. Limber pine occurs on dry (subxeric) upper slope sites, such as at the tops of ridges, often on poorly developed soils (Orthic Regosols). This species is well-adapted to low soil moisture and nutrient levels (Kuchar 1973), but occurs only in small patches in the study area.

Because of a relatively high frequency of fire, closed-canopied lodgepole pine forests are the modal forest for the Montane subregion. In the absence of fire, succession is towards Douglas fir on the drier sites and white spruce on the more moist sites (Strong and Leggat 1992).

Site moisture and nutrient conditions are important factors controlling forest understory composition and potential climax forest. For example, the driest and most nutrient-poor lodgepole pine stands have an understory layer dominated by bearberry, grading to white meadowsweet (*Spiraea betulifolia)* in the more mesotrophic sites, with thimbleberry (*Rubus parviflorus)* the dominant shrub on the richest and moistest sites (Archibald et al 1996).

Forested community types found in the Upper Bob Creek Ecological Reserve are described below. No limber pine communities were sampled in the study area, but they are likely present on very dry, nutrient-poor sites on exposed ridges.

4.2.11 Douglas fir /Hairy wild rye

This community type was found at 4 sites in the study area. It occurred on steep, dry sites at a range of elevations (1460 to 1708 m). At these sites, shallow Eutric Brunisolic soils had developed on colluvial and residual (eroded bedrock) parent materials. Aspect was west-facing or east-facing at sites examined in this study, though the type has been found on a variety of aspects (Willoughby et al 1996). The type is one of a number of coniferous community types occurring where site moisture and nutrient regimes are, respectively, submesic and medium (Archibald et al 1996). In the Porcupine Hills, a Montane area to the east, Jaques (1979) found that at lower elevations, below 1400 m, Douglas fir occupied north- or east- facing aspects, while at higher elevations it was found on all aspects.

Upper Bob Creek Community Type: Douglas fir/Hairy wild rye	
Sites: 33,35,36,39	Range classification: non-use
Moisture regime: submesic to mesic	Soil drainage: well
Nutrient regime: mesotrophic	Soil subgroup: O.EB
Slope: 15-45%	Aspect: west, east

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Trees:	*Pseudotsuga menziesii*	Douglas fir	60
	Pinus contorta	Lodgepole pine	1
Shrubs:	*Rosa acicularis*	Prickly rose	3
	Spiraea betulifera	White meadowsweet	6
	Juniperus communis	Ground juniper	2
Forbs:	*Aster conspicuus*	Showy aster	5
	Arnica cordifolia	Heart-leaved arnica	5
	Fragaria virginiana	Wild strawberry	4
	Thalictrum venulosum	Veiny meadow rue	2
	Lathyrus ochroleucus	Cream-coloured vetchling	1
	Galium boreale	Northern bedstraw	1
Graminoids:	*Elymus innovatus*	Hairy wild rye	6
	Calamagrostis rubescens	Pine grass	3

4.2.12 Lodgepole pine/ White meadowsweet

This community type is included in a group of community types growing on sites with mesic moisture regimes and medium nutrient regimes (Archibald et al 1996), which includes types

4.2.13 and 4.2.14 discussed below. The dominant overstory species and the cover of white meadowsweet vary with the successional status of the site (Willoughby et al 1996). The lodgepole pine/white meadowsweet community type was found on an east-facing slope at an elevation of 1569 m, and was dominated by pine in the overstory. It occurred on Orthic Eutric Brunisols, which had developed on till (Leskiw 1993). A history of fire is responsible for maintaining the pine overstory. Succession in the lodgepole pine/meadowsweet community type is to white spruce or Douglas fir or both (Archibald et al 1996).

Upper Bob Creek Community Type: Lodgepole pine/ white meadowsweet	
Sites: #40	Range classification: non-use
Moisture regime: mesic	Soil drainage: well
Nutrient regime: medium	Soil subgroup: O.EB
Slope: 10-53%	Aspect: east(this study); south to southwest (Willoughby et al 1996)

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Trees	*Pinus contorta* *Populus tremuloides*	Lodgepole pine Aspen	66 1
Shrubs:	*Spiraea betulifolia* *Shepherdia canadensis* *Rosa acicularis*	White meadowsweet Canada buffaloberry Prickly rose	18 1 3
Forbs:	*Fragaria virginiana* *Arnica cordifolia* *Aster conspicuus* *Vaccinium membranaceum*	Wild strawberry Heart-leaved arnica Showy aster Tall bilberry	4 4 3 9
Graminoids:	*Elymus innovatus* *Calamagrostis rubescens* *Melica smithii*	Hairy wild rye Pine grass Melic grass	1 10 2

4.2.13 White spruce- Douglas fir/ White meadowsweet

This type is characterized by white spruce and Douglas fir in the overstory. It occurs on sites similar to the lodgepole pine/meadowsweet community type described above, but is successionally more mature. Moisture conditions are slightly more favourable in this community type.

Upper Bob Creek Community Type: White spruce-Douglas fir/ White meadowsweet	
Sites: #42, 43	Range classification: non-use (secondary)
Moisture regime: mesic	Soil drainage: moderately well to well
Nutrient regime: mesotrophic	Soil subgroup: O.EB; O.DG
Slope: 20-40%	Aspect: north, west

Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Trees:	*Picea glauca*	White spruce	33
	Pseudotsuga menziesii	Douglas fir	20
	Pinus contorta	Lodgepole pine	7
Shrubs:	*Spiraea betulifolia*	White meadowsweet	6
	Rubus parviflorus	Thimbleberry	5
	Rosa acicularis	Prickly rose	1
Forbs:	*Thalictrum venulosum*	Veiny meadow rue	10
	Arnica cordifolia	Heart-leaved arnica	6
	Aster conspicuus	Showy aster	5
	Galium boreale	Northern bedstraw	1
Graminoids:	*Calamagrostis rubescens*	Pine grass	2
	Elymus innovatus	Hairy wild rye	1

4.2.14 White spruce/moss

The white spruce/moss community type is the predicted climax community type on sites occupied by the lodgepole pine/ white meadowsweet and the Douglas fir - white spruce/ white meadowsweet community types. In the study area it was found primarily on north-facing slopes or adjacent to drainages. The more favourable soil moisture conditions at these sites have likely helped to protect these sites from fire. The most common underlying parent materials are colluvial, and soils are Orthic Eutric Brunisols (Leskiw 1993). White spruce is the undisputed dominant in the overstory, although a few aspen occur. As a result of the dense spruce overstory, cover of grasses and forbs is low in this community type.

Upper Bob Creek Community Type: White spruce/ moss	
Sites: #30, 32, 41	Range classification: non-use
Moisture regime: mesic	Soil drainage: moderately well to well
Nutrient regime: mesotrophic	Soil subgroup: O.EB

Upper Bob Creek Community Type: White spruce/ moss			
Slope % (range): 5-25		Aspect: north	
Key and indicator species:			
	Scientific name	**Common name**	**Canopy cover (%)**
Trees:	*Picea glauca* *Populus tremuloides*	White spruce Douglas fir	64 2
Shrubs:	*Rosa acicularis* *Linnaea borealis*	Prickly rose Twin-flower	2 8
Forbs:	*Arnica cordifolia* *Thalictrum venulosum* *Aster conspicuus* *Pyrola asarifolia* *Orthilia secunda*	Heart-leaved arnica Veiny meadowrue Showy aster Pink wintergreen One-sided wintergreen	6 1 1 1 1
Graminoids:	*Carex spp.* *Elymus innovatus*	Sedge Hairy wild rye	2 1
Moss:	*Hylocomium splendens* *Pleurozium schreberi*	Stair-step moss Schreber's moss	49 5

4.2.15 White spruce/ Thimbleberry

This community type occurs on ecosites with moisture/nutrient regimes that are respectively mesic/rich (Archibald et al 1996). The presence of thimbleberry is indicative of the better than average nutrient conditions, which may be a result of local nutrient-rich seepage. This community type was found only at one site, on Orthic Black Chernozemic soils which had developed on morainal parent materials on a lower slope west of Bob Creek valley. The dominant species in the overstory is white spruce, which represents the climax overstory species at this site.

Upper Bob Creek Community Type: White spruce/ Thimbleberry	
Sites: #44	Range classification: non-use
Moisture regime: mesic to subhygric	Soil drainage: moderately well
Nutrient regime: mesotrophic to permesotrophic	Soil subgroup: O.BL; O.EB
Slope: 15%	Aspect: north
Key and indicator species:	

Scientific name		Common name	Canopy cover (%)
Trees:	*Picea glauca*	White spruce	75
Shrubs:	*Rubus parviflorus*	Thimbleberry	11
	Cornus canadensis	Bunchberry	12
	Linnaea borealis	Twinflower	4
	Rosa acicularis	Prickly rose	1
Forbs	*Arnica cordifolia*	Heart-leaved arnica	3
	Aster conspicuus	Showy aster	2
	Angelica dawsonii	Yellow angelica	1
Graminoids:	*Melica smithii*	Melic grass	1

4.2.16 Limber pine - Douglas fir/Juniper - Bearberry (Willoughby et al 1996)

This community type was not sampled during this study. However, limber pine-dominated community types likely form an edaphic climax on shallow-soiled, steep ridges of high elevation, where bedrock exposures are frequent, such as in the northwest part of the study area. These are areas exposed to high winds. A limber pine-Douglas fir/ Juniper- Bearberry community type was described by Willoughby et al (1996). The presence of bearberry and juniper is indicative of dry, nutrient-poor soil conditions.

