Galton Range Bioterrain and Ecosystem Mapping Project

Volume I – Final Report

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EXECUTIVE SUMMARY

The Galton Range Bioterrain and Ecosystem Mapping project was initiated by the BC Environment, Fish and Wildlife Service, Cranbrook, in co-operation with the Rocky Mountain Bighorn Sheep Habitat Conservation Trust Fund. The study area encompassed five (5) BEC subzones and consisted of a 15,000 ha area south of the Elk River located approximately 5 km south of Elko. From Highway #93 the study area extended east to the height of land along the Galton Range and stretched south to the USA border (49E 00' N to 49E 13' N and 148E 54' W to115E10' W approximately). British Columbia TRIM map sheets (1:20,000 scale) included are 82G.025, 82G.15, 82G.016, 82G.005 and 82G.006. Elevation ranges from 740 m, in the PPdh2, of the Elk River Valley to 2397 m at the highest point along the Galton Range. The main focus of the study was to provide 1:20,000 scale TRIM registered ecosystem mapping and associated database products suitable for identifying potential habitat enhancement priority areas and developing habitat management prescriptions aimed at restoring and improving Rocky Mountain bighorn sheep and mule deer winter ranges. Other species of concern which were also included in the modelling were elk, white-tailed deer, moose, American marten, black bear and grizzly bear. The resulting expanded legend to the ecosystem units and other data collected provide a basis for modelling for a wide range of other species. Products of the study include a 1:20,000 scale orthophoto mosaic with clear TRIM overlays, black/white paper copy bioterrain and ecosystem maps, and wildlife habitat treatment maps. The final report (Volume I) documents the project objectives, methodology, results and discussion. Six (6) candidate priority habitat enhancement project areas are identified along with a brief outline of key habitat treatment recommendations. Volume II provides documentation of important databases including the expanded legends to the ecosystem maps, wildlife species status listings for the study area, modelling documentation, colour plates of representative ecosystem units, wildlife suitability and capability ratings, wildlife habitat treatment legends, field plot databases, and abbreviated ecosystem and bioterrain polygon databases.

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1.0 INTRODUCTION

The British Columbia Ministry of Environment, Land and Parks in co-operation with the Rocky Mountain Bighorn Sheep Habitat Conservation Trust Fund is continuing its program to monitor, manage and enhance bighorn sheep ranges in the East Kootenay Trench (EKT) of the Rocky Mountains. To date six other similar projects have been completed in the EKT including three immediately north of the Galton study area. These include Sheep Mountain (Lea et al. 1990), Mount Broadwood (Ketcheson 1994) and Bull Mountain (Ketcheson 1996). Further north in the EKT three other projects are presently in various stages of completion and include ones at Premiere Ridge/Diorite (per. comm. Clint Smyth), Kindersley /Stoddart (Marcoux et al. 1997) and East Columbia Lake (Marcoux et al. 1997).

The current project, undertaken by Wildlands Ecological Consulting Ltd. (formerly Riddell Environmental Research Ltd.), was initiated to create a 1:20,000 scale Bioterrain and Ecosystem Map (TEM) of the western exposure of the Galton Range in southeastern British Columbia (Figure 1). In the past this region has supported some of the highest densities of over-wintering mule deer and bighorn sheep in the province (per. comm. Dennis Demarchi). However, due to disease, forest encroachment and ingrowth, grazing pressure, predation and other factors mule deer and bighorn sheep numbers have declined substantially. The focus of this project was to create a TEM map suitable for use in habitat enhancement planning for bighorn sheep and mule deer. Secondary species of interest included white-tailed deer, elk, moose, black bear, grizzly bear and pine marten. Field data was also collected regarding the occurrence of red and blue listed species, rare habitat/vegetation communities, and special wildlife features.

1.1 Objectives

The following key project objectives were identified:

1. To produce bioterrain and ecosystem maps, in ArcInfo GIS format, which are registered to TRIM base maps (1:20,000 scale) and accompanied by a bioterrain and ecosystem attribute database.

2. To produce an orthophoto mosaic of the study area.

3. To produce an expanded legend describing the attributes of each ecosystem type and documenting dominant and associate/diagnostic plant species occurrence by structural stage category. Also to identify dominant and associate forage and browse species for ungulates, forage and browse productivity values, and security cover values.

4. To classify the habitat suitability and capability of each ecosystem/structural stage type for ungulates, both bear species and marten.

5. To produce a wildlife management treatment map for the study area.

6. To identify six priority areas with good potential, through management efforts, to enhance winter habitat for bighorn sheep and mule deer.

1.2 Background

The following sections provide an overview and a review of the literature pertaining to the Galton Range's geology, soils, vegetation, wildlife and ecology.

1.2.1 Regional Geology

The Galton study area (Figure 1) is located within the Rocky Mountains of the Eastern System of the Cordillera and the Rocky Mountain Trench of the Interior System of the Cordillera. The Rocky Mountains include several ranges (Kootenay Ranges, Park Ranges, Front Ranges and Border Ranges) (Holland, 1964). The Galton Range is the easternmost range of the Border Ranges which lie adjacent to the Rocky Mountain Trench.

Sedimentary, metasedimentary, and igneous bedrock ranging in age from Precambrian to Tertiary are found within the study area. The sediments which form the bedrock were deposited in a shallow basin-like depression known as the Cordilleran geosyncline which came into existence in Precambrian time and persisted with various modifications until the end of the Mesozoic (Tertiary time) (Rice, 1937).

The sediments in the Cordilleran geosyncline were metamorphosed during periods of mountain building. Extrusive and intrusive igneous rock (lava flows and dykes and sills) were also formed during these episodes and bedrock was folded and faulted.

After the last period of mountain building in the Tertiary, the bedrock was subjected to a long period of erosion. Sediments were eroded from the mountains and deposited in low-lying areas, e.g. the Rocky Mountain Trench.

In the latest geological time period (the Quaternary), which covers the last two to three million years of the Earth's history, climatic fluctuations gave rise several times to glacial and nonglacial conditions (Ryder, 1981). Unconsolidated surficial sediments which overlie the bedrock were formed during these glacial and nonglacial intervals.

1.2.2 Bedrock Geology

1.2.2.1 Rocky Mountain Trench

The Rocky Mountain Trench lies between the Purcell Mountains of the Interior System of the Cordillera to the west and the Rocky Mountains of the Eastern System to the east.

The Rocky Mountain Trench is a major topographic feature that extends from 47EN latitude in Montana to beyond 59EN latitude in British Columbia. It follows a zone of crustal weakness that is possibly an ancient continental margin (Ryder, 1981).

During Tertiary time, the trench was heavily eroded by streams whose courses were antecedent to the building of the Rocky Mountains to the east and uplift of the Purcell Mountains to the west (Holland, 1964). Weakly consolidated Tertiary sediments carried by streams were deposited on the downfaulted and tilted bedrock in the trench during Tertiary time. Erosion of the Trench was completed by the end of the Tertiary and it was occupied by ice of the Cordilleran glacier during Quaternary time.

Glaciation of the Trench modified its form, but the main effect of glaciation was to change previously established drainage systems. Quaternary sediments were deposited and streams became established in their present courses with the waning of the ice. During postglacial times these streams have incised themselves into the deep drift of the Trench.

Up to 1000 metres of Tertiary and Quaternary sediments were deposited on the uneven bedrock surface of the Trench (Ryder, 1981). Rock outcrops on the Trench floor are exposed parts of ridges that separate deep structural basins. In general, the bedrock surface rises gradually westwards into the hilly terrain of the Purcell Mountains.

1.2.2.2 Rocky Mountains - Border Ranges

The Rocky Mountains consist mostly of sedimentary rocks. These rocks were deformed and uplifted during the Laramide Orogeny in Cretaceous and Tertiary time. The sediments were thrust eastward over younger strata at the margin of the Great Plains (Ryder, 1981). The deformation processes gave rise to north-northwest and south-southeast trending faults and folds that control the present day linear topography. The character of terrain is variable because of differences in structural style and rock type. Accordingly the region is subdivided into several smaller units, e.g. Border Ranges.

The Rocky Mountains are underlain by sedimentary and metamorphic rocks which range from Proterozoic to Cretaceous in age. The youngest rocks are exposed in the Rocky Mountain Foothills to the east of the study area and progressively older rocks lie to the west. The predominant rocks are Paleozoic and Proterozoic limestones, quartzites, schists, and slates. Two volcanic formations of Mesozoic age are known, but intrusive rocks are limited in extent.

The Galton Range (Border Ranges) is the most western of the Border Ranges of the Rocky Mountains. It lies adjacent to the Rocky Mountain Trench and is bordered on the east by the MacDonald Range. The length of the Galton Range between the Elk River and the International Boundary is 35 kilometres and its width is 13 kilometres. High peaks of 2130 to 2285 metres rise along a straight abrupt front above the Trench. The general terrace elevation along this area is 915 metres. The Galton Range is a comparatively simple synclinal block of late Proterozoic argillaceous sedimentary rocks bounded by a steep fault-line scarp along the Rocky Mountain Trench and by the Wigwam fault on the east which is located along the valley of the Wigwam River (Holland, 1964). Creek gradients become more steep downslope and descend to the Trench floor over waterfalls and rapids.

Bedrock in the Galtons is mostly Precambrian in age and the rock on the east is younger than the rock on the west. Argillite, siltstone, dolomitic siltstone, quartzite, limestone, and conglomerate of the Roosville, Phillips, Gateway and Siyeh Formations occur within the study area (Leech,1960).

1.2.3 Quaternary Geology

Surficial or Quaternary deposits overlie the bedrock throughout the study area. These deposits were formed in the latest geological time period (the Quaternary) which covers the last two to three million years of the Earth's history. Most of the deposits which occur at ground surface throughout the study area are related to the most recent phase of the last Cordilleran Glaciation, known as the Fraser Glaciation. Deposits of two earlier phases of the Fraser Glaciation are also found in the Rocky Mountain Trench (Clague, 1975). Evidence of older glacial advances have been reported in adjacent parts of Alberta, British Columbia, and the United States (Ryder, 1981; Clague, 1989).

In the East Kootenays during the Fraser Glaciation, ice accumulated in cirques at high elevations in the Rocky and Purcell Mountains. These small glaciers expanded and merged into southerly flowing ice streams developed in the larger valleys, e.g. the Rocky Mountain Trench. These ice sheets which occupied the major valleys were up to 1000 metres thick and deposited morainal sediments directly from the glacier ice. Glaciers coalesced across ridge crests and only higher peaks protruded. During the retreat of the ice tongues, meltwater streams and glacial lakes deposited sediments in low lying areas.