4.3 Significant Plant Species

At least 10 rare or uncommon plant species have been recorded at Upper Bob Creek Ecological Reserve in this study or by previous workers (Table 1). Details of their status, habitat requirements (Moss 1983; Wallis et al 1987) and details of occurrence are given below. Moist montane meadows appear to offer habitat for the greatest potential number of rare plants. A number of other species may occur in the study area, but their presence is not confirmed (Appendix D).

Sources used to determine the status of plant species found in the Ecological Reserve include the following: Packer and Bradley (1984), Wallis et al (1986) and (1987), Fairbarns et al (1987) and Alberta Natural Heritage Information Centre (1996). Species rare in Alberta were defined by Packer and Bradley (1984) as those with known collections from five or fewer localities. The status of these and several other species was further assessed by Wallis et al (1986) and (1987), and Fairbarns et al (1987). These lists generally include species which are rare due to limited geographical distribution, and those which occur in small numbers wherever they grow. A list of Plant Species of Concern has also been recently collated by the Alberta Natural Heritage Information Centre (ANHIC 1996), which updates the information provided in other references. This list identifies species of special concern or high priority because they are rare, endemic, disjunct or in peril. Species are ranked based primarily on number of occurrences, with

consideration also given to distribution and current threats to populations. These ranking classes are summarized in Appendix E.

Significant plant species at Upper Bob Creek Ecological Reserve:
1) *Angelica dawsonii* S. Watts (Yellow angelica)
Status: restricted southwest Alberta range, but not uncommon (Wallis et al 1986);
Habitat: moist meadows and woods along streams
Occurrence: recorded by Brown et al (1986); and this study (sites 32-34, 37, 41, 42, 44, 45)

2) *Balsamorhiza sagittata* (Pursh) Nutt. (Balsamroot)
Status: restricted southwest Alberta distribution (Moss 1983); representative Montane species, but not uncommon
Habitat: montane grassland and open woods; forest edges;
Occurrence: found at several sites in the Reserve (this study)

3)*Camassia quamash* (Pursh) Greene (Blue camas)
Status: species of special concern; S2 on Alberta tracking list; uncommon in Alberta (7 mapped locations in the province); found only in the southwest part of the province; moderately threatened due to habitat loss (ANHIC 1996)
Habitat: wet meadows
Occurrence: recorded in the study area (ANHIC database, 1996); also Brown et al (1986)

4)*Carex scopulorum* Holm. (Holm's Rocky Mountain sedge)
Status: uncommon in Alberta (in foothills areas; Moss 1983);
Habitat: moist open areas
Occurrence: recorded in this study, and by Brown et al (1986)

5)*Castilleja cusickii* Greenm. (Yellow paintbrush)
Status:species of special concern ranked S2 on ANHIC tracking list; rare in Alberta (Packer and Bradley 1984); recommended classification as 'endangered' (Wallis et al 1986);
Habitat: moist meadows and grassland
Occurrence: recorded this study (site #13)

6)*Conimitella williamsii* (D.C. Eat.) Rydb. (Conimitella)
Status: species of special concern - S2 on ANHIC tracking list; only 6-20 records (ANHIC 1996)
Habitat: open montane, grassland slopes
Occurrence: recorded in this study (sites #7, 10); and by Brown et al (1986)

7) *Corallorhiza striata* Lindl. (Striped coralroot)
Status:uncommon and scattered in Alberta (Moss 1983); habitat moderately threatened (J. Rintoul, Alberta Natural Areas Program, pers. comm.)
Habitat: woods
Occurrence: recorded this study

Table 1. Rare or uncommon plants recorded at Upper Bob Creek Ecological Reserve.

Species	Common name	Ranking (ANHIC)
Species of concern [a] :		
Castilleja cusickii	Yellow paintbrush	S2
Camassia quamash	Blue camas	S2
Conimitella williamsii	Conimitella	S2
Poa nevadensis	Nevada bluegrass	SU
Senecio foetidus var. hydrophiloides	Marsh butterweed	S3
Other significant species:		
Angelica dawsonii	Yellow angelica	---
Balsamorhiza sagittata	Balsamroot	---
Carex scopulorum	Holm's rocky mountain sedge	---
Corallorhiza striata	Striped coralroot	---
Osmorhiza occidentalis	Western sweet cicely	---

[a] Alberta Natural Heritage Information Centre: Tracking list of plant species of special concern.

8)*Osmorhiza occidentalis* (Nutt.) Torr. (Western sweet cicely)
Status: only 5 records in Alberta (Moss 1983); restricted range in Alberta (Wallis et al 1986;)
Habitat: montane woods
Occurrence:recorded this study (site 10), and by Brown et al (1986)

9)*Poa nevadensis* Vasey ex Scribn. (Nevada bluegrass)
Status: identified as a priority species, but status not confirmed (ANHIC 1996); rare in Alberta (Wallis et al 1987; Packer and Bradley 1984)
Habitat: moist meadows
Occurrence: recorded this study

10)*Senecio foetidus* Howell *var. hydrophiloides* (Marsh butterweed)
Status: identified as rare in Alberta (Packer and Bradley 1984; Wallis et al 1987); ranked as S3 - locally abundant, but has a limited distribution (ANHIC 1996)
Habitat: moist montane meadows
Occurrence: recorded this study (sites 34, 37, 38, 40, 41, 45), and by Brown et al (1986)

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APPENDIX A. Map 1 polygon database. - Upper Bob Creek Ecological Reserve.

MAP POL.	PM CODE*	SOIL1	SOIL2	MOISTURE/NUTRIENT REGIMES	VEG1	VEG2	VEGETATION DESCRIPTION **
1	C1	O.EB		submesic/medium	GL		fescue grassland
2	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
3	F1	O.HG		mesic/rich	e2		thimbleberry/pine grass Aw
4	C1	O.EB		submesic/poor	b2		bearberry Aw
5	C1	O.EBsh		submesic/medium	c1	c3	Canada buffaloberry/HWR Fd; also Aw
6	F1	O.HG		mesic/rich	e2		thimbleberry/pine grass Aw
7	C1	O.EB		subxeric/medium	GL		dry grassland
8	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
9	C1	O.EB		mesic/medium	d3		white meadowsweet Sw
10	C1	O.EB		submesic/medium	GL		grassland
11	C1	O.EB		submesic/medium	c2		Canada buffaloberry/HWR Pl
12	F1	O.HG		mesic/rich	e2		thimbleberry/pine grass Aw
13	C1	O.EB		submesic/medium	GL		grassland
14	C1	O.EB		submesic/poor	b2		bearberry Aw
15	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
16	C1	O.EB		mesic/medium	d1		white meadowsweet Fd
17	C1	O.EB		submesic/medium	c2	c1	Canada buffaloberry/HWR Pl; Fd
18	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
19	C1	O.EB		mesic/medium	d3		white meadowsweet Sw
20	M1	O.BL	O.HG	mesic/rich	e2	e3	thimbleberry/pine grass Aw; Sw
21	C1	O.BL		submesic/medium	GL	c3	grassland with patches of poplar
22	M1	O.BL		submesic/medium	GL	c3	grassland with poplar
23	M1	O.BL		submesic/medium	c3		Canada buffaloberry/HWR Aw
24	M2	O.BL		submesic/medium	GL		fescue grassland
25	F2	O.HG		subhydric/rich	CS		closed shrub
26	M2	O.BL		submesic/medium	GL		grazed fescue grassland
27	M2	O.BL		submesic/medium	GL		grazed fescue grassland
28	M2	O.BL		submesic/medium	GL		fescue grassland
29	F3	O.HG		subhydric/rich	CS	FG	closed shrub and grassland
30	M2	O.BL		submesic/medium	GL		fescue grassland
31	M1	O.BL	O.HG	subhygric/rich	f1		balsam poplar Pb
32	F3	O.HG		subhydric/rich	CS		closed shrub
33	F3	O.HG		subhydric/rich	CS		closed shrub
34	C1	O.BL		submesic/medium	GL		grassland with poplar
35	C1	O.BL		submesic/medium	GL		grassland with poplar
36	C1	O.BL	O.HG	mesic/medium	d2		white meadowsweet Pl
37	C1	O.EB		subxeric/poor	a1		limber pine/juniper Fd-Pf
38	C1	O.EB		mesic/medium	d3		white meadowsweet Sw
39	C1	O.EB		mesic/rich	e1		thimbleberry/pine grass Pl
40	C1	O.EB		mesic/rich	e1		thimbleberry/pine grass Pl
41	C1	O.EB		mesic/rich	e3		thimbleberry/pine grass Sw
42	C1	O.EB		subxeric/poor	a1		limber pine/juniper Fd-Pf
43	C1	O.EB		subxeric/poor	a1		limber pine/juniper Fd-Pf
44	C1	O.EB		mesic/rich	e1		thimbleberry/pine grass Pl
45	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
46	M1	O.BL	O.HG	mesic/medium	d1		white meadowsweet Fd
47	M1	O.BL	O.HG	submesic/medium	GL	c3	grassland; with Canada buffaloberry/HWR
48	FM1	O.BL	O.HG	mesic/rich	e2		thimbleberry/ pine grass Aw
49	M1	O.BL	O.HG	submesic/medium	GL		grassland; with Canada buffaloberry/HWR
50	M1	O.BL		submesic/medium	GL		grassland; with Canada buffaloberry/HWR
51	M2	O.BL		submesic/medium	GL		fescue grassland

Map polygon database (cont'd)

POL.	PM*	SOIL1	SOIL2	REGIMES	VEG1	VEG2	VEGETATION DESCRIPTION **
52	F2	O.HG		subhydric/rich	CS		closed shrub
53	M2	O.BL		submesic/medium	GL		fescue grassland
54	F3	CA.BL		submesic/medium	GL		grazed fescue grassland
55	F4	O.HG	R.G	subhydric/rich	CS	SM	closed shrub; sedge meadows
56	F4	O.HG	R.G	subhydric/rich	CS		closed shrub
58	FM1	O.HG		subhygric/rich	f1		Balsam poplar Pb
59	M2	O.BL		submesic/medium	GL		fescue grassland
60	FM1	O.BL		subhygric/rich	CS		closed shrub
61	MC1	O.BL		submesic/medium	GL		fescue grassland
62	MC1	O.BL		subhygric/rich	f1		Balsam poplar Pb
63	M2	O.BL		submesic/medium	GL		grassland
64	MC1	O.BL		mesic/rich	e2		thimbleberry/pine grass Aw
65	FM1	O.HG		subhygric/rich	CS	f1	closed shrub; Balsam poplar Pb
66	FM1	O.BL	GL.BL	subhygric/rich	f1		Balsam poplar Pb
67	FM1	O.BL		submesic/medium	GL		fescue grassland
68	MC1	O.BL		submesic/medium	GL		fescue grassland
69	MC1	O.BL		mesic/rich	e2		thimbleberry/pine grass Aw
70	FM1	O.HG		subhygric/rich	CS		closed shrub
71	MC1	O.BL		submesic/medium	GL		fescue grassland
72	MC1	O.BL		subhygric/rich	f1		Balsam poplar Pb
73	FM1	O.HG		subhydric/rich	CS		closed shrub
74	MC1	O.BL		submesic/medium	GL		fescue grassland
75	MC1	O.BL		submesic/poor	b2	FG	bearberry Aw; grassland
76	MC1	O.BL		mesic/medium	d3		white meadowsweet Sw
77	F4	O.HG	R.G	subhydric/rich	CS		closed shrub
78	MC1	O.BL		submesic/medium	GL		fescue grassland
79	MC1	O.BL		mesic/rich	e1		thimbleberry/ pine grass Pl
80	MC1	O.BL		submesic/poor	b2	FG	bearberry Aw; grassland
81	FM1	O.HG		subhygric/rich	CS		closed shrub
82	MC1	O.BL		mesic/rich	e3		thimbleberry/pine grass Sw
83	FM1	O.HG		subhygric/rich	CS	SM	grassland/shrubby
84	MC1	O.BL		submesic/medium	GL		fescue grassland
85	MC1	O.BL		mesic/rich	e2		thimbleberry/pinegrass Aw
86	MC1	O.BL		submesic/medium	GL		fescue grassland
87	MC1	O.BL		subxeric/medium	GL		drier fescue grassland
88	MC1	O.BL		submesic/poor	b2	FG	bearberry Aw; grassland
89	MC1	O.BL		mesic/rich	e3		thimbleberry/pine grass Sw
90	MC1	O.BL	O.DG	submesic/medium	GL		fescue grassland
91	MC1	O.BL	O.DG	submesic/poor	b2	FG	bearberry Aw; grassland
92	MC1	O.BL		submesic/medium	GL		fescue grassland
93	MC1	O.BL	O.DG	submesic/medium	GL		fescue grassland
94	MC1	O.BL	O.DG	submesic/poor	b2	FG	bearberry Aw; grassland
95	MC1	O.BL		submesic/medium	c3		Canada buffaloberry/HWR Aw
96	F1	O.HG	R.HG	subhygric/rich	f1		Balsam poplar Pb
97	F4	O.HG		subhydric/rich	CS		closed shrub
98	MC1	O.EB		submesic/medium	GL		grazed grassland
99	M2	O.BL		submesic/medium	GL		fescue grassland
100	MC1	O.DG	O.EB	mesic/rich	e2		thimbleberry/pine grass Aw
101	MC1	O.DG	O.EB	mesic/rich	e3		thimbleberry/pine grass Sw
102	M3	O.EB		submesic/poor	b2	FG	bearberry Aw; grassland
103	M2	O.BL		submesic/medium	GL		fescue grassland
104	FM1	O.HG		subhygric/rich	CS	f1	closed shrub; balsam poplar Pb
105	MC1	O.DG	O.EB	submesic/poor	b2	FG	bearberry Aw; grassland
106	FM1	O.HG		subhygric/rich	f1	CS	Balsam poplar Pb; closed shrub
107	MC1	O.DG	O.EB	mesic/rich	e3		thimbleberry/pine grass Sw

POL.	PM*	SOIL1	SOIL2	REGIMES	VEG1	VEG2	VEGETATION DESCRIPTION **
108	M3	O.EB		mesic/rich	e2		thimbleberry/pine grass Aw
109	M3	O.EB		mesic/rich	e1		thimbleberry/pine grass Pl
110	FM1	O.HG	O.EB	subhygric/rich	f1		balsam poplar Pb
111	M3	O.EB		mesic/rich	e1		thimbleberry/pine grass Pl
112	M3	O.EB		mesic/rich	e1		thimbleberry/pine grass Pl
113	F1	O.HG	R.HG	subhygric/rich	f1		balsam poplar Pb
114	MC1	O.BL	O.DG	mesic/rich	e2		thimbleberry/pine grass Aw
115	MC1	O.BL	O.DG	mesic/medium	d3		white meadowsweet Sw
116	MC1	O.BL		submesic/medium	c3	FG	Canada buffaloberry/HWR Aw; grassland
117	C1	O.EB	O.DG	mesic/rich	e3		thimbleberry/pine grass Sw
118	MC1	O.BL	O.DG	mesic/rich	e1		thimbleberry/pine grass Pl
119	MC1	O.EB	O.DG	submesic/medium	c1		Canada buffaloberry/HWR Fd
120	MC1	O.BL	O.DG	mesic/rich	e1		thimbleberry/pine grass Pl
121	MC1	O.BL	O.DG	mesic/medium	d3		white meadowsweet Sw
122	MC1	O.BL	O.DG	submesic/poor	b2	FG	bearberry Aw; grassland
123	MC1	O.BL	O.DG	mesic/medium	d3		white meadowsweet Sw
124	M1	O.BL	O.DG	mesic/rich	e2		thimbleberry/ pine grass Aw
125	MC1	O.BL	O.DG	submesic/medium	c3		Canada buffaloberry/HWR Aw
126	MC1	O.BL		submesic/medium	c3		Canada buffaloberry/HWR Aw
127	MC1	O.BL	O.DG	mesic/medium	d3		white meadowsweet Sw
128	C2	O.GL	O.EB	submesic/poor	b2	FG	bearberry Aw; grassland
129	MC1	O.BL	O.DG	mesic/rich	e2		thimbleberry/pine grass Aw
130	FM1	O.HG	O.BL	mesic/rich	e3		thimbleberry/pinegrass Sw
131	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
132	C2	O.GL	O.EB	submesic/poor	b2	FG	bearberry Aw; grassland
133	MC1	O.BL	O.DG	mesic/rich	e2		thimbleberry/pinegrass Aw
134	FM1	O.BL	O.DG	mesic/rich	e3		thimbleberry/pinegrass Sw
135	MC1	O.BL	O.DG	submesic/medium	GL		fescue grassland
136	MC1	O.BL	O.DG	submesic/medium	GL		fescue grassland
137	C2	O.GL	O.EB	submesic/poor	b2		bearberry Aw
138	MC1	O.BL	O.DG	mesic/rich	e2		thimbleberry/pine grass Aw
139	C2	O.GL	O.EB	mesic/rich	e3		thimbleberry/pinegrass Sw
140	MC1	O.BL	O.DG	mesic/rich	e3		thimbleberry/pinegrass Sw
141	CR1	O.EB	O.R	submesic/poor	b2	FG	bearberry Aw; grassland
142	CR1	O.EB	O.R	submesic/medium	c1		Canada buffaloberry/HWR Fd
143	CR1	O.EB	O.R	submesic/medium	c1		Canada buffaloberry/HWR Fd
144	C1	O.GL	O.EB	submesic/poor	b2	FG	bearberry Aw; grassland
145	F1	O.HG		mesic/rich	e2		thimbleberry/pine grass Aw
146	F1	O.HG		mesic/rich	e3		thimbleberry/pinegrass Sw
147	MC1	O.EB		mesic/medium	d1		white meadowsweet Fd
148	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
149	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
150	F1	O.HG		mesic/rich	e3		thimbleberry/pinegrass Sw
151	C2	O.GL	O.EB	mesic/medium	d1		white meadowsweet Fd
152	C2	O.GL	O.EB	submesic/poor	b2		bearberry Aw
153	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
154	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
155	C2	O.GL	O.EB	mesic/medium	d3		white meadowsweet Sw
156	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
157	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
158	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
159	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
160	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
161	F1	O.HG		mesic/rich	e3		thimbleberry/pinegrass Sw
162	C2	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd

POL.	PM*	SOIL1	SOIL2	REGIMES	VEG1	VEG2	VEGETATION DESCRIPTION **
163	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
164	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
165	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
166	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
167	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
168	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
169	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
170	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
171	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
172	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
173	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
174	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
175	C2	O.EB		mesic/medium	d2		white meadowsweet Pl
176	C1	O.EB;		mesic/medium	d3		white meadowsweet Sw
177	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
178	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
179	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
180	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
181	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Aw
182	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
183	CR1	O.EBsh		subxeric/poor	GL		grassland
184	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
185	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
186	F1	O.HG	R.G	mesic/rich	e3		thimbleberry/pinegrass Sw
187	C2	O.GL	O.EB	submesic/medium	c2		Canada buffaloberry/HWR Pl
188	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
189	C2	O.GL	O.EB	subxeric/medium	GL		grassland
190	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
191	F1	O.HG	R.G	mesic/rich	e3		thimbleberry/pinegrass Sw
192	C2	O.GL	O.EB	subxeric/poor	a1		limber pine/juniper Fd-Pf
193	C2	O.GL	O.EB	subxeric/poor	a1		limber pine/juniper Fd-Pf
194	C2	O.GL	O.EB	mesic/medium	d1		white meadowsweet Fd
195	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
196	C2	O.GL	O.EB	subhygric/rich	f1		balsam poplar Pb
197	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
198	CR1	O.EBsh		submesic/medium	c3		Canada buffaloberry/HWR Aw
199	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
200	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
201	C2	O.GL	O.EB	submesic/poor	b2		bearberry Aw
202	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
203	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
204	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
205	CR1	O.EBsh		subxeric/poor	GL		grassland
206	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
207	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
208	C2	O.GL	O.EB	submesic/poor	b2	FG	bearberry Aw; grassland
209	C2	O.GL	O.EB	mesic/medium	d2		white meadowsweet Pl
210	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
211	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
212	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
213	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
214	CR1	O.EBsh		subxeric/poor	GL		dry grassland
215	C2	O.GL	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
216	CR1	O.EBsh		subxeric/poor	a1		limber pine/juniper Fd-Pf
217	CR1	O.EBsh		submesic/poor	b2		bearberry Aw

POL.	PM*	SOIL1	SOIL2	REGIMES	VEG1	VEG2	VEGETATION DESCRIPTION **
218	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
219	CR1	O.EBsh		submesic/poor	b2		bearberry Aw
220	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
221	CR1	O.EBsh		submesic/medium	c3		Canada buffaloberry/HWR Aw
222	CR1	O.EBsh		submesic/medium	c1		Canada buffaloberry/HWR Fd
223	C2	O.GL	O.EB	submesic/medium	GL		grassland
224	C2	O.GL	O.EB	submesic/poor	b2	FG	bearberry Aw; grassland
225	C2	O.GL	O.EB	submesic/poor	b2	FG	bearberry Aw; grassland
226	M3	O.EB		mesic/medium	d2		white meadowsweet Pl
227	M3	O.EB		mesic/rich	e2		thimbleberry/pine grass Aw
228	M3	O.EB		mesic/rich	e3		thimbleberry/pine grass Sw
229	M3	O.EB		mesic/rich	e2		thimbleberry/pine grass Aw
230	M3	O.EB		mesic/medium	d2		white meadowsweet Pl
231	M3	O.EB		submesic/medium	GL		grassland
232	M3	O.EB		submesic/medium	c4		Canada buffaloberry/HWR Aw-Sw-Pl-Fd
233	M3	O.EB		submesic/medium	c4		Canada buffaloberry/HWR Aw-Sw-Pl-Fd
234	M3	O.EB		submesic/medium	GL		grassland
235	M3	O.EB		mesic/medium	d2		white meadowsweet Pl
236	M3	O.EB		submesic/medium	GL		grassland
237	M3	O.EB		mesic/medium	d2		white meadowsweet Pl
238	M1	O.BL		submesic/medium	GL		grassland
239	M1	O.BL		submesic/medium	GL		grassland
240	M1	O.BL		mesic/rich	e2		thimbleberry/pine grass Aw
241	M1	O.BL		submesic/medium	c4		Canada buffaloberry/HWR Aw-Sw-Pl-Fd
242	C1	O.EB		mesic/medium	d3		white meadowsweet Sw
243	C1	O.EBsh		mesic/medium	d2		white meadowsweet Pl
244	C1	O.EB		mesic/rich	e2		thimbleberry/pine grass Aw
245	C1	O.EB		mesic/rich	e2		thimbleberry/pine grass Aw
246	C1	O.EB		mesic/rich	e3		thimbleberry/pine grass Sw
247	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
248	MC1	O.DG		mesic/rich	e2		thimbleberry/pine grass Aw
249	MC1	O.DG		submesic/medium	GL		grassland
250	MC1	O.DG		mesic/rich	e2	FG	thimbleberry/pine grass Aw; grassland
251	MC1	O.DG		submesic/medium	GL		grassland
252	C1	O.EB		submesic/medium	c1	c3	Canada buffaloberry/HWR Fd, Aw
253	C1	O.EB		submesic/medium	c3	FG	Canada buffaloberry/HWR Aw; grassland
254	C1	O.EB		submesic/medium	GL		grassland
255	C1	O.EB		submesic/medium	c3	c1	Canada buffaloberry/HWR Aw, Fd
256	F2	O.HG		subhydric/rich	CS		shrubland
257	MC1	O.DG	O.BL	submesic/medium	c1		Canada buffaloberry/HWR Fd
258	C1	O.EB		submesic/poor	b2	FG	bearberry Aw; grassland
259	C1	O.EB		submesic/medium	c3		Canada buffaloberry/HWR Aw
260	M1	O.BL	O.HG	mesic/rich	e2		thimbleberry/pine grass Aw
261	FM1	O.HG		mesic/rich	e3		thimbleberry/pine grass Sw
262	M1	O.BL		submesic/medium	c1		Canada buffaloberry/HWR Fd
263	C1	O.EBsh		submesic/medium	GL		fescue grassland
264	CR1	O.R	O.EB	subxeric/poor	a1	FG	limber pine/juniper Fd-Pf; grassland
265	C1	O.EBsh		submesic/poor	b2	FG	bearberry Aw; grassland
266	C1	O.EBsh		submesic/medium	c1	c3	Canada buffaloberry/HWR Fd; Aw
267	M1	O.BL		mesic/medium	d3	d1	white meadowsweet Sw (White spruce/mo
269	C1	O.EB		mesic/medium	d3	d1	white meadowsweet Sw (White spruce/mo
270	C1	O.EB		mesic/medium	d3	d1	white meadowsweet Sw (White spruce/mo
271	C1	O.EB		mesic/medium	d2		white meadowsweet Pl
272	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
273	C1	O.EB		submesic/poor	GL		grassland

POL.	PM*	SOIL1	SOIL2	REGIMES	VEG1	VEG2	VEGETATION DESCRIPTION **
274	C1	O.EB		submesic/poor	b2		bearberry Aw
275	C1	O.EBsh		subxeric/poor	a1	FG	limber pine/juniper Fd-Pf; grassland
276	C1	O.EB		subxeric/poor	a1	FG	limber pine/juniper Fd-Pf; grassland
277	M1	O.BL		mesic/rich	e2		thimbleberry/pine grass Aw
278	M1	O.BL		submesic/medium	GL		fescue grassland
279	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
280	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd
281	CR1	O.R	O.EB	submesic/medium	c1		Canada buffaloberry/HWR Fd
282	M1	O.BL		mesic/rich	e2		thimbleberry/pine grass Aw
283	C1	O.EB		submesic/poor	b2	FG	bearberry Aw; grassland
284	M1	O.BL		mesic/rich	e2		thimbleberry/pine grass Aw
285	M1	O.BL		mesic/rich	e2		thimbleberry/pine grass Aw
286	C1	O.EB		submesic/medium	c1		Canada buffaloberry/HWR Fd

POL. = map polygon number
* Refer to Appendix B for definitions of codes
** refer to Archibald et al (1996) for further information on ecosite phases in forested polygons

APPENDIX B. Descriptions of physical land unit codes from Appendix A - Upper Bob Creek Ecological Reserve.