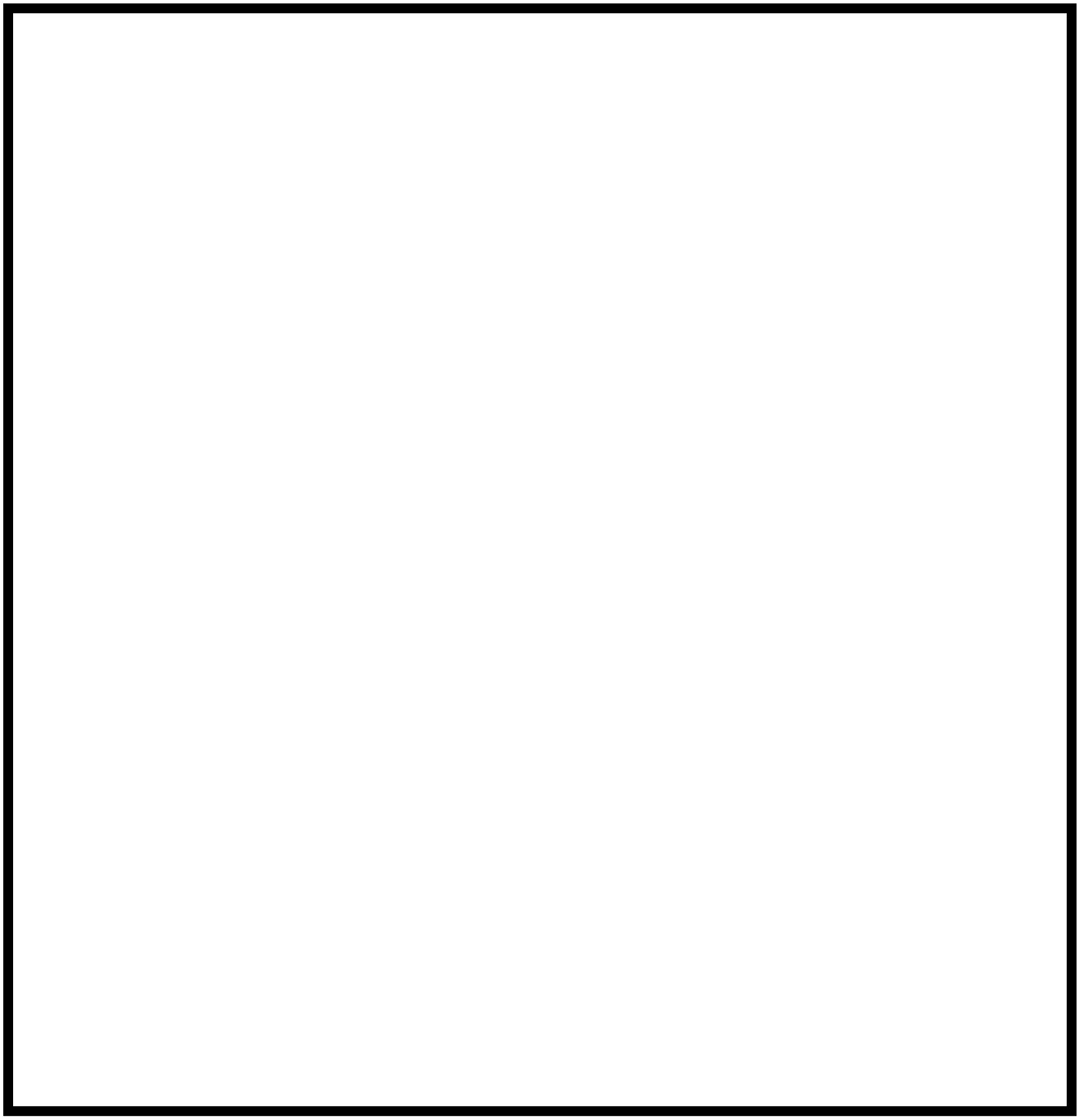
During postglacial times, rivers and streams became entrenched in glacial deposits and in places bedrock canyons were eroded. Most downcutting occurred within a few thousand years of deglaciation. Former glaciofluvial and glaciolacustrine deposits now constitute terraces in the Rocky Mountain Trench and in other mountain valleys. Floodplains and recent lacustrine materials formed along watercourses and alluvial fans developed where mountain creeks emerged onto level ground. Eolian deposits were formed by the wind from fine grained glacial deposits. Slopes have been modified by weathering and mass wasting which formed colluvial deposits. Organic deposits accumulated in low-lying, poorly drained areas.

1.2.3.1 Quaternary Deposits and Sediments

Quaternary deposits form landforms which are mappable on stereo airphotos (see Bioterrain Map Legend). The landforms have distinctive topographic and geomorphic expression, slope characteristics, geologic origin, materials, drainage characteristics, and mass wasting features which can be identified on airphotos and confirmed by field investigations. The unconsolidated sediments of Quaternary deposits form the parent material for soils.

Morainal deposits of the sediment till were deposited directly from the glacier ice during the Fraser and earlier glaciations. These deposits are found at ground surface up to 2000 metres along main and side valleys in the East Kootenays. It appears that only morainal deposits related to more recent alpine glaciations are found above that elevation in cirque basins at

Figure 1. Map outlining the location of the Galton Range study area, in southeastern British Columbia.



- - - - - -	**Galton Range Study Area Boundary**	**Scale 1:250 000**

some locations, e.g. Canyon Creek. Morainal deposits from 5 to 30 metres in thickness occur in the Rocky Mountain Trench and are interlayered with other deposits. At some locations these thicker deposits have been moulded into linear forms by the forward movement of the ice sheet.

The texture of tills in morainal deposits are variable and represent the parent rock and/or Quaternary deposits from which they were derived. For example, tills developed on limestone, dolomite, and argillite have a silty matrix.

Surficial deposits along the upper slopes of main valleys and side valleys consist mostly of shallow colluvium overlying rock. The colluvial sediments were deposited by mass wasting along valley sides. Many of these deposits are still being formed by active geomorphic processes. The most common colluvial deposits are coarse textured and consist of coarse, mostly angular rock fragments intermixed with sand and silt. An important characteristic used in identifying and separating colluvium from till is the high proportion of angular rocks seen in colluvium in contrast to the rounded rocks and fine sediments seen in till. Colluvium is generally less consolidated and better drained than till. Colluvial materials obtain their textures from the bedrock and/or surficial sediments from which they were derived. For example, quartzite breaks into coarse rubbly debris and fine grained colluvium is found on slopes along creeks which are incised into Quaternary deposits of the Rocky Mountain Trench.

Bedrock underlies all Quaternary sediments and is at the surface both along ridge crests and in lower portions of side valleys above 2000 metres. Veneers and blankets of colluvial and morainal deposits form an uneven cover on the bedrock. Precambrian slate, argillite, quartzite, quartz pebble conglomerate, dolomite, and limestone are the principal rock types within the Galtons.

Glaciofluvial and glaciolacustrine sediments consisting of sand, gravel, silt, and clay occur along the valley bottom of the Rocky Mountain Trench. Glaciofluvial sediments consisting of stratified silt, sand, and gravel occur in kame terraces and outwash plains along old glacial rivers. At some localities, meltwater channels have been incised into the deposits near the glacier front. Fine grained sediments deposited in low flow periods comprise the glaciolacustrine deposits within the study area.

Fluvial deposits which resemble glaciofluvial deposits in texture (gravel, sand, and silt) are found along present day rivers and streams in the Rocky Mountain Trench. They are also found along the east-west streams which enter the Trench. In some locations rivers and streams are underfit and occupy a smaller portion of valley bottoms than during glacial times.

These recent fluvial deposits can be intermixed with glaciofluvial materials and are topographically closest to the modern stream. Fluvial deposits reflect the properties (hydrologic regime, gradient and sediment load) of the present day stream. For example, cobbles and boulders can be found in the fluvial deposits along the steep mountain creeks which cross the Galtons.
Recent lacustrine deposits of clayey silt, silty clay, sandy silt, and silty sand are found

overlying the older fluvial glaciofluvial, glaciolacustrine, and morainal deposits, particularly in the Rocky Mountain Trench where postglacial lakes were present.

Eolian sediments consisting of fine sand and silt which has been eroded and transported by the wind in late glacial and postglacial time. Eolian deposits are common in the Trench and were derived from glaciofluvial and glaciolacustrine materials. These materials are non-consolidated but are cohesive because of weak cementation by calcium carbonate.

Organic deposits are found in depressions or old lake basins in rock or drift and in areas of high water table on recent floodplains and in abandoned meltwater channels. These deposits consist of decayed vegetative matter.

1.2.4 Geomorphic Processes

The alpine zone displays a variety of landforms resulting from active mass wasting processes. The dominant landforms are colluvial aprons and fans that begin as talus slopes below cliffs and extend across the sides of valleys and encroach on the valley bottoms. Other mass wasting features, such as rock slides, provide rock and fine grained colluvial debris that is moved downslope by solifluction, sheet wash and streams. Debris torrent gullies and feeder systems for these gullies begin in alpine areas and carry rock and soil debris during peak water periods. These debris torrent gullies form fluvial and colluvial fans at the end of their reaches in lower areas along valley bottoms.

The landforms built by mass wasting processes within the treeless alpine terrain probably encroached on the tree-covered valley slopes. Former glacial features within main valleys were either highly modified or removed by mass wasting processes that also eroded the preexisting drift or mantled it with colluvium. Mass wasting processes such as debris flows, slumps, earthflows, and soil creep have affected areas outside of the alpine zone, particularly where thicker fine grained deposits or bedrock are at ground surface.

Other evidence of active geomorphic processes within the main valleys include fluvial fans at the termini of debris torrent gullies and numerous gullies which drain upland areas. Small gullies also form in thicker surficial sediments on steeper slopes.

Tracks of snow avalanches appear as distinctive lines on parts of the valley sides. Recent fluvial features, glaciofluvial, and glaciolacustrine features along the main valley bottoms are reworked on sideslopes, particularly along rivers and creeks.

1.2.5 Soils

The soils and terrain of the study area were mapped at a scale of 1:50000 (Lacelle 1978) and described by Lacelle (1990). The 13 Soil Associations mapped in the study area include: Caithness, Calderol, Conrad, Couldrey, Fishertown, Flatbow, Maguire, Matkin, Mout Mike, Rainbowl, Roche Mountain, Rosen Lake and Wycliffe. Changes in Soil Association were linked to landscape position, elevation, and parent material.
The dominant soils found on the floor of the Rocky Mountain Trench were Orthic Eutric Brunisols developed on gravelly, fluvioglacial outwash plains and terraces (Fishertown Soil

Association). There were significant occurences (10-30%) of Orthic Eutric Brunisols developed on gravelly, silty till material (Wycliffe Soil Association) found on the floor and lower valley sides of the Rocky Mountain Trench.

The dominant soils found on the lower valley sides (1050-1350 masl) were Orthic Eutric Brunisols developed on blanket (>1m) (Caithness Soil Association) and veneer (<1m) (Rosen Lake Soil Association) deposits of rubbly, silty colluvial materials. There were significant occurences (10-30%) of Orthic Eutric Brunisols developed on gravelly, silty till materials (Flatbow Soil Association) found at the base of the valley slopes.

The dominant soils found at the mid valley sides (1350-1800 masl) were Orthic Dystric Brunisols developed on blanket (Calderol Soil Association) and veneer (Roche Mountain Soil Association) deposits of non-calcareous, rubbly colluvial materials. There were significant occurences (10-30%) of Brunisolic Gray Luvisols developed on calcareous till (Mount Mike Soil Association) and non-calcareous till (Matkin Soil Assocation).

The dominant soils found at higher elevations (1800-2300 masl) were Orthic Humo-Ferric Podzols. Soil parent materials encountered at these upper slope positions included blanket (Couldrey Soil Association) and veneer (Rainbowl Soil Association) deposits of medium-grained colluvial material, blanket deposits of sandy colluvial material (Conrad Soil Association) and fine to rubbly till deposits (Maguire Soil Association).

1.2.6 Climate

The continental climate of the Galton study area is characterized by cool winters and hot dry summers with a fairly long growing season at lower elevations. At higher elevations the climate is more typically cold, moist and snowy with cool short growing seasons and long cold winters (Meidinger and Pojar 1991).

The predominately north-south orientation of the Galton Range impedes the eastward movement patterns of Pacific air masses which tend to move across the study area from a northwest or southwest direction. In winter the Galton Range also checks the westward flow of cold Artic air masses, thus helping to moderate the winter climate of the area (Meidinger and Pojar 1991). The west to southwesterly aspect of the Galton Range, climate and steepness of the terrain combine to produce strongly contrasting soil moisture regimes between the warm (136E-285E) and cool (286E-135E) aspects. Warm slopes tend to have thinner dry soils and the cool slopes typically have thicker organic layers with more soil development and greater moisture retention abilities.

1.2.7 Vegetation

The study area includes a diverse assemblage of plant community types ranging from open stands of ponderosa pine - bluebunch wheatgrass in the valley floor of the Trench to open subalpine fir parkland and whitebark pine along the crest of the Galton Range. For a list of scientific names of plants referred to in the text the reader is directed to Appendix I. The physiography and climate of the Galton Range typically dictate that vegetation, on warm aspects, will consist of open forest with expansive grasslands and shrublands, and on cool aspects predominately dense closed canopy forest.

Five biogeoclimatic (BEC) subzone/variants (Braumandl and Curran 1992) exist in the study area, and two ecoregions and ecosections (Demarchi 1995). The BEC units include the Kootenay Dry Hot Ponderosa Pine Variant (PPdh2), Kootenay Dry Mild Interior Douglas-fir Variant (IDFdm2), Dry Cool Montane Spruce Subzone (MSdk), Dry Cool Engelmann Spruce - Subalpine Fir Subzone (ESSFdk), and the Dry Cool Engelmann Spruce - Subalpine Fir Undifferentiated Subzone (ESSFdku). Ecoregions and respective ecosections represented are the Southern Rocky Mountain Trench with East Kootenay Trench (EKT) ecosection, and the Northern Continental Divide with Border Ranges (BRR) ecosection. The characteristics of each these BEC and ecological classifications are summarized in Table 1.