PM UNIT CODE	PARENT MATERIALS AND LANDFORM	SOIL CLASSIFICATION*	SLOPE CLASS	DRAINAGE CLASS	VEGETATION - summary
COLLUVIAL					
C1	Colluvial and residual veneers over inclined or ridged bedrock; upper slopes; strong to extreme slopes with various aspects	O.EB - often shallow to bedrock	6-7; 7-8	Rapid	South-facing slopes are grassland or open mixed forest with meadows; north and west -facing are closed forest of pine or douglas fir
C2	Colluvial and residual veneers over inclined eroded bedrock; upper slopes	O.GL; O.EB	6-7	Well to rapid	North-facing are closed forest (pine or pine-spruce); south-facing are dry grassland with aspen copses or somewhat more open pine forest
COLLUVIAL AND BEDROCK					
CR1	Colluvial veneers over inclined eroded bedrock, with exposures of ridged bedrock; shallow poorly developed soils; occurs on or near ridgetops; very strong to extreme slopes	O.EB shallow to bedrock (dominant); O.R	7-8; 8-9	Rapid to very rapid	Open forest - limber pine-douglas fir or aspen with meadows; or grassland with scattered trees, some eroded areas
MORAINE AND COLLUVIAL					
MC1	Morainal and colluvial veneers over bedrock; lower and mid slopes west of Bob Creek valley	O.BL (dominant); O.DG (subdominant)	5-6	Well to moderately well	South-facing slopes are grassland with some aspen woodland and some open shrub; north-facing slopes are forested (mixed or coniferous forests)

MORAINAL					
M1	Rolling morainal veneers and blankets over inclined bedrock; lower slopes close to Bob Creek valley	O.BL (dominant) O.HG (minor amounts)	5-6	Moderately well	Mixed forest with meadows; grasslands with scattered poplar woodlands
M2	Undulating till deposits on lower slopes close to bottom of Bob Creek valley	O.BL	3-4	Moderately well	Grasslands
M3	Morainal veneers over inclined eroded bedrock; mid-elevations	O.EB	5-6	Well to moderately well	Coniferous forests of pine and douglas fir
FLUVIAL AND MORAINAL					
FM1	Morainal till deposits (dominant) interspersed with level fluvial deposits; lower slopes and ridges dissected by drainage channels;	O.HG; O.BL; GL.BL	2-3	Imperfectly to poorly	shrubby (willows; bog birch); also balsam poplar
FLUVIAL					
F1	Fluvial veneers and blankets over inclined bedrock; Bottoms of coulees in upper slope areas;	O.HG (dominant); R.G (subdominant)	5	Imperfectly to poorly	Tall shrubs; or forested with spruce or spruce-pine
F2	Fluvial veneers over undulating morainal till deposits in fluvial terraces and other areas associated with older channels of Bob Creek, and in coulees in lower slope areas	O.HG (dominant); CA.BL, CU.R	3	Moderately well to poorly	Shrubby - most commonly willows
F3	Bottom of Bob Creek valley; level fluvial deposits	O.HG (dominant); R.G and CU.R	3	Poorly to very poorly	Grassy-sedge meadows and closed shrub (willows and bog birch)

* codes for soil classification are from the Canadian System of Soil Classification (Canada Soil Survey 1987)

APPENDIX C. Summary of vegetation, landform and soils information collected at each site, Upper Bob Creek Ecological Reserve, 1994 and 1995. Refer to Fig. 1 for site locations.

a) grassland and shrubby lowland sites:

Site	Vegetation community type*	Parent materials**	Soil type**
01	*Festcam-Festida-Dantpar*	Undulating moraine	O.BL
02	*Festida-Dantpar-Festsca*	Morainal and residual veneers over bedrock	O.BL eroded
03	*Festcam-Festida-Dantpar*	Morainal veneers	O.BL
04	*Betugla-Salipet-Salimyr*	Morainal blankets	O.HG
05	*Festcam-Festida-Dantpar*	Morainal veneers	O.BL
06	*Festcam-Festida-Dantpar*	Morainal and residual veneers over bedrock	O.BL
07	*Calarub-Elyminn*	Colluvial veneers	O.R
08	*Festcam-Festida-Dantpar*	Colluvial and residual veneers	O.EBsh; O.R
09	*Poaprat-Festsca*	Fluvial veneers over undulating till	CU.R; CA.BL
10	*Festcam-Festida-Dantpar*	Morainal veneers	O.BL
11	*Betugla-Salipet-Salimyr*	Fluvial deposits	O.HG
12	*Festcam-Festida-Dantpar*	Morainal veneers	O.BL
13	*Festcam-Festida-Dantpar*	Morainal veneers	O.BL
20	*Festcam-Festida-Dantpar*	Colluvial veneers over bedrock	O.EBsh
21	*Betugla-Salipet-Salimyr*	Fluvial veneers over undulating moraine	O.HG
22	*Betugla-Salipet-Salimyr*	Fluvial veneers over undulating moraine	O.HG
23	*Festcam-Festida-Dantpar*	Morainal and colluvial veneers	O.DG
24	*Festcam-Festida-Dantpar*	Undulating moraine	O.BL

Site	Vegetation community type*	Parent materials**	Soil type**
25	*Poaprat-Festcam*	Morainal and colluvial veneers	O.DG/O.EB
26	*Festsca-Festida-Dantpar*	Morainal and residual veneers	O.BL
27	*Festida-Dantpar-Festsca*	Morainal and colluvial veneers	O.BL
28	*Festcam-Festida-Dantpar*	Colluvial and residual veneers over bedrock	O.EBsh
29	*Festsca-Poaprat-Phlepra*	Undulating moraine	O.BL

b) forested sites:

Site	Vegetation community type* (ecosite phase in brackets)**	Surficial materials***	Soils***
30	*Picegla/moss (white meadowsweet Sw)*	Colluvial and residual veneers over inclined bedrock	O.EBsh
31	*Poputre/Rosaaci/Calarub (thimbleberry/pine grass Aw)*	Morainal and colluvial veneers over rock	O.BL
32	*Picegla/moss (white meadowsweet Sw)*	Colluvial and residual veneers over inclined bedrock	O.EBsh
33	*Pseumen/Elyminn (Canada buffaloberry/Hairy wild rye Fd)*	Colluvial and residual veneers over inclined bedrock	O.EBsh
34	*Poputre/Rosaaci/Calarub (thimbleberry/pine grass Aw)*	Morainal veneers and blankets	O.BL; O.HG
35	*Pseumen/Elyminn (see #33)*	Colluvial veneers over rock	O.GL;O.EB
36	*Pseumen/Elyminn (see #33)*	Colluvial veneers over rock	O.GL;O.EB
37	*Poputre-Picegla/Vaccsco*	Till and colluvial veneers over rock	O.BL;O.DG
38	*Poputre/Rosaaci/Calarub (see #34)*	Morainal blankets	O.BL

Site	Vegetation community type* (ecosite phase in brackets)**	Surficial materials***	Soils***
39	*Pseumen/Elyminn (see #33)*	Colluvial and residual veneers over inclined bedrock	O.EBsh
40	*Pinucon/Spirbet (white meadowsweet Pl)*	Morainal blankets	O.EB
41	*Picegla/moss (see #32)*	Morainal veneers and blankets	O.BL;O.HG
42	*Picegla-Pseumen/Spirbet (white meadowsweet Fd)*	Colluvial and residual veneers over inclined bedrock	O.EBsh
43	*Picegla-Pseumen/Spirbet (see #42)*	Morainal and colluvial veneers	O.BL;O.DG
44	*Picegla/Rubupar (thimbleberry/pine grass Sw)*	Morainal and colluvial veneers	O.BL
45	*Picegla-Popubal/Sympalb (balsam poplar Pb)*	Fluvial deposits	O.HG
46	*Poputre/Arctuva/Festsca (bearberry Aw)*	Morainal and colluvial veneers	O.EB
47	*Poputre/Rosaaci/Calarub (thimbleberry/pine grass Aw)*	Morainal blankets	O.EB

* seven-letter latin acronyms for plant species are from Alberta Environ. Protection (1993);
** Ecosite phase descriptions (Archibald et al 1996): Aw - aspen, Fd - Douglas fir, Pf - limber pine, Pl - lodgepole pine, Pb - balsam poplar, Sw - white spruce
*** information on parent materials and soil types is from site data where available, or from Leskiw (1993)

APPENDIX D. Significant plant species which may occur in the Ecological Reserve, and status, habitat and occurrence details.