In the study area the PPdh2 is situated on glaciofluvial plains on the valley floor of the Trench (EKT ecosection), and grades into the IDFdm2 which takes in the steep sidewalls of the Trench and lower slopes of the Galton Range. Much of the IDFdm2 is located on dolomite bedrock which expresses itself in the more calcarerous soils and associated vegetation, such as soopolallie. In the IDFdm2 there are a variety of surficial materials consisting of mainly colluvial and morainal blankets, narrow active fluvial riparian units and colluvial fans. The MSdk is located in the BRR ecosection situated upslope of the IDFdm2. It features mainly, colluvial blankets and veneers, narrow fluvial riparian units and some colluvial fans. Further upslope the ESSFdk is characterized by colluvial veneers on the slopes and morainal deposits in the in the headwaters of the major drainages. Then extending to the Galton Range crest is the ESSFdku which has predominately colluvial veneers and colluvial lithic veneers, and exposed bedrock.

Zonal climax vegetation in the PPdh2, characteristically, consists of open ponderosa pine and Douglas fir stands with bluebunch wheatgrass in the understory. Associated species include prairie rose, saskatoon, antelope brush, and rosy pussytoes. The IDFdm2 climax zonal sites typically support open and closed stands off Douglas-fir with some western larch, and an understory of pinegrass. Other important species include saskatoon, snowberry, birch-leaved spirea, tall Oregon-grape, common juniper and limited soopolallie. As discussed below fire suppression initiatives have resulted in forest ingrowth and encroachment by Douglas-fir which currently affect the natural expression of vegetation in these two BEC units.

Climax zonal sites in the MSdk support stands of hybrid white spruce, Douglas-fir and subalpine fir with understorys of snowberry, false azalea, birch-leaved spirea, tall Oregon-grape and minor amounts of soopolallie. In the herb layer grouseberry, pinegrass and heart-leaved arnica are common. In the ESSFdk, climax vegetation on zonal sites consists of subalpine fir and Engelmann spruce stands with dense cover of false azalea and frequent

representation by black huckleberry and black gooseberry. The herb layer contains grouseberry, heart-leaved arnica, western meadowrue and frequently one-leaved foamflower. Further upslope in the ESSFdku zonal vegetation consists of subalpine fir and Engelmann spruce with some remnant whitebark pine in the overstory. The understory is dominated by grouseberry and heart-leaved arnica with varying cover of white-flowered rhododenron, false azalea, mountain arnica, wood-rush spp., bracted lousewort and beargrass.

A review of the literature revealed that many similar ecosystem types were described for surrounding areas such as for Mt. Broadwood (Ketcheson 1994), Sheep Mountain (Lea et al. 1990), Bull Mountain (Ketcheson et al. 1996), Priemer Ridge (Demarchi nd), Brewer Creek (Kernaghan et al. 1999), Kindersley/Stoddart Creek (Marcoux et al. 1997), Montana (Pfister et al.1977), west-central Montana (Schallenberger 1966), Waterton Lakes National Park (Achuff et al. 1996), Kootenay National Park (Achuff et al. 1984) and others.

Within the EKT Quaedvlieg (1969) studied the ecology of antelope brush (i.e. bitterbrush) on Premier Ridge and Bull River winter ranges and related annual productivity to plant age. The shrub was not utilized by livestock or wildlife in spring and early summer but was browsed by cattle in late summer and received light use by wildlife, especially, in winter. He determined the oldest plant to be 35 years old but noted that this was relatively young compared to other areas (eg. Vaseaux Lake at 45, 76 and 112 years) and expected that these plants were established after the large forest fires of 1931. New growth productivity was substantially increased by the effects of heavy grazing and mechanical topping and the highest densities of plants were on heavily grazed or burned areas and lowest on less heavily grazed portions. He observed that antelope brush is not well developed in climax vegetation and is much more vigorous in an intermediate seral stages. The author concluded that on the Premier Ridge and Bull River ranges antelope brush was not a preferred browse species for wildlife, contrary to common perceptions.

Lea (1989) provided a detailed analysis of vegetation types present in the East Kootenays many of which are similar to types encountered in the Galton Range. In this report dominant and associate plants are identified for each type along with typical site conditions, soils, terrain and ecology.

1.2.7.1 Disturbance Patterns

Pre-historically, the dominant natural disturbances affecting vegetation in the study area were wildfire, aboriginal caused ignition and insect infestation (Gayton 1996). Consequently, most vegetation communities were in a various stages of succession after being fire initiated. Other natural disturbance factors affecting vegetation in the study include blowdown by heavy winds, avalanching, and grazing/browsing by ungulates. In recent years important human disturbances have included fire suppression, prescribed and accidental fire, livestock grazing, clearcut and selective logging, farmland cultivation, and road/trail construction and maintenance. Conflicts between livestock grazing and wildlife use, in the EKT, has led to a number of studies. More recently the effects of fire suppression have been the focus of ongoing research.

Table 1. Summary table of Biogeoclimatic (BEC) and Ecological Classification schemes used to classify the Galton Range study area. Typical elevation bands on warm (south; S) and cool (north; N) slopes are indicated for the study area along with dominant tree species and ecosystem types.

Ecological Classification					Biogeoclimatic Classification					Vegetation		
Ecodomain	**Ecodivision**	**Ecoprovince**	**Ecoregion**	**Ecosection**	**BEC Zone**	**Climate**	**Map Symbol**	**Subzone/Variant**	**Elevation(m)**	**Dominant Tree spp.**	Map Unit	**Mapped Site Series (No. and description)**
Humid Temperate	Humid Continental Highlands	Southern Interior Mountains	Southern Rocky Mountain Trench	East Kootenay Trench (EKT)	Ponderosa Pine (PP)	Dry	PPdh2	Kootenay Dry Hot Ponderosa Pine Variant	S: to 950 N: to 900	**Py, Fd** Sxw, At, Ac, (Lw, Pl)	AW PW AR CD	0 Antelope brush-Bluebunch wheatgrass 1 Py-Bluebunch Wheatgrass-Junegrass 3 Py/At-Rose-Solomon=s seal 4 Act-Red osier dogwood-Nootka rose
					Interior Douglas Fir (IDF)	Dry	IDFdm2	Kootenay Dry Mild Interior Douglas-fir Variant	S:950-1350 N:900-1200	**Fd** Py, Lw, Pl, Sxw, At, Ac, (Ep)	DT AW DS SP SS SH	1 Fd/Pl-Pinegrass-Twinflower 2 Antelope brush-Bluebunch wheatgrass 3 Fd-Snowberry-Balsamroot 4 Fd/Lw/Sx-Pinegrass 5 Swx/At-Wild sarsparilla 7 Swx-Horestail
			Northern Continental Divide	Border Ranges (BRR)	Montane Spruce (MS)	Dry	MSdk	Dry Cool Montane Spruce Subzone	S:1350-1750 N:1200-1650	**Se, Bl, (Fd)** Fc, Pl, Lw, At, Ac, Ep, (Sxw, Cw)	SG SW LJ LP SS SH	1 Swx-Soopolallie-Grouseberry 2 Saskatoon-Bluebunch wheatgrass 3 Pl-Juniper-Pinegrass 4 Pl - Oregon-grape - Pinegrass 5 Swx-Soopolallie-Snowberry 6 Swx-Dogwood-Horsetail
					Engelmann Spruce-Subalpine Fir (ESSF)	Dry	ESSFdk	Dry Cool Engelmann Spruce-Subalpine Fir Subzone	S:1750-2050 N:1650-1950	**Se, Bl** Pa, Pl, La, At, (Fd^f, Lw^f)	FA DM FG FM FH	1 Bl-Azalea-Foamflower 2 Fd-Douglas maple-Soopolallie 3 Bl-Azalea-Grouseberry 5 Bl-Azalea-Step moss 6 Bl-Azalea-Horsetail
					Engelmann Spruce-Subalpine Fir (ESSF)	Dry	ESSFdku	Undifferentiated Dry Cool Engelmann Spruce-Subalpine Fir Subzone	S:2050- crest N:1950-crest	**Bl,Pa,Se** Lw	FG PJ PB WG HG	1 Bl-Grouseberry 2 Pa/Bl-Common Juniper-Grouseberry 3 Bl/Pa-Beargrass-Grouseberry 4 Pa-Grouseberry 5 Bl-Pink mountain-heather

1.2.7.1.1 Fire Ecology

According to Gayton (per. comm.), prior to the 1890's fire in the study area was initiated by natural causes and aboriginal caused ignition. Then between the 1890's and 1920's there was increased ignition as settlers cleared the land and resource extraction ensued (eg. logging, mining). The rate of ignitions and intensity was even greater during the 1920 and 1930's as droughts affected the region. In approximately 1948 to the present organized fire suppression came into effect and the fire ignition rate decreased significantly.

Based on early records the forest structure on the floor of the Trench (i.e. PPdh2), and extending upslope (i.e. IDFdm2), consisted of open stands fireproof mature ponderosa pine, Douglas-fir and western larch trees (Gayton 1996). The vegetation and wildlife evolved with frequent fires in these Afire-maintained ecosystems≅ as they were subjected to low-intensity surface fires fire every 5 to 25 years. The result was an open forest canopy and abundant ground cover of grasses, forbs and shrubs. Dorey (1979) found the fire return interval in the Grasmere area averaged 6.4 years between 1813 and 1940. Based on fire data for Kootenay and Banff National Parks, approximate fire intervals for the MSdk, ESSFdk and ESSFdku might be expected to be 40, 85 to 125 and 145+ years, respectively (Anonymous 1991). These figures provide only an indication of the trend across BEC units and more research is required for the study area. A review of the airphotos of the study area revealed several areas in the ESSFdku which had recently burned. This author suspects that fire intervals, at the Galton Range, may be shorter for this BEC subzone than they are in the ESSFdk, on cool aspects especially, due to increased lightening strike.

According to John Parminter (per. comm.), the oldest fires on record with the Forest Service are from 1919 at which time a large fire burned from south of Grasmere to midway up the Scherf Creek, Reserve Creek and Miller Creek drainages. At that time smaller fires burned portions of Rainbow Creek and the north fork of Phillipps Creek drainages as well. In 1931 a large fire burned through the entire northern portion of the study area from Maguire Creek north. Then in 1934 a very large fire burned through the headwaters, extending to the mid section of each drainage, from Canyon Creek south to the north fork drainage of Phillipps Creek. Two other small fires burned a section along the north side of Phillipps Creek in 1941 and later Bowman Creek and Canyon Creek drainages in 1945. From that time to 1983 there were no other fires recorded for the study area. Fires occurring in the study area after 1983 are available from the District Forest Service but were not reviewed for this report.

A number of studies have considered various aspects related to the areas fire ecology. Demarchi and Lofts (1985) studied the effects of spring burning on the browse species. They found that productivity of saskatoon, antelope-brush, baldhip rose and redstem ceanothus was not affected appreciably by spring burning. They also found nutrient concentrations of nitrogen and phosphorus increased in the first year after burning. Thomson (1990) also studied the impact of fire on the rejuvenation abilities of several forage species including antelope brush, in southeastern British Columbia. In Northern Idaho, Smith and Fischer (1997) summarized the ecology of fire related to forest habitat and community types, pre-settlement fire regimes, patterns of succession, forest fuels and fire management issues. The

response of a number of plant species to fire is also summarized. Many of the plant community types are similar to ones present in the Galton Range.

1.2.7.1.2 Fire Suppression

The recognition that fire suppression was resulting in forest ingrowth and encroachment resulted in a number of studies and management initiatives in the Trench. This ingrowth and encroachment has directly contributed to a reduction in grassland and shrubland habitats used by wildlife and livestock. It has also resulted in a reduction in the growth rates of trees after the initial ingrowth and similarly contributed to poorer quality rangelands. The natural state of Afire-maintenance≅ tended to significantly reduce the risk of insect and disease outbreak, and catastrophic fire events Gayton (1996). With fire suppression the risk of these events has increased substantially. In conjunction with this the increased duff layer tends to delay soil warming in spring and in return delay plant growth. As forest canopy closure increases the less palatable and nutritional pinegrass becomes the predominant herbaceous layer cover at the exclusion of other more important forage species of grasses and forbs.

The increased awareness of the importance of fire in the Trench for maintaining more open canopy closures, better quality timber and more productive rangelands is discussed by White (1997). Recently, an ecosystem restoration project has been initiated in the Invermere Forest District aimed at restoring more natural canopy closures through logging, and light intensity burns rotated over the landscape. The pre-settlement fire interval for valley bottoms was determined to range from 3 to 30 years and this is being used as a guide for management treatments. Other research currently underway includes the Ecosystem Maintenance Burning Evaluation and Research (EMBER) aimed at the development of an integrated prescribed fire program for areas traditionally exposed to high-frequency, low intensity fires (Anonymous nd).

Previously, Kemper (1971) examined the patterns and rates of forest regeneration on critical winter range in the Premier Ridge area. The composition of pinegrass was found to rapidly increase as forest cover invaded grasslands while there was a corresponding decrease of other grass species. Forbs varied greatly in abundance and shrubs appeared to react more slowly to changing canopy closures. Unforested sites produced four times the amount of grass as did forested sites. The production of forbs and shrub species, typical of open areas also declined as canopy closure increased. The author concluded that both the quality and quantity of forage decreased as areas become forested which consequently put more pressure on the remaining grasslands resulting in overgrazing. He also noted that tree growth on warm aspects typically has lower growth rates and suggested that these south and southwestern exposures should be maintained in early successional stages.

1.2.7.1.3 Grazing

The vegetation and wildlife habitat in the EKT including the study area has been the concern of a number of researchers, landowners and managers. Consequently, the relationship between livestock and wildlife grazing/browsing has been widely studied in the Trench.

Early work by Demarchi (1970) examined the effects of grazing on forage species densities and nutritional values. He determined that *Stipa comata* increased on overgrazed grasslands and then was succeeded by *Antennaria rosea*, *Chenopodium album* and *Lepidium densiflorum* as grazing severity increased. Grazing increased the crude protein of *Agropyron spicatum* but decreased the density and weight of the plants. Other grazing studies are discussed below.

1.2.8 Wildlife

Historically, the Galton Range has been noted for its ability to support large populations of over-wintering mule deer and sizeable population of bighorn sheep (per. comm. Dennis Demarchi). For a list of the scientific names of animals referred to in the text the reader if referred to Appendix II.

In a biophysical study of the Sheep Mountain wildlife area, immediately north of the Galton study area, Lea et al. (1990) determined forage and cover values for ecosystem units. They also provided ungulate habitat limitations and recommendations for management. The ecosystem units developed in that study are similar to those described in the current study. More recently Ketcheson (1994) created a biophysical map for the Mount Broadwood Heritage Conservation Area immediately north and adjoining the Galton study area. In her report she also relates ecosystem units to characteristic dominant and associate plant species, ungulate forage productivity, and wildlife suitability and capability ratings. She also provides recommended habitat enhancement treatments for each ecosystem unit. This study was completed prior to the establishment of the mapping standards used on the Galton study area and so the mapped ecosystems are slightly different.

The importance of the EKT to overwintering ungulates is reflected in the number of studies focussed on assessment of ungulate winter ranges. An early study by Demarchi (nd) characterized the plant communities of Premier Ridge bighorn winter range and impacts of grazing and wildlife use. Then Demarchi (1967) conducted a study of the Wigwam Flats, Bull River, Premier Ridge, Columbia Lake and Stoddart Creek bighorn sheep winter ranges. He delineated the extent and condition of these ranges and characterized the biophysical relationships and floristic composition of plant communities and determined their rates of productivity. The degree of competition by other wildlife and domestic stock for the range resource was also examined.

Demarchi (nd), at Premier Ridge, found that bighorn sheep used all habitat types, except lodgepole pine forest on terraces, and preferred open vegetation types on slopes. He concluded that all brush and grassland communities were overgrazed and attributed increased cover of antelope brush, *Poa compressa*, cheat grass and lodgepole pine to overgrazing and fire. Main factors limiting bighorn population increases were overgrazing of fire-induced plant communities by elk, mule-deer and cattle, and the encroachment of Douglas-fir on grasslands.

Demarchi (1971a) documented seral-shrub and grassland habitat reductions resulting from encroachment of forest due to fire suppression. Although related to flooding of Libby reservoir, a number of management recommendations were suggested. These included

reductions of livestock stocking quotas, and the removal and reduction of forest cover from ungulate winter ranges through the means of logging, controlled burns and/or land clearing with chains and rails.

Bighorn sheep in the EKT have been subjected to periodic massive die-offs in historical times that show epizootic patterns. Certain aspects of habitat quality and quantity may have ramifications for disease transmission and so any consideration of habitat enhancement treatments should be sensitive to the nature of this disease inflicted mortality. A number of researchers have studied the nature of bighorn sheep die-offs and Schwantje (1988) gives a relatively thorough summary of the history, causes and effects of these die-offs as they relate to the EKT.

Hebert (1973) studied nutritional parameters associated with migration of bighorn sheep between summer and winter ranges in the EKT. To compliment nutritional trials of captive sheep he conducted range studies to determine plant species composition on winter ranges and approximate composition of winter and summer diets of bighorn sheep. In addition the phenology and moisture content of range forage was assessed in order to evaluate the availability, palatability and suitability for maintenance of over-wintering sheep.

As a result of conflicts between livestock grazing interests and wildlife proponents a number of studies were initiated (Demarchi 1971b; Hudson et al. 1974, 1975). Consequently, Hudson et al. (1974,1975) examined the nature of wildlife habitat availability and use by ungulates in the EKT. Ranges studied included Wigwam Flats and Mt. Broadwood located immediately north of the Galton study area. The study examined plant communities present, bighorn sheep food habits, and the nature of their habitat use based on biophysical parameters. There was a negative correlation between bighorn sheep habitat use and canopy closure. Shrublands were used for browse more extensively during periods of heavy snow accumulation and heaviest use was on saskatoon, willow, rose and, especially, redstem ceanothus. Bighorn sheep distribution was positively correlated to biomass of palatable grasses in most seasons except in mid-summer and mid-winter. The authors suggested that this might be due to a decreased importance of grasses in mid-winter and a strategy to maximize forage intake on areas with intermediate biomass and density in mid-summer. Also the availability of palatable plants might be greater on rubbly slopes than in areas of higher biomass. The sheep were more selective to forage quality between November and March, and both snow depth and distance to salt were negatively correlated to sheep distribution.

Hudson et al. (1974,1975) found that bighorn sheep used lower elevations in spring, during the rut, and in winter. They used higher elevations in mid-summer. Winter ewes and juvenile groups were found to use wind-swept southwest facing benchlands at the lower elevations and in early spring and during the warm dry summer months sheep moved to subalpine areas. In mid-winter bighorn sheep were found to use slightly higher elevations on warm aspects and during periods of high snow packs they used steep rubble slopes, shrub communities, and exposed knolls. The dependence on escape terrain did not appear to vary greatly between

seasons. Oldemeyer et al. (1971) found that most feeding sites were within 91 m (100 yards) of escape terrain.

Hudson et al. (1974, 1975) also looked at overlap in habitat use by ungulates. At Premier Ridge mule deer were positively correlated to elevation, slope, terrain ruggedness, openess of forest and shrub vegetation. There was a negative correlation to canopy closure. Bighorn sheep habitat selection appeared to be most strongly influenced by steep, relatively snow-free slopes, and rugged terrain on warm aspects. There was a positive relationship to slope and rockyness, and a negative correlation, in winter, to forage height. This concurred with the observed selection for lower bunchgrasses with fewer seed heads and more leafy materials that were available through winter snows. In winter, sheep were found to have very localized distributions.

More recently Davidson (1994) reviewed bighorn sheep population dynamics in the EKT, habitat enhancement activities, winter habitat ratings in the Galton range for bighorn sheep and a record of sheep translocations to the Galton Range. In summary, there were seven ewes transplanted to Maguire Creek, in February 1984, from Armstrong Bay of Columbia Lake. These sheep used the west face of Maguire creek, until May, and then moved upslope to lamb. They wintered at the north end of the Galton Range at Limestone Lookout and the one collared ewe was last seen, in November 1985, at mouth of Phillips Creek after being seen 3 weeks prior at Limestone Lookout 30 km north. In February of 1985, seven more ewes and three lambs were transplanted to Maguire Creek area but not monitored. Also discussed are various management treatment strategies and response of ranges to prescribed fire, wildfire, selective logging, slashing and fertilization.

Warkentin (1972) found that elk and deer, at Bull River and Grasmere, made heavy use of alfalfa and hay fields adjacent to over-wintering areas in early spring. He concluded there was likely little impact on crops but did not speculate as to the importance of the crops to these species. Other researchers, including Gaube and Douglas (1991), examined the depredation on private agricultural lands by elk and deer in the EKT.

Churchill (1982) studied elk winter habitat selection in the White River area. Elk selected clearcuts for feeding and made use of adjacent forest cover for escape and resting. In years of greater snow depths they were expected to avoid clearcuts. Elk preferred moderate slopes, ridges, herbaceous vegetation and burnt areas within clearcuts at least 200 m from active roads. They selected the largest clearcut, had no preference for forest-nonforest ecotones, and strongly avoided human activity and vehicle traffic by taking cover in adjacent forest.

The importance of the EKT in providing favourable ungulate habitat resulted in the completion of a number of major wildlife surveys in the Trench. Simpson (1992) studied the mid-winter distribution of elk and found that low numbers of elk made use of the study area. However, immediately adjacent areas along Lake Koocanusa and the Elk River were found to support high to medium numbers of elk. Jamieson and Hebert (1992, 1993) reported on the seasonal migration and movement patterns, and habitat use by elk in areas north of the study area. In this study elk were captured in the Colvalli-Pickering Hills area and the Skookumchuck-Premier Ridge areas. Jalkotzy (1994) then analysed and summarized radio-

telemetry data collected from re-located elk using the EKT between 1986 and 1993. This analysis focussed on determining seasonal movement and migration patterns, home ranges attributes, habitat use and mortality rates. Demarchi et al. (1992) reviewed the seasonal movement patterns and habitat requirements of elk in the South Elk Management Zone.

Although literature related to the species of concern, other than the sheep and mule deer, was not extensively reviewed in this document, a few select reports are included here or referenced elsewhere in the report (eg. Appendix III).

The grizzly bear population in the nearby Flathead River area was studied extensively by McLellan (1989). This research yielded a number of published and unpublished reports regarding the ecology, food habits (McLellan and Hovey 1995), population dynamics and effects of human disturbances on the species. Other food habits related studies of interest include one involving four study locations in western Montana (Mace and Jonkel 1986), a study in Yoho and Kootenay National Parks (Raine and Riddell 1991) and the four contiguous mountain national parks (Kansas and Riddell 1995). More recently, Mace and Waller (1997) completed a study of grizzly bear ecology in western Montana. Similarities in habitat types between this study and the Galton Range make this a relevant study for information regarding habitat use, food habits, den selection, habitat potential and effectiveness, and other aspects of grizzly bear ecology in the region.

Fuhr and Demarchi (1990) proposed a methodology to assess grizzly bear habitat in British Columbia. In it they rated grizzly bear foods as to dietary importance, and also rated BEC and ecoregion units as to habitat potential. The PPdh2 and IDFdm2 of the EKT ecoregion were rated low for habitat potential and the MSdk and ESSFdk of the Border Ranges was given a high to moderate rating.

2.0 STUDY AREA

The study area (Figure 1) encompasses over 15,000 ha and is located in the East Kootenay Trench approximately 40 km southwest of Fernie and 5 km south of Elko, British Columbia (49E 00' N to 49E 13' N and 148E 54' W to115E10' W approximately). The southern portion of the study area is delineated by the Canada - USA border and it extends north to the Elk River taking in all lands, except private holdings, from Highway #93 on the west to the height of land formed by the Galton range on the east. British Columbia TRIM map sheets (1:20,000 scale) included are 82G.025, 82G.15, 82G.016, 82G.005 and 82G.006. Elevation ranges from 740 m, in the PPdh2, in the Elk River Valley to 2397 m at the highest point along the Galton Range.