Species of concern[a] :		Ranking (ANHIC)
Erigeron radicatus[b,c]	Dwarf fleabane	S2
Oryzopsis exigua[b,c]	Little rice grass	S1
Phacelia hastata[c]	Silver-leaved scorpion weed	S2
Plantago canescens[c]	Western ribgrass	S2
Potentilla plattensis[b,c]	Low cinquefoil	S2
Senecio cymbalarioides[c]	Alpine groundsel	S1
Spiraea densiflora[c]	Pink meadowsweet	S2
Other significant species		
Goodyera oblongifolia[c]	Rattlesnake plantain	--
Microseris nutans[c]	Nodding scorzonella	S2S3

[a] Alberta Natural Heritage Information Centre: Tracking list of plant species of special concern.
[b] Species of concern which has been found nearby (on Black Mountain east of the study area)
[c] Recorded by Brown et al (1986)

---

1)*Erigeron radicatus* Hook. (Dwarf fleabane)
Status: species of special concern ranked S2 on tracking list (ANHIC 1996); rare in Alberta (Packer and Bradley 1984, Wallis et al 1987); rare in Canada (Fairbarns et al 1987); western species, rare throughout its range (Wallis et al 1986)
Habitat: dry ridges, open slopes, scree slopes (mostly north of Upper Bob Creek Ecological Reserve)
Occurrence: recorded by Wallis et al (1986) at the south end of Whaleback Ridge, and on west-facing slope of nearby Black Mountain

2)*Goodyera oblongifolia* Raf. (Rattlesnake plantain)
Status: uncommon in Alberta; scattered records in the foothills (Moss 1983)
Habitat: woods
Occurrence:recorded by Brown et al (1986)

3)*Microseris nutans* (Hook.) Sch.-Bip. (Nodding scorzonella)
Status: rare in Alberta (Packer and Bradley 1984; Wallis et al 1987); southwest Alberta distribution
Habitat: dry to moist slopes, open woods; Douglas fir stands (Wallis et al 1987);
Occurrence: recorded by Brown et al (1986)

4)*Oryzopsis exigua* Thurb. (Little rice grass)
Status: rare in Alberta (Packer and Bradley; ; Wallis et al 1987); rare in Canada (Fairbarns et al 1987); distribution is southwest corner of the province
Habitat: dry open ground or open woods
Occurrence:recorded by Brown et al (1986)

5)*Phacelia hastata* Doug. ex Lehm. (Silver-leaved scorpion weed)
Status: uncommon in Alberta; in southwest part of province (Moss 1983); species of concern with only 6-20 occurrences (ANHIC 1996)
Habitat: dry slopes and valleys
Occurrence: recorded by Brown et al (1986)

6)*Plantago canescens* Adams (Western ribgrass)
Status: uncommon in Alberta; 7 records in the province (Moss 1983); species of concern with only 6-20 occurrences (ANHIC 1996)
Habitat: grassy and gravelly slopes
Occurrence: recorded by Brown et al (1986)

7)*Potentilla plattensis* Nutt. (Low cinquefoil)
Status: rare in Alberta (Packer and Bradley 1984); only 3 records; species of fescue grasslands
Habitat: dry areas in grassland and coulees
Occurrence: recorded by Brown et al (1986)

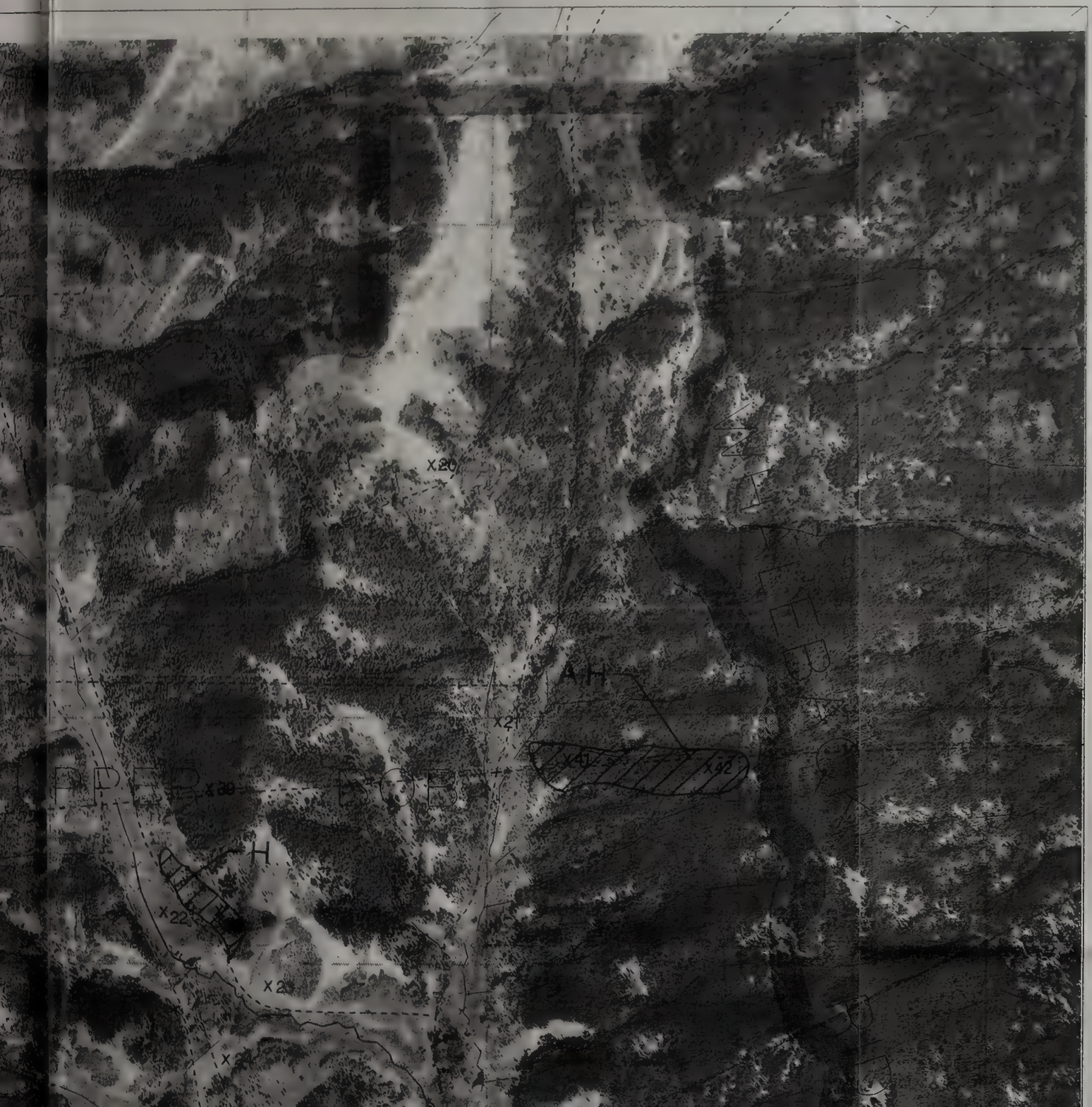
8)*Senecio cymbalarioides* Buck (Alpine groundsel)
Status: rare in Alberta (Packer and Bradley 1984; Wallis et al 1987); rare in Canada (Fairbarns et al 1987); southwestern Alberta species
Habitat: moist subalpine meadows; 2000-2300 m;
Occurrence: recorded by Brown et al (1986)

9)*Spiraea densiflora* Nutt. (Pink meadowsweet)
Status: rare in Alberta (Packer and Bradley 1984)
Habitat: moist meadows, thickets and woods, boggy places (4)
Occurrence: recorded by Brown et al (1986)

APPENDIX E. Ranking system used to evaluate status of significant plant species. The system was originally developed by The Nature Conservancy, and is presented in ANHIC (1996). Only the ranks for species discussed in this report are included here.

Provincial Rank	Definition
S1	Five or fewer occurrences or only a few remaining individuals or may be imperiled because some factor of its biology makes it especially vulnerable to extirpation.
S2	6-20 occurrences or with many individuals in fewer occurrences; or may be susceptible to extirpation because of some factor of its biology.
S3	21-100 occurrences, may be rare and local throughout its range, or in a restricted range (may be abundant in some locations or may be vulnerable to extirpation because of some factor of its biology).
SU	Status uncertain often because of low search effort or cryptic nature of the element; possibly in peril


D.F
H
H
A.H
A.H
UPPER
ECOLOGICAL
x20
x21
x39
x41
x42
x22
x23
x24
x46
x25



UPPER B
ECOLOGIC

SIGNIFICANT VEG

WEST OF TH

SCAL

KILOMETRE 0.0 0.2 0.4 0.6 0.8

MILE 0.0 0.25 0.5

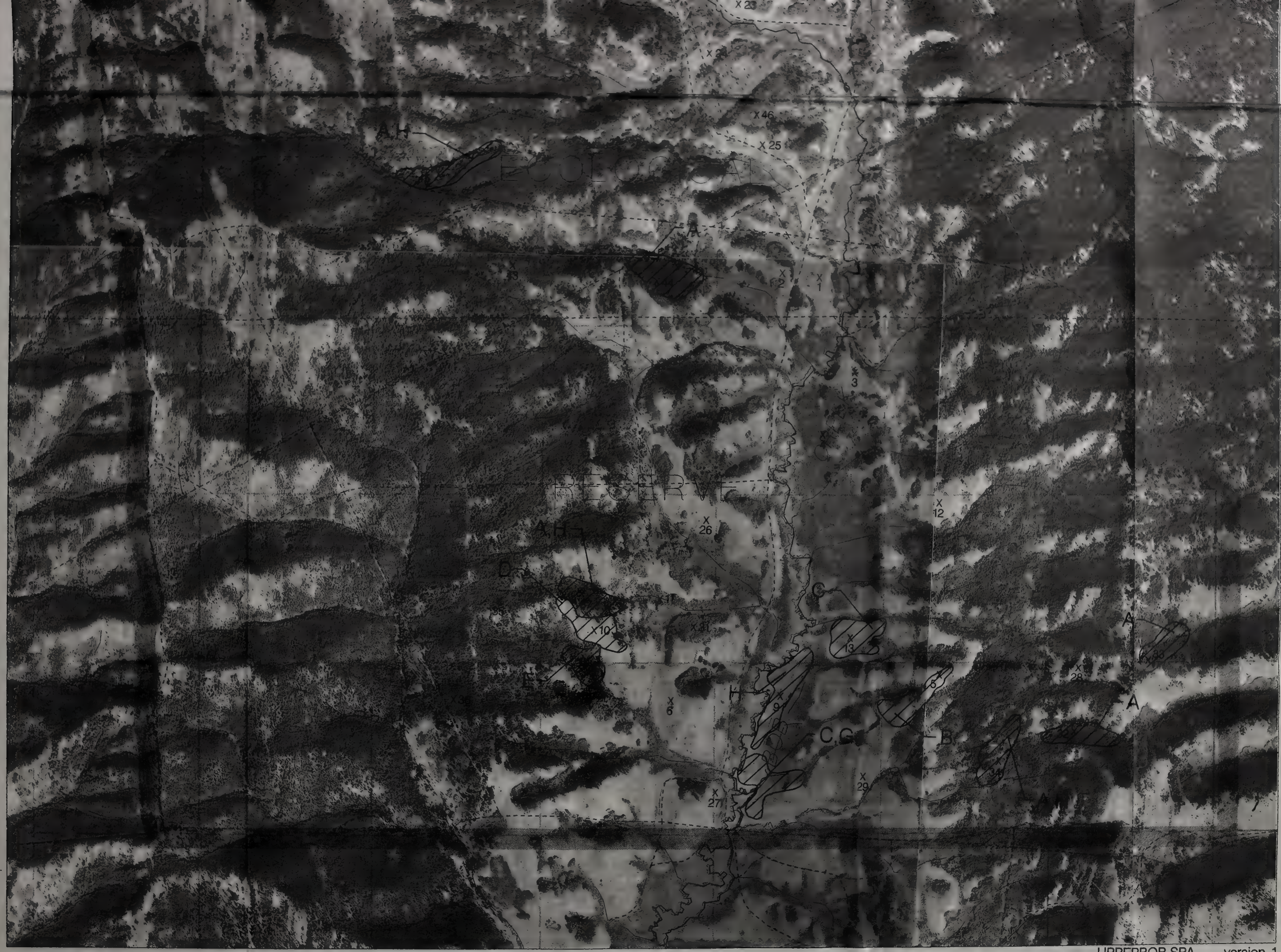
Prepared b
Corporate Management Service;

Date

PLANIMETRIC SYMBOLS

- Hard Surface – All Weather
- Loose or Stabilized Surface – All Weather
- Loose Surface – Dry Weather
- Truck Trail
- Seismic Line or Trail
- Bridge
- Road Allowance
- Railway
- Transmission Line

DITCH



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January 1997

Loose Surface - Dry Weather
Truck Trail
Seismic Line or Trail
Bridge
Road Allowance
Railway
Transmission Line
Pipeline
Oil Wellsite
Gas Wellsite

DITCH
Ditch, Canal or Flume
Perennial Lake - Open Water
Intermittent Lake
Gravel Bar, Sand or Mud
Gate
Fence existing
Fence proposed
Map Unit Boundaries
X 29 Sample Sites
Grazing Lease /Permit Boundary

SIGNIFICANT VEGETATION FEATURES

A. Angelica dawsonii
B. Carex scopulorum
C. Castilleja cusickii
D. Conimitella williamsii
E. Corallorhiza striata
F. Osmorhiza occidentalis
G. Poa nevadensis
H. Senecio foetidus var. hydrophiloides

UPPERBOB.SPA – version 1
January 1997

UPPER BOB CREEK ECOLOGICAL RESERVE

ECOLOGICAL LAND CLASSIFICATION

WEST OF THE FIFTH MERIDIAN

SCALE 1:15 000

KILOMETRE 0.0 0.2 0.4 0.6 0.8 1.0 1.5 2.0 KILOMETRE

MILE 0.0 0.25 0.5 0.75 1.0 1.5 MILE

Prepared by Resource Data Division
Corporate Management Service; Alberta Environmental Protection; January 1997

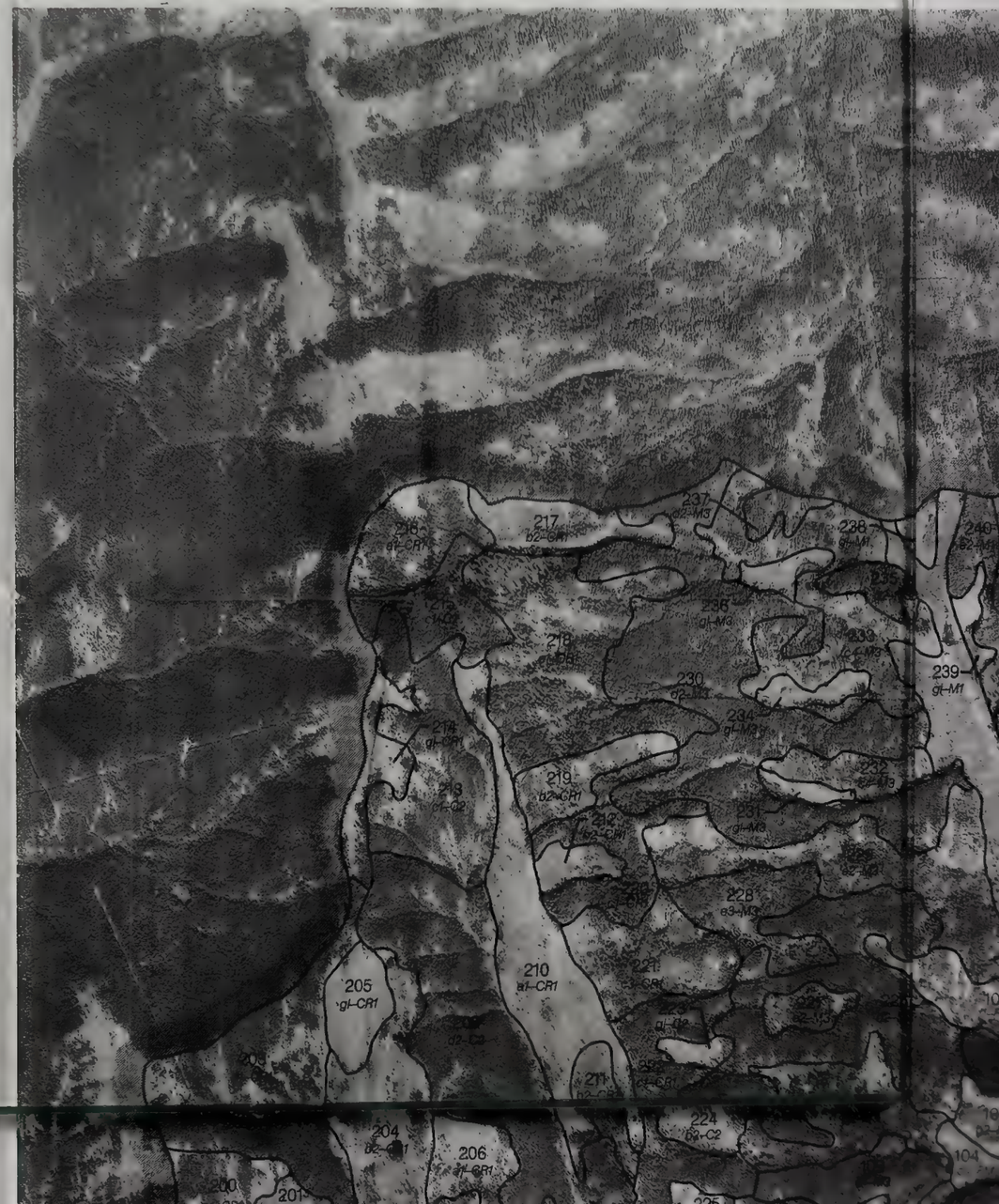
Date of Orthophoto 1982

VEGETATION CODES

CODE +	DESCRIPTION + +
a1	Limber pine/juniper Fd
b2	Bearberry Aw
c1	Canada buffaloberry/hairy wild rye Fd
c2	Canada buffaloberry/hairy wild rye Pl
c3	Canada buffaloberry/hairy wild rye Aw
c4	Canada buffaloberry/hairy wild rye Aw–Sw–Pl–Fd
d1	White meadowsweet Fd
d2	White meadowsweet Pl
d3	White meadowsweet Sw
e1	Thimbleberry/pinegrass Pl
e2	Thimbleberry/pinegrass Aw
e3	Thimbleberry/pinegrass Sw
fl	Balsam poplar Pb
gl	Grassland
sm	Sedge Meadow
cs	Closed shrub