3.0 METHODS

The first phase of the project involved a comprehensive information search during which all major reports, maps, databases and other ecology information related to the study area were reviewed. Existing Ministry of Forestry (MOF) and British Columbia Conservation Data Centre (BCCDC) plot data was accessed, and relevant vegetation and wildlife maps obtained from Crown Publishing were reviewed. In addition, biophysical reports and maps produced for surrounding areas such as Mt. Broadwood, Sheep Mountain and Bull River were reviewed.

3.1 Orthophoto Mosaic

The initial step of the mapping involved the creation of five rectified orthophoto mosaics registered to individual TRIM base maps. Existing 1:60,000 (1988) air photos were used for this purpose along with the TRIM Digital Elevation Model data. The resulting digital orthophoto mosaic, with UTM grid, was saved to CD Rom and used to produce 3 copies of black and white photos printed on Kodak photographic quality paper.

Clear mylars were imprinted with the TRIM base maps and pre-existing terrain polygons from recently completed terrain mapping, by Minning (1995). The mylars were then superimposed on the orthophoto mosaics to form the basis for the bioterrain and ecosystem mapping.

3.2 Field Sampling

Surficial geology field work was conducted on the ground with foot and truck traverses and in the air with a helicopter traverse during the 1995 and 1996 Level D terrain hazard mapping activities. Some terrain information was also obtained during the bioterrain mapping activities in 1997. Field information was used to verify and refine final airphoto polygon boundaries, to confirm and upgrade information on material types and thicknesses and terrain features and terrain stability determined originally by airphoto interpretation. The previous map legend was revised to incorporate additional sampling and update to bioterrain mapping standards.

The ecosystem field sampling methodology closely adhered to that outlined in RIC 1995, Cadrin et al. (1996), Anonymous (1996) and Luttmerding et al. (1990). Minimum data collection protocol for detailed and visual inspection level plots was according to RIC (1995). Data was recorded on Form FS 822 for detailed plots and on the abbreviated forms for Visual Level plots. For the sake of brevity the reader is referred to the above standards to obtain specific methodologies. Any digressions from the standard methodology are documented under the appropriate section below. Sampling intensity was based on a 26% level of polygon sampling (Level 3) requiring completion of an estimated 59 detailed plots and 331 visual plots. Additional sampling was conducted in the Scherf Creek drainage.

A number of the wildlife forms (1997 version) were completed for a cross-section of ecosystem types to assist in habitat modelling and suitability/capability ratings validation. Incidental observations of all wildlife were recorded for each plot. In addition ungulate, large carnivore, and red and blue listed species were recorded with corresponding UTM coordinates as encountered *en route* between plots. Pellet groups were recorded, by species, for each plot and all sign of elk, moose, sheep, bear, and red and blue listed species were recorded as encountered during travelling.

All observations of special or rare ecosystems (i.e. BCCDC listed), rare plants, archeological sites, or special wildlife features (eg. corridors, mineral licks, raptor nests, etc.) were recorded with UTM coordinates. Plots were accessed *via* foot travel, 4X4 truck, Quad and helicopter.

3.2.1 Vegetation Plots

Detailed vegetation plots for the tree, shrub, herb and bryophyte/lichen layers consisted of a 11.28 m (400 m2) radius plot. The percent cover of all vascular plants, lichens and mosses were recorded to the nearest percentage. Species of limited cover were recorded to the nearest one thousandth percent cover *as per* the most recent data collection standards. Unknown specimens were collected, preserved and submitted to expert taxonomists for identification.

Field data recorded at the ground based visual plots included the percent cover of all trees and shrubs, dominant grasses, forbs and mosses, and other associate/diagnostic plants. In addition, the percent cover of important forage and browse species were also recorded. Data recorded at plots completed *via* helicopter or by 40x scope were, generally, limited to tree

and shrub species and less frequently herbaceous plant species.

3.2.2 Forage Productivity

Forage productivity sampling was based on the methodology described by Habitat Monitoring Committee (1996). Forage plots were composed of 4 subplots placed along the cardinal axes. Each sub-plot was 28 cm in radius (0.25 m^2) and was placed 1.5 metres from main vegetation plot centre to sub-plot centre . All forb and graminoid cover was removed to a height of 1 cm above ground level and saved in paper bags identified as to plot and sub-plot. Wet weights of each sample were recorded and the samples were then oven dried at 55EC for 24 hr before obtaining dry weights. All weights were recorded to the nearest 0.1 grams using a *Ohaus* triple beam balance scale.

Data analysis consisted of determining the combined sub-plot dry weight of each field plot and calculating a kg dry weight/ha value for each site series/structural stage type. Then, following Luttmerding et al. (1990), these figures were converted into a forage productivity rating code based on actual biomass production.

3.2.3 Browse Production

Browse productivity was based on the methodology of Habitat Monitoring Committee (1996). The total percent cover of the B2 shrub layer was recorded for the vegetation plot along with a mean height (cm). Analysis was based on calculating the volume of browse (m2 shrub cover on plot x mean height) and determining the cubic metres available *per* hectare. These values were then evenly bracketed out of 5 according to the rankings devised by Luttmerding et al. (1990).

3.2.4 Coarse Woody Debris (CWD)

An estimate of coarse woody debris was obtained at all detailed plots and at select visual level plots. Due to project constraints data recorded was restricted to the percent cover of CWD greater than 7.5 cm diameter cross-section at the base, and the mean and range of CWD diameters, occurring in the vegetation plot. This information was collected as incidental data and was used for modelling pine marten habitat values.

3.2.5 Wildlife Trees

Data was collected for wildlife trees according to the standards described by Anonymous (1996). A count of all dead and live wildlife trees was recorded, for each vegetation plot, along with detailed data for up to 7 to 14 trees. In addition, a # 3 cruising prism was used to sample any large diameter trees occurring within range but outside of the vegetation plot. The wildlife tree information was collected incidental to other plot data and was not analysed.

3.3 Data Analysis

Bioterrain and ecosystem data from all visual plots was entered into an Excel compatible spreadsheet. Plot data collected at the detailed plots (Form FS 822) was entered into the Venus database (Version 3.0 Beta 4). Polygon attribute data for the bioterrain and ecosystem information was entered into an Excel compatible database which was structured according to Cadrin et al. (1996) and later MELP (1998).

3.3.1 Expanded Legend Development

In the expanded legend to the ecosystem types the dominant and associate/diagnostic plant species were listed in diminishing order of dominance, based on percent cover and frequency of occurrence, for the tree, shrub, forb and moss/lichen layers in that order. Important browse species, of trees, with significant regeneration (> 5% cover) available in the B2 shrub layer was denoted by a A(B)≅ in the legend. Approximately 15 to 30 species of plants were included for each structural stage. Plots used to characterize each site series/structural stage type were listed at the bottom of the legend with each plot type distinguished according to detailed (D), ground based visual (G), helicopter based visual (H), x40 scope based visual (S), and polygon assessments completed while travelling (T).

Rationale for the inclusion of dominants and associates is based on pre-existing protocols used by Ministry of Forestry for BEC correlation (per. comm. Greg Britton). Thus, plant species with over 10% cover and occurring in at least 41% of the plots were assigned to the dominant category while those with less than 10% cover but occur in >40% frequency of occurrence in plots were assigned to the associate/diagnostic category. In cases where sampling efforts were inadequate a list of predicted species was included to assist in characterizing the ecosystem type and to facilitate wildlife habitat modelling initiatives. Inclusion of predicted species was based on sampling results from the other structural stages within the site series and/or characteristic species indicated for the site series type by Braumandl and Curran (1992).

Key forage species for mule deer and bighorn sheep were denoted in the expanded legend by bold font superscripts at the end of the listed plant food. Key plant food species used by bighorn sheep were identified with a As≅ and for mule deer a Am≅. Plant species not used by either of these ungulates but used by either bear species were identified with a Ab≅. Capital superscripts were used to denote plant species with greater than 20% cover on average (eg. AS≅ for Bighorn Sheep) and small case superscripts to denote plant foods with between 5 and 20% mean cover.

Included in the expanded legend, for each site series/structural stage, was a rating value for the calculated forage and browse productivity. A similar value was included for security cover as calculated from empirical data (see below). Where sampling was inadequate the values were subjectively derived by blending values available for adjacent site series/structural stages. To distinguish between values based on empirical data and those subjectively assigned, the former were highlighted in bold font and the latter were entered as plain text.

Security cover was measured in the field for a wide range of ecosystem/structural stage types using a security cover sampling canvas. Percent obstruction was recorded for each of the four compartments (25cm W x 50 cm H) on a 2.0 m tall by 25 cm wide panel. Alternative compartments were coloured flourescent orange on the white background for sight-ability. The observer stood at plot centre and data was collected for each of the 4 cardinal directions with the sampling panel placed at a distance of 15 m away. Data from the entire 2 m was analyzed to obtain the statistical mean for each plot and for each ecosystem type. These data were bracketed out of 5 and included Very High (most obstruction; 1), High (2), Medium (3), Low (4) and Very Low (5).

3.3.2 Wildlife Suitability and Capability Modelling

Assignment of wildlife suitability and capability ratings was based on the standards outlined by RIC (1997; later amended to RIC 1998b). Feeding and Security Cover activity values for each species, except marten, were combined into a single Living activity value for presentation by ecosystem unit. Modelling for marten followed a slightly different approach as outlined below.

For the ungulates the initial stage of habitat modelling involved the construction of a list of plant species used by each species for the winter (W) and summer (S) season (Appendix III). Ratings were based on a review of available literature and/or subjective estimation where data was missing. The winter season was defined as the period from November to April, and the summer period as May to October (RIC 1998b). A similar list was developed for the two bear species for early season pre-greenup (E), mid season greenup (M) and late season post greenup/berry season (L). Approximate dates for each bear season are April to mid-May (E), mid-May to mid-July (M) and mid-July to late October (L), respectively. Once this list was developed Food Importance Values (FIV's) were assigned to each food species for each animal by season.

Using the expanded legend a Plant Food Availability (PFA) database was constructed which ranked the dominance of each food species by BEC unit/site series/structural stage. Thus species with greater than 20% cover were assigned a High rating (1), those with 5 to 20% cover a Medium rating (2), and species with less than 5% cover a Low rating (3). These values were modified by the forage and browse productivity values to obtain final PFA ratings.

Wildlife habitat modelling then was based on the multiplication of the FIV times its ranking in the PFA database and then tallying these to obtain a habitat Feeding Activity Value (FAV) for each BEC unit/site series/structural stage, by animal species of concern, and season of use.

Final integration of the FAV and security cover values for all of the large mammals, except bighorn sheep, was based on weighting the food at 70% of the final score and security cover at 30%. Modelling for bighorn sheep was based on using a 50:50 weighting to reflect the greater impact of dense cover on habitat quality. This produced an integrated habitat Living

Importance Value (LIV) for each BEC unit/site series/structural stage type. A simple habitat suitability index curve was determined for each species to reflect optimal security cover values (Table 2).

The final integrated habitat LIV were then converted to the final suitability and capability values. Maximum suitability and capability values were subjectively assigned to each species, for the entire study area (Table 3), based on the predicted relationship between the best habitat in the study area compared to the best habitat in the province. The assigned maximum values were determined on the basis of the author's field experience, the literature review and input from provincial wildlife staff (per. comm. Dennis Demarchi). The model's LIV were calibrated to the maximum scores predicted for the study area and presented as a ranking out of 6 (RIC 1998b), for each season. The final suitability and capability scores were reviewed,

Table 2. Habitat suitability indices for security cover rated out of 1.0 (best) for each wildlife species of concern.

Security Cover		Species Of Concern						
Class	**Code**	**Bighorn Sheep**	**Mule Deer**	**White-tailed Deer**	**Elk**	**Moose**	**Black Bear**	**Grizzly Bear**
Very High	1	0	0.4	0.4	0.4	0.8	0.8	0.8
High	2	0.2	0.6	0.8	0.6	1	1	1
Moderate	3	0.6	1	1	1	0.8	0.8	0.8
Low	4	1	0.8	0.6	0.8	0.4	0.4	0.4
Very Low	5	1	0.6	0.4	0.6	0.2	0.2	0.2

Table 3. List of maximum suitability and capability ratings applied to the Galton Range study area based on relative status related to the rest of the Province of British Columbia.

Species of Concern	Season of Use									
	Summer (S)		**Winter (W)**		**Early (E)**		**Mid (M)**		**Late (L)**	
	Suit.	**Cap.**	**Suit.**	**Cap.**	**Suit.**	**Cap.**	**Suit.**	**Cap.**	**Suit.**	**Cap.**
Bighorn Sheep	3	1	3	1	-	-	-	-	-	-
Mule Deer	2	1	2	1	-	-	-	-	-	-
White-tailed Deer	3	2	3	2	-	-	-	-	-	-
Elk	3	1	2	1	-	-	-	-	-	-
Moose	4	3	4	3	-	-	-	-	-	-
Black Bear	-	-	-	-	3	2	3	2	3	2
Grizzly Bear	-	-	-	-	3	3	3	2	4	3
Marten	3	2	3	2	-	-	-	-	-	-

validated against field data, and adjusted where required (Appendix IV and V). To account for the variance in ecosystem habitat quality related to select modifiers, such as warm *versus* cool aspect, each model's output was adjusted according to Appendix VI.

A modifier was used to model for ungulate winter habitat exclusion resulting from high snow packs. Capability and suitability ratings were reduced based on the predicted degree of habitat exclusion for each BEC zone and dominant aspect (i.e. warm vs. cool). Thus high elevation ESSFdk and ESSFdku winter habitat on north aspects was reduced to nil or low

ratings for elk, deer and sheep. Table 4 indicates how the suitability and capability ratings were adjusted for each species of ungulate in order to account for the influence of snow packs.

Table 4. Correction factors used to adjust winter period Suitability and Capability Ratings, for each elk, deer and bighorn sheep, to account for the influence of snow pack on habitat quality.

BEC Subzone/Variant	Cool Aspects	Warm Aspects
PPdh2	0	0
IDFdm2	-1	0
MSdk	-2	0
ESSFdk	-3	+1
ESSFdku	-3	+1

To reflect early season ungulate-carrion scavenging opportunities for bears those ecosystem units with the best combined ungulate ratings were selected for modification. Thus the top 20% of ecosystems which were ranked very high for winter habitat value to deer, sheep, elk and moose were systematically increased by a value of 1 (Example: Low changes to Moderate). No attempt was made to incorporate ant foraging or ground squirrel opportunities by habitat unit type due to a lack of knowledge regarding the habitat relationships.

For pine marten the ecosystem structural stage, degree of CWD and canopy closure were selected as the three most important habitat attributes selected for (Allen 1982, Buskisk 1984, Lofroth and Steventon 1990, Banfield 1974, Backhouse and Manning 1996). Table 5 summarizes habitat suitability indices used for each habitat component used to model ecosystem habitat values for marten. The algorithm used to model for final LIV's weighted structural stage and canopy closure equally and their combined value represented 70% of the final score with CWD representing the remaining 30%.

Table 5. Habitat suitability indices used to model for marten ecosystem habitat values in the Galton Range study.

Structural Stage				Coarse Woody Debris			Canopy Closure		
Structural Stage	**Code No.**	**Importance Rating**	**Score**	**BEC subzone /variant**	**Importance Rating**	**Score**	**Percent Cover**	**Summer Score**	**Winter Score**
Old Growth	7	Very High	1	ESSFdku	Low	0.33	0-5	0.25	0
Mature	6	High	0.8	ESSFdk	High	1	6-15	0.5	0.25
Young	5	Moderate	0.6	MSdk	Moderate-Low	0.66	16-25	0.75	0.5
Pole Sapling	4	Low	0.4	IDFdm2	Moderate-Low	0.66	>25	1	1
Shrub	3	Very Low	0.2	PPdh2	Low	0.33			

Herb	2	Very Low	0.1		

3.4 Mapping

3.4.1 Ecosystem and Bioterrain Mapping

Mapping methodology closely followed the standards outlined in RIC (1995; later amended to RIC 1998a). However, mapping took place directly on the clear mylar overlay benefiting from the rectified image apparent through it. This approach helped to reduce transposing error, assisted in BEC line placement, and allowed for direct digitizing into the GIS.

The surficial geology component of the bioterrain mapping project was based on airphoto interpretation and mapping carried out for a Level D terrain hazard mapping study done in the same part of the Galtons during 1995 and 1996 by GVM Geological Consultants Ltd. (Minning, 1996 and 1997). The Level D mapping, prepared from 1:40 000 scale black and white B.C. Government airphotos, was transferred to an overlay on the airphoto mosaic used for the bioterrain mapping. The terrain unit boundaries and titles were also transferred to the colour 1:15,000 scale (1994) project airphotos. During this transfer, some terrain unit boundaries were changed and polygons were subdivided where appropriate on the larger scale (1: 20 000 scale) mapping.

In the initial Level D terrain hazard mapping project bedrock geology maps, regional geology reports, and surficial geology and soils maps were reviewed during mapping. Airphoto interpretation was carried out using the Terrain Classification and Mapping System for British Columbia (Howes and Kenk 1988, 1997) and Mapping and Assessing Terrain Stability (Forest Practices Code 1995; RIC 1995).

Airphoto interpretation of vertical airphotos with a stereoscope determined landforms that have distinctive topographic and geomorphic expression, slope characteristics, geologic origin, materials, drainage characteristics, and mass wasting features. Landforms that were identified on the airphotos were classified and mapped as terrain units on the basis of their environment of deposition. Descriptions of each mapped terrain unit were summarized and described in the preliminary map legend that was used with the airphotos during field work. The final surficial geology portion of the bioterrain mapping used the field-confirmed airphoto mapping from 1995 to 1997. This mapping was presented on the mosaic overlay map prepared for the bioterrain component.

The resulting bioterrain polygons were then subdivided into ecosystem units according to the guidelines outlined in (RIC 1995; RIC 1998a). Vegetation, soils, and other bioterrain information was integrated with the surficial geology information during these final mapping activities.

The finalized bioterrain and ecosystem polygons were then digitized directly into a GIS and stored in an Arc/Info format. Polygon databases for the bioterrain and ecosystem attributes were created according to the structure outlined in the Cadrin (1996) and MELP (1998), and a final map legend was created. This data base was then merged with the GIS product and black and white paper copies of each bioterrain and ecosystem map were produced to

accompany the final report. The border of each sheet was edge matched with mapped polygons of adjacent map sheets and the previous mapping completed for the Mount Broadwood study. Finally, two operational maps were prepared by combining TRIM sheets 82G.025 and 82G.016 with 82G.015, and sheet 82G.006 with 82G.005.

Field plot locations were placed onto the clear mylar, benefiting from the image below, and then directly digitized into the GIS along with major traverse routes. Plot co-ordinates were obtained directly off of the maps, using the GIS, for inclusion into the databases and field forms.

3.4.2 Wildlife Habitat Treatment Mapping

A habitat treatment map of the study area was produced based on lumping together ecosystem units into new functionally similar units. This task was accomplished by identifying adjoining polygons which had the same dominant map code or ecosystem type, same structural stage group and same dominant aspect (i.e. cool or warm). Three Structural Stage groupings were developed with group 1 including Structural Stages 1 to 3, Group 2 including Stages 4 and 5 and Group 3 including Stages 6 and 7.

The habitat treatment maps were combined into two operational maps, as outlined above, and a set of black and white paper copies were printed for inclusion with the final report. An expanded legend to the habitat treatment maps was developed which documented limitations to ungulates and habitat treatment considerations. It also provided treatment recommendations for ungulates, black bear and grizzly bear, and marten.

3.5 Habitat Enhancement

The study area was evaluated based on a review of the final mapping and wildlife modelling outputs, literature review, and historical records to determine six potential habitat enhancement projects. These were considered to be habitat treatment units with good potential to significantly improve habitat values for bighorn sheep and mule deer. Summary tables were produced documenting suitability/capability ratings and habitat treatment recommendations for each project area.

4.0 RESULTS AND DISCUSSION

The following section identifies, and briefly reviews, the results as presented in tabular and appendix form below. Accompanying this report are two operational bioterrain and ecosystem maps, and two wildlife treatment maps that are composites of the five TRIM sheets.

4.1 Field Effort

The field program was conducted between early July and mid September, 1997. Additional sampling was completed in the Scherf Creek drainage during early October, 1997. This resulted in the completion of 58 detailed plots (Appendix XXX) and 381 visual plots (Appendix XXIX), including an additional sample of 48 visual plots completed in the Scherf Creek drainage. A total of 439 plots were completed in the study area, representing a 26 % level (Level 3) of polygon sampling. Table 6 presents the final number of plots completed by BEC unit.

Table 6. Number of plots completed in each BEC unit, by plot type, during the Galton Range study.

BEC Unit	Number Of Plots		
	Visual	Detail	Total
PPdh2	34	7	41
IDFdm2	125	18	143
MSdk	101	11	112
ESSFdk	86	13	99
ESSFdku	35	9	44
All Subzones	381	58	439

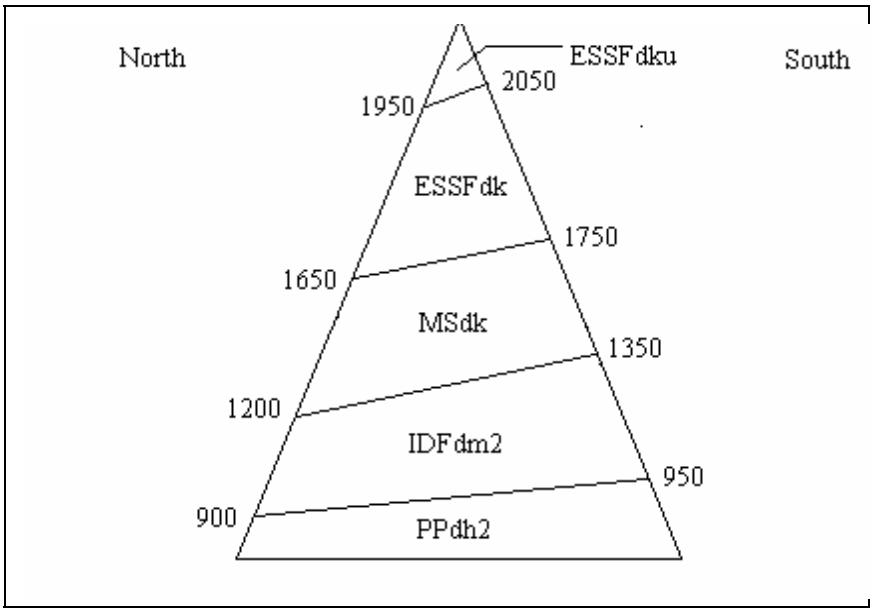
4.2 Ecosystem Classification

Summaries of all ecosystems mapped within each BEC zone are provided in Appendices VII, X, XIII, XVI and XIX. Immediately following these are colour plates of a range of ecosystem types within the respective BEC zone. The expanded legend to the ecosystems, for the Galton Range, is included as Appendices IX (PPdh2), XII (IDFdm2), XV (MSdk), XVIII (ESSFdk) and XXI (ESSFdku). These legends present biophysical descriptions of each BEC ecosystem and summaries of the vegetation associated with each structural stage. For explanations of the modifier codes listed for each ecosystem unit refer to the ecosystem summaries indicated above. Forage and browse productivity ratings are included along with security cover values.

Correlation to MOF site series is provided in the ecosystem summary tables and expanded legends. In the expanded legend the corresponding MOF site series is indicated in the upper right hand corner of each table. For example, the label MSdk/01 indicates that that ecosystem description belongs to the '01' site series of the MSdk found in Braumandl and Curran (1992). For the ESSFdku subzone tentative proposed site series are provided to help facilitate an understanding of relative positioning of each unit on the edatopic grid.

Elevation breaks for the BEC units, on warm and cool aspects, is provided in Figure 2. Although several fragments of alpine tundra were located along the Galton Range ridge they were considered too small to map. Table 7 provides a summary of the trends in soil characteristics across the various BEC units occurring in the study area. Soil matrices were

Figure 2. Landscape diagram of BEC subzone/variant elevation (m) breaks on north (warm) and south



(cool) aspects in the Galton Range study area (not to scale).

predominately medium textured but the high coarse fragment content resulted in a classification of coarse soils. Soils throughout the study area were commonly acidic except for some soils in the IDFdm2 and PPdh2 that were derived from dolomite parent materials. These latter soils were mildly alkaline. Soil depths ranged from a few centimetres in the ESSFdku to over 2 m deep in the PPdh2.

Appendix XXXI provides an abbreviated version of the final ecosystem and bioterrain map polygon database. A map legend for the bioterrain mapping portion is included as Appendix XXXII.

Table 7. Trends in soil characteristics across the BEC subzone units in the Galton Range study area.

BEC Unit	Soil Characteristics			
	Soil Depth (cm)	Coarse Fragment Content (%)	Soil Texture Matrix	Soil pH
PPdh2	100-200+	0 (some gravels)	medium(some coarse sandy soils)	Weakly acidic to alkaline(calcareous)
IDFdm2	80-120	20-50	medium	Weakly acidic to alkaline(calcareous)
MSdk	60-100	20-50	medium	Acidic
ESSFdk	50-60	30-70	medium	Acidic
ESSFdku	<30-40	>60	medium	Acidic

4.3 Wildlife Suitability and Capability Ratings

Appendix XXII provides a listing of the final suitability values for each of the species of management concern, by ecosystem type. Similar listings are provided for capability ratings in Appendix XXIII.

4.3.1 Habitat Models

The wildlife habitat models used in determining suitability and capability ratings were by practicality quite simple. The models were developed to make objective use of the field data collected and minimize subjective assignment of ratings. However, there was a subjective component involved where the model's output varied considerably from the infield wildlife assessments. These inconsistencies are believed to be mainly a result of small sample sizes or model simplicity.

It is important to document each model's structure and rationale used to determine the suitability and capability ratings. This was done in the methodology section above. Another important aspect of any wildlife modelling exercise is to document the identified assumptions and source of errors. These are summarized below.

<u>Model Assumptions and Source of Errors</u>

1. *Adequate field habitat data was collected based on the 26% level of polygon sampling.*

   Considerable variability was encountered within certain ecosystem types and so greater sample sizes in those types would improve the accuracy of the models. As expected other types were quite uniform from site to site. Ecosystem types of limited areal extent were often not adequately sampled and it is unknown how closely the extrapolated data reflects actual field conditions for structural stages not sampled.

However there appeared to be sufficient plot information to adequately characterize the majority of types.

2. *The wildlife models consider all major habitat variables required to provide accurate outputs.*

   A subjective assessment of the models' outputs found that they did appear to produce the results expected although there was some need for fine-tuning. Discrepancies between the models' output and infield assessments may be due to omissions of one or more relatively important environmental parameters, behaviour factors, seasonal movements or other variables. Comparatively, it is recognized that the localized and subjective nature of infield habitat assessments, used for calibration, may in fact not accurately reflect true habitat values.

3. *Forage and browse productivity ratings based on biomass assessments of all plant species, including unpalatable ones, does not adversely affect the final food rating of an ecosystem type.*

   Although the forage/browse productivity of a site is combined with the percent cover of food species this may not give an accurate indication of the actual amount of palatable forage/browse available. For example, sites with very high productivity of unpalatable species and a few food species of low percent cover may result in inflated food importance values. It is recommend that key foods be determined prior to field data collection and forage clipping plots be limited to those species.

4. *Forage production does not vary appreciably between the early July and the end of August when most forage clipping plots were completed.*

   Seasonal biomass production is expected to reach maximum levels at varying times of the year depending on the BEC unit being sampled. Thus maximum production may be attained in mid June in the PPdh2 and not until mid August in the ESSFdku. In the present modelling there was no adjustment made to forage weights to compensate for this factor.

5. *An adequate selection of key food species were selected and assigned accurate importance values to form a basis for food habits based habitat modelling.*

   Food species selection was limited to a review of available food habits literature for the surrounding region. The degree of difference between actual food habits of the species of concern in the study area and that determined through the literature search is unknown. High costs to obtain specific localized food habits data often precludes such studies and so the approach used here seems reasonable.

   Another aspect to be considered regarding the use of key food species for modelling is that those which are ubiquitous and have limited food value importance (i.e. not preferred or actively sought). Such species would include the aster species, grasses,

yarrow and wild strawberry. Use of these species in the model may tend to rate all habitats equally and mask the true dietary value of very nutritious food species of low frequency of occurrence and percent cover.

Finally, there is also the consideration of seasonal food preferences based on plant phenology and nutritional status. The use of the two season year for ungulates and three seasons for bears may either over or under-rate the importance of a plant food at various times through the season.

6. *The weighting placed on food versus security habitat accurately reflects each species habitat selection sensitivities*.

The weightings used in each model are based on similar weightings used by other researchers using Habitat Evaluation Procedures (HEP) style models and consultation with Provincial Wildlife staff. However, the current documentation of each model will allow for future improvements based on new research findings and expert review.

7. *Seasonal distribution by elevation is adequately addressed by the models.*

No snow depth data was available for the Galton study area for use in the wildlife models. As a result a subjective approach was used to introduce reasonable adjustments to the final suitability/capability ratings to better reflect the degree of winter habitat displacement resulting from high snow pack levels. It is unknown how accurate these adjustments are to the actual in field conditions.

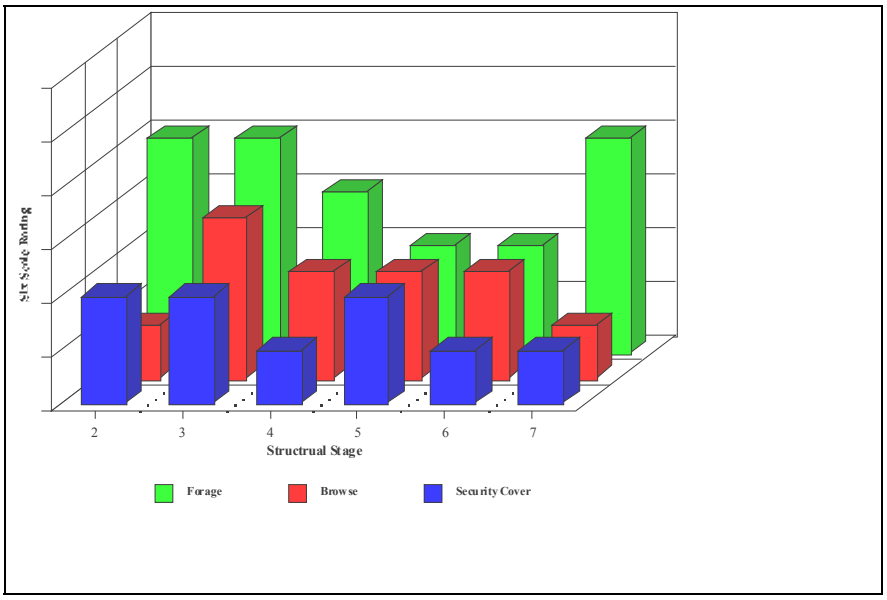
8. *All major ecosystem types were described*.

Based on the open legend system, when modifiers are considered, it was not practical to describe the vegetation and ecology of all modified ecosystem types. Thus similar types were lumped together resulting in a loss of detail. For some ecosystem types there were up to 15 different modifiers used over the study area. The model would certainly be more accurate if modelling occurred at this finer level of detail but again this maybe precluded by high costs. However, future options remain to produce more detailed and accurate models using the data collected and additional supplemental sampling. This may be warranted for example to model for grizzly bears which select particular modified ecosystem types supporting microsite inclusions (eg. gullies or moist sites on deep soils) with premium food values. The data would be re-analysed at the modified ecosystem level to extract specific food values and the model run again at this level.

4.3.2 Important Habitat Types

Based on a review of the expanded legend and the final suitability/capability tables it can be expected that generally forage and browse productivity of preferred species will be the highest in structural stages 2 and 3 (Figure 3).

Figure 3. Example of typical trends in forage and browse productivity, and security cover availability, by structural stage, based on actual data for the IDFdm2/Site Series 01 (DT).



Demarchi and Harcombe (1982) reviewed habitat enhancement treatments for mule deer and bighorn sheep. They recommended focussing efforts on increasing forage production by maintaining large patches of grasslands (Structural Stage 2). In the majority of cases this objective is best achieved through the means of logging to create open patches and to open up the canopy layer. They also suggest the use of prescribed fire during the dormant late winter period is also effective for improving productivity and vigor of the shrub and herb layers. In areas where wildlife compete with livestock grazing, deferred grazing can be initiated once target levels of grazing have been achieved.

Table 8 provides a summary of ecosystem types that were rated the highest in terms of habitat capability, for each species, during the most critical season. The following section provides a brief discussion regarding these habitats and other knowledge on habitat use in the study area.

4.3.2.1 Big Horn Sheep

The bighorn sheep model indicated that favourable winter habitat (High) occurs in a variety of BEC subzone/variants (Table 8). Most ecosystem types in the IDFdm2 units rated high for overwintering along with south facing mesic to submesic slopes in the MSdk, ESSFdk and ESSFdku. These latter higher elevation sites are often windswept and tend to "melt off" leaving them with minimal snow depths later in the winter when snow packs at lower elevations may limit foraging opportunities. At earlier periods in the winter bighorn sheep are known to move to lower elevation slopes. This is corroborated by the winter pellet field data, and past observations of winter sheep distributions (Demarchi 1967, per. comm. Bill

Warkentin). Of the four pellet groups recorded at plots two were in the PPdh2 and the other two were in the IDFdm2.

Although there was a wide range of ecosystem structural stages that were rated as important the grassland stages typically were rated as High or Moderately High in capability. Habitat use in the forested ecosystems can be expected to be highest in those units with a open canopy structure. It should be noted that the suitability and capability model did not take into account distance to escape terrain for sheep. That assessment needs to be done at the polygon level. The field team observed and documented forest ingrowth and encroachment throughout the study area and it is these factors which are widely believed to be largely responsible for the deterioration of winter habitat for this species and mule deer. The specific mechanism for this being 1) reduced forage productivity and 2) impaired predator detection associated with forest encroachment onto grasslands and increasing canopy closure.

Regarding specific bighorn sheep winter range, in the study area, there are only a few localized areas heavily used by bighorn sheep. According to Bill Warkentin (per. comm.) these include the lower to midslope west face of the Galton Range on the north side of Raymond, Maguire, Red Canyon and Phillipps Creeks where rough terrain conditions occur adjacent to open grasslands. Sheep also use the open areas on the knolls located south of Phillipps Creek and north of the Canada-USA border. The south facing slopes along Maguire Creek, extending to mid drainage, are also favoured by bighorn sheep. At other times of the year, sheep use open habitat along the upper crest of the Galton Range extending from the Galton Pass area north.

During the study bighorn sheep or recent sign was observed in spring on the south facing slope along Maguire Creek (MSdk), west facing slope north of Red Canyon (IDFdm2) and the ridge crest northeast of Galton Pass (tracks in snow; ESSFdku). Later in the summer sheep were observed on the northside of Phillips Creek at the mouth of the drainage (IDFdm2), headwaters of Raymond Creek (ESSFdku), and on the east side of the Galton Range in the Wigwam drainage north of Ted Lake.

4.3.2.2 Mule Deer

Bill Warkentin (per. comm.) identified important winter ranges, for mule deer, to include much of the open canopy habitat along the west face of the Galton Range and south facing exposures in the Raymond Creek, Maguire Creek, Red Canyon Creek and Phillipps Creek Drainages. Habitat in the PPdh2 between the Elk River and Highway #93 was once used heavily by overwintering mule deer but is now used more by white-tailed deer. Much of this portion of the PPdh2 is presently under relatively closed canopy due to forest ingrowth and encroachment thus favouring white-tailed deer. Currently, the PPdh2 flats south of the MacDonald homestead and running along either side of Highway #93 is used heavily by mule deer between early April and early May at which time 200-300 deer may be seen in an evening (per. comm. Bill Warkentin).

Table 8. Top critical season habitat types, by BEC unit, based on habitat capability, for ungulates (winter habitat), marten (winter habitat) and both bear species (late season habitat), for the Galton Range study area.

BEC Unit	Species of Concern							
	Bighorn Sheep	**Mule Deer**	**White-tailed Deer**	**Elk**	**Moose**	**Grizzly Bear**	**Black Bear**	**Marten**
PPdh2	CD(4)-2,3,4,5	CD(4)-6,7	AW(0)-3 AR(3)-3,4 CD(4)-2,3,5,6,7	AW(0)-2,3 PW(1)-2,3,4,5,6,7 CD(4)-6,7		CD(4)-6,7	CD(4)-2,3,6,7	PW(1)-7 AR(3)-7 CD(4)-7
IDFdm2	DT(1)-2,3,4,5,6,7 AW(2)-2,3,5,6,7 DS(3)-2,3,4,5,6,7 SP(4)-2,3,4,5,6,7	DT(1)-2,3,4,5 AW(2)-2,3,4,5,6,7 DS(3)- 2,3,4,5,6,7 SP(4)-2,3,6,7	DT(1)-2,3,5 AW(2)-3,4 DS(3)-2,3,4,5,6,7 SP(4)-2,3,4,6,7 SS(5)-4,6 SH(7)-4,5,6	DT(1)-2,3,4,5,6,7 AW(2)-2,3,4,5,6,7 DS(3)-2,3,4,5,6,7 SP(4)- 2,3,4,5,6,7 SS(5)-6 SH(7)-3,4,5,6	DT(1)-2,3	DT(1)-2,3	DT(1)-2,3 DS(3)-2,3	DT(1)-7 AW(2)-7 DS(3)-7 SP(4)-7 SS(5)-7 SH(7)-7
MSdk	SG(1)-2,5 LP(4)-4,5,6,7	SG(1)-3	SG(1)-3	SG(1)-3	SG(1)-2,3,4,6,7 LP(4)-2 SS(5)-4,5 SH(6)-3,4,5,6	SG(1)-2,3,4 LP(4)-2,3 SS(5)-3,4,5 SH(6)-3,4,5,6,7	SG(1)-2,3,5,6,7 LP(4)-2,3,4,5,6,7 SS(5)-2,3,4,5,6,7 SH(6)-2,3,4,5,6,7	SG(1)-6,7 SW(2)-7 LJ(3)-7 LP(4)-7 SS(5)-6,**7** SH(6)-6,**7**
ESSFdk	FA(1)-2,3 FG(3)-2,3	FA(1)-2,3,5 FG(3)-3,4	FA(1)-3	FA(1)-2,3		FA(1)-2,3,4,5,6,7 FG(3)-2,3,4,5,6 FH(6)-2,3,4,5,6,7	FA(1)-3,5,6,7 FH(6)-3,4	FA(1)-**6,7** DM(2)-7 FG(3)-6,7 FM(5)-**6,7** FH(6)-**6,7**
ESSFdku	FG(1)-2,3,7	FG(1)-2,3,4		FG(1)-2,3		FG(1)-2,3,4,5,6,7 WG(4)-3,4,5,6,7		

Initial two letter code represents the ecosystem map unit followed by the corresponding site series in brackets and the structural stages.
For marten the use of bold fonts indicate High (1) capability and plain text represents Moderately High (2) capability

Based on the model most of the best winter range should exist in the IDFdm2 unit followed by the PPdh2 and MSdk units.

4.3.2.3 Other Ungulates

The majority of the study area is better suited to mule deer than white-tailed deer. Indeed, only the IDFdm2 DT(01) structural stage 2, and the MSdk SG(01) structural stage 3 were rated as Moderately High capability for white-tailed deer. It is likely that the progressive ingrowth and encroachment of forest in the PPdh2 and IDFdm2 may continue to alter the habitat to in favour of white-tailed deer over mule deer. As noted above there has been a shift in the distribution and abundance of white-tailed deer utilizing winter range in the PPdh2 south of the Elk River and east of Highway #93. In 1960's there were about equal numbers of either species utilizing this winter range but currently this range is dominated by white-tailed deer (Bill Warkentin per. comm.).

Elk numbers have historically been relatively low in the study area and this is still the current situation (Simson 1992; per. comm. Bill Warkentin). During field exercises elk were only observed on one occasion when approximately 9 cow elk were seen, in October, on the west facing slopes (MSdk) south of Scherf Creek. Most winter elk pellets were recorded for plots in the PPdh2 (71%; n=14) and very little winter pellet sign was recorded for the IDFdm2, MSdk and ESSFdk. The results of the modelling indicated that the best winter habitats (Moderately High and High) were located, in a wide variety of structural stages, in the IDFdm2 (93%). All ecosystem types encountered in the IDFdm2 had one or more structural stages which were rated in the two upper capability classes. Only one other ecosystem type, a MSdk structural stage 3, was rated Moderately High.

Moose are not common in the study area. There were no observations of moose and there was very limited post-winter sign observed. One significant overwintering location, based on winter pellet abundance, was noted in the headwaters of the Red Canyon Creek in the ESSFdk . Contrary to this observation the model did not indicate any Moderately High or High rated ecosystem types in the ESSFdk. This is likely due to the predominance of unpalatable shrub species here (eg. False azalea). Snow depths were likely substantial in the headwaters of the Red Canyon and the selection of this site, by moose, may have been the result of predator avoidance strategies more than selecting for food availability. Again these models did not factor in the pressures of predation on habitat importance values. Other incidental observations of winter pellets included observations from the north fork of Phillipps Creek, Maguire Creek and mid Red Canyon Creek. The majority of ecosystem types rated as High or Moderately High were located in the MSdk including all component ecosystem types except the SW(02). Although a wide variety of structural stages were rated highly, the best appeared to be in young forest and earlier successional stages.

4.3.2.4 Bears

The majority of High capability ratings for late season grizzly bear habitat were primarily in early successional stages located in the MSdk and ESSFdk (67% combined), followed by the ESSFdku (24% of total). Generally, it appeared that ecosystems with mesic to hygric moisture regimes, and medium to rich soil nutrient regimes were rated the highest. These include a variety of structural stages which likely reflect both succulent plant and soft mast crop distributions. In the ESSFdku it is likely that the whitebark pine mast crops tended to increase the value of those ecosystems types. In the PPdh2 the riparian mature and old growth habitat (CD) was rated High for late season habitat and in the IDFdm2 early successional mesic habitat (DT) was rated High.

Observations of grizzly bears in the study area was limited to a sow with a 2 year old cub which were encountered at close range on the Red Canyon road in late May. Although the field crew accidentally separated the sow and cub (was treed) for a short period there was no overt aggressive response from the sow.

Throughout the IDFdm2 and MSdk, especially, there was fairly frequent evidence of bears hunting for ants in ripped open logs and stumps. Bear scats were observed in the vicinity of 5 plots and on several other occasions. Of the 19 observations of bear sign 10 occurred in the IDFdm2, 1 in the PPdh2 and MSdk each and 2 in the ESSFdk. Black bears were observed on 4 separate occasions. These included a black phase subadult near the start of the Red Canyon road, a black bear on the trail north of Maguire Creek, a cinnamon coloured adult between Red Canyon Creek and Maguire Creek, and a sow with young cub on the south-facing slopes mid-way up Miller Creek.

A number of good microhabitat inclusions were encountered in the study area. One particularly good feeding area with abundant cow parsnip and other succulent foods was located in the MSdk near Red Canyon Creek bridge. This location was visited in mid-August and at that time there was recent scats and abundant evidence of recent feeding on cow parsnip. At this location an active rub tree was found as well. The field crew encountered very little sign of diggings made by grizzly bear within the study area. This is attributed to the lack of root crops such as hedysarum, milk-vetches (*Astragalus spp*.) or other important species groups although glacier lily was locally abundant.

Black bear modelling resulted in similar capability/suitability ratings when compared to those of the grizzly bear model. The majority (62%) of ecosystems assigned High capability ratings occurred in the MSdk. As with grizzly bears the majority of High scoring ecosystems had mesic to hygric moisture regimes and medium to rich in nutrient regimes. In the field most cambium strippings of conifer trees, by bear (likely black bear), were observed to occur on mesic to hygric sites in the IDFdm2.

In comparison to grizzly bears, more ecosystems with mature and old growth structural stages were rated as High for black bears. Also, there were no ecosystem units in the ESSFdku which were rated as having High capability for black bears. Grizzly bears are known to use higher elevation habitats more than for black bear and therefore the results of this modelling would appear to fit that understanding (Banfield 1974).

4.3.2.5 Pine Marten

Based on model results the highest capability habitat for pine marten occurs in old growth forests in the ESSFdk ecosystem type FA(01), and in old growth forest in the MSdk and ESSFdk FM(05) and FH(06) ecosystem types. All old growth ecosystem types in the IDFdm2 were rated as Moderately High capability for supporting pine marten. While no reports or studies were reviewed in terms of pine martens use of the PPdh2 there may be some favourable habitat available where dense herbaceous cover supports sizeable rodent populations. The model indicated Moderately High capabilities for closed canopy forest in the PPdh2 PW(01), AR(03) and CD(04) ecosystem types. Returning these stands to a more open fire maintained natural state would presumably reduce their value in supporting viable marten populations.

As noted above, opening the canopy up to increase ungulate forage production in the PPdh2, IDFdm2 and MSdk will have a negative impacts on pine marten habitat values. Maintaining portions of closed canopy forest and course woody debris would assist in mitigating these impacts. The only evidence of pine marten observed during the field work was a set of tracks in the snow across an ESSFdk talus slope in the Scherf Creek drainage.

4.3.2.6 Red and Blue Listed Species

Red and blue listed species listed on the BC CDC tracking list are denoted in the summary of invertebrates inhabiting the study area (Appendix II). Of these only the blue listed grizzly bear and bighorn sheep were observed during the field program. Recent burrowing sign made by, the blue listed, American badger was noted south of the Elk River near Highway #93. This individual(s) appeared to have been actively hunting ground squirrel. The diggings were in a PPdh2 AR (03) ecosystem type located in an old glacial meltwater channel. At this location there were good moisture conditions, relatively lush plant growth, and favourable digging conditions based on the clay loam soils with little coarse fragment content (10%).

4.4 Wildlife Habitat Treatment Mapping

Wildlife treatment maps were produced according to the methods outlined above. Expanded legends to the habitat treatment maps are included in Appendix XXIV (PPdh2), XXV (IDFdm2), XXVI (MSdk), XXVII (ESSFdk) and XXVIII (ESSFdku).

4.4 Rare Plants and Pant Communities

Only one plant , elk sedge (*Carex geyeri*), was listed on the BC Conservation Data Centre Rare vascular plant tracking list for the Cranbrook Forest District (November 12, 1996). This species was recorded at several plots but was not common in the study area.

A number of rare plant communities occur in the study area, primarily in the IDFdm2 and PPdh2. These are listed in Table 9 along with notes on their relative status in the study area and provincially. Some of the communities encountered were of quite limited areal extent and/or appeared as inter-grades to other more common ecosystem types.

4.5 Special Features

There were no wallows, dens, calving/lambing/fawning grounds, or archeological sites observed during field exercises and no well defined mineral licks were located either.

Based on the nature and intensity of field investigations we are unable to provide any conclusive evidence regarding migration or movement corridors. However, based on trail densities and relative sizes it would appear that there is substantial use made of the forested south embankment of the Elk River, lower west facing slopes of the Galton Range and EKT embankment, and most ridgeline areas.

Table 9. List of rare plant community types encountered in the Galton Range study area with provincial and study area status.

BEC Unit	Rare Plant Community		Provincial Tracking		Study Area Status
	Scientific name	Common Name	Rank	List	
PPdh2/02b	*Elymus spicatus - Koleria macrantha*	Bluebunch wheatgrass – Junegrass	S2	Red	rare, small patches
IDFdm2/00	*Festuca idahoensis - Symphoricarpos occidentalis*	Idaho Fescue - Snowberry	S3	Blue	rare, grades into other types
ICHmk1/05	*Picea engelmanii x glauca - Ribes lacustre - Aralia nudicaulis*	Hybrid white spruce – Gooseberry- Sarsaparilla	S3	Blue	rare, small patches along riparian areas
PPdh2/01	*Pinus Ponderosa - Elymus spicatus - Koleria macrantha*	Ponderosa pine - Blue bunch wheatgrass – Junegrass	S2	Red	common, ingrown with Douglas-fir
PPdh2/04	*Populus balsamifera spp. Trichocarpa - Cornus stolonifera - Rosa nutkana*	Black cottonwood – Dogwood - Nootka Rose	S1S2	Red