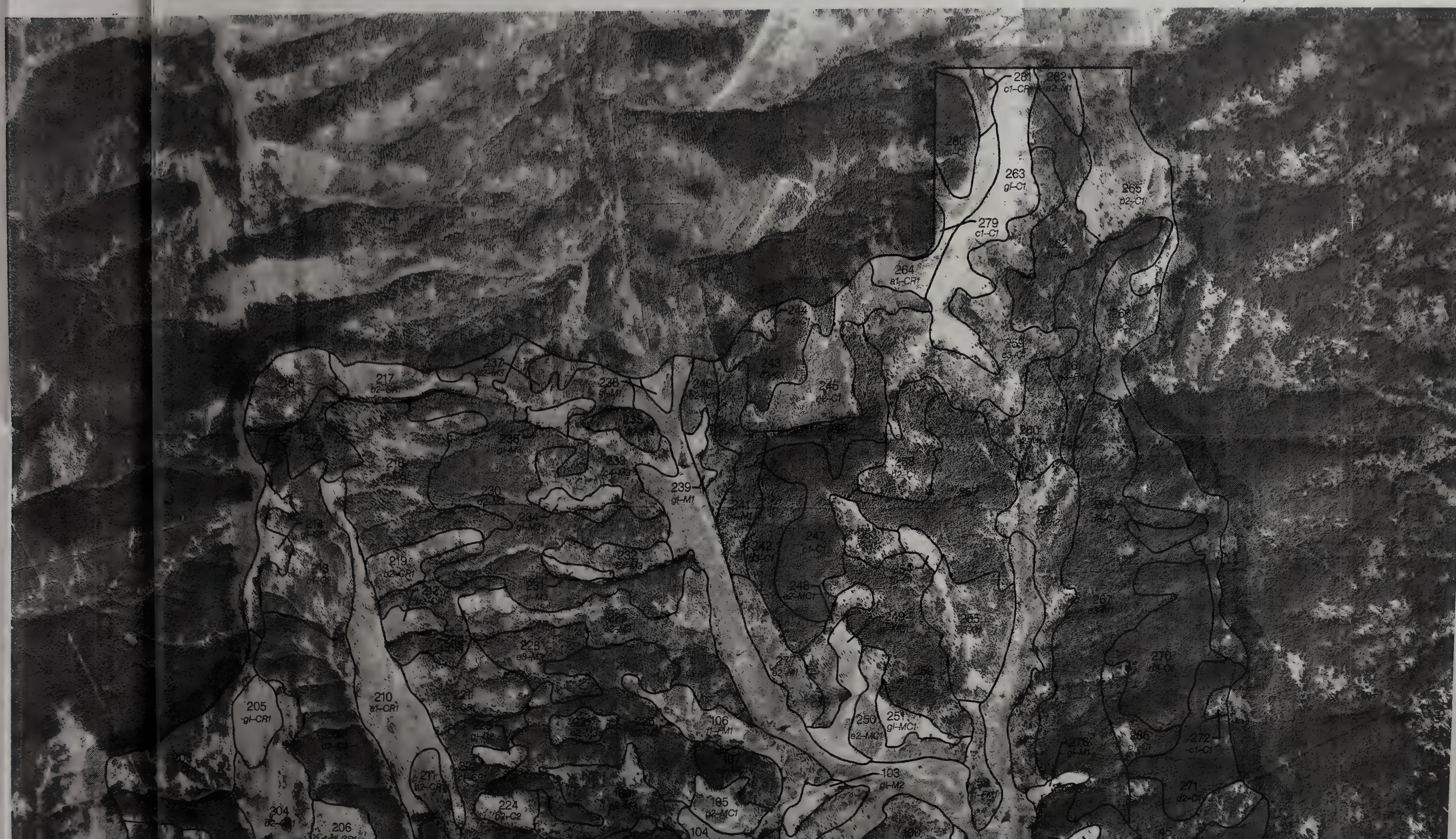
LABEL CODES

203
a1–CR1
- Polygon ID Numbers
- Physical Land Unit Codes
- Vegetation Codes



+ Refer to Archibald et al(1996) for details of forest ecosite phases

+ + Key to overstory species abbreviation
Aw – Aspen



281
c1-CR1
282
263
gl-C1
265
b2-C1
279
c1-C1
264
a1-CR1
217
237
238
240
245
b2-C1
239
gl-M1
230
231
232
228
219
b2-CR1
210
a1-CR1
205
gl-CR1
106
250
a2-MC1
251
gl-MC1
103
gl-M2
224
b2-C2
105
b2-MC1
104
204
206
248
a2-MC1
242
247
260
276
272
c1-C1
271
d2-C1

sm	Sedge Meadow
cs	Closed shrub

+Refer to Archibald et al(1996) for details of forest ecosite phases

++Key to overstory species abbreviation

Aw – Aspen
Fd – Douglas fir
Pb – Balsam poplar
Pf – Limber pine
Pl – Lodgepole pine
Sw – White spruce

PHYSICAL LAND UNIT CODES

PM UNIT CODE	PARENT MATERIALS AND LANDFORM	SOIL CLASSIFICATION*	SLOPE CLASS	DRAINAGE CLASS	VEGETATION – summary
COLLUVIAL					
C1	Colluvial and residual veneers over inclined or ridged bedrock; upper slopes; strong to extreme slopes with various aspects.	O.EB – often shallow to bedrock	6–7; 7–8	Rapid	South–facing slopes are grassland or open mixed forest with meadows; north and west–facing are closed forest of pine and douglas fir
C2	Colluvial and residual veneers over inclined eroded bedrock; upper slopes	O.GL; O.EB	6–7	Well to Rapid	North–facing are closed forest (pine or pine–spruce); south–facing are dry grassland with aspen copses or somewhat more open pine forest
COLLUVIAL AND BEDROCK					
CR1	Colluvial veneers over inclined eroded bedrock; with exposures of ridged bedrock; shallow poorly developed solls; occurs on or near ridgetops; very strong to extreme slopes	O.EB shallow to bedrock (dominant); O.R	7–8; 8–9	Rapid to very rapid	Open forest–limber pine–douglas fir or aspen with meadows; or grassland with scattered trees, some eroded areas
MORAINE AND COLLUVIAL					
MC1	Morainal and colluvial veneers over bedrock; lower and mid slopes west of Bob Creek valley	O.BL (dominant); O.DG (subdominant)	5–6	Well to moderately well	South–facing slopes are grassland with some aspen woodland and some open shrub; north–facing slopes are forested (mixed or coniferous forests)
MORAINAL					
M1	Rolling morainal veneers and blankets over inclined bedrock; lower slopes close to Bob Creek valley	O.BL (dominant) O.HG (minor amounts)	5–6	Moderately well	Mixed forest with meadows; grasslands with scattered poplar woodlands
M2	Undulating till deposits on lower slopes close to bottom of Bob Creek valley	O.BL	3–4	Moderately well	Grassland
M3	Morainal veneers over inclined eroded bedrock; mid–elevations	O.EB	5–6	Well to moderately well	Coniferous forest of pine and douglas fir
FLUVIAL AND MORAINAL					
FM1	Morainal till deposits (dominant)interspersed with level fluvial deposits;lower slopes and ridges dissected by drainage channels	O.HG; O.BL; GL.BL	2–3	Imperfectly to poorly	Shrubby (willow; bog birch); also balsam poplar
FLUVIAL					
F1	Fluvial veneers and blankets over inclined bedrock; Bottoms of coulees in upper slopes areas	O.HG (dominant); R.G (subdominant)	5	Imperfectly to poorly	Tall shrubs, or mixed forest with white spruce or balsam poplar.
F2	Fluvial veneers over undulating morainal till deposits in fluvial terraces and other areas associated with older channels of Bob Creek, and in coulees in lower slope areas	O.HG (dominant); CA.BL, CU.R	3	Moderately well to poorly	Shrubby – most commonly willows
F3	Bottom of Bob Creek valley; level fluvial deposits	O.HG (dominant); R.G and CU.R (subdominant)	3	Poorly to very poorly	Grassland–sedge meadows and closed shrub (willows and bog birch)

* codes for soil classification are from the Canadian System of Soil Classification (Canada Soil Survey 1987)

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c2 Canada buffaloberry/hairy wild rye P

c3 Canada buffaloberry/hairy wild rye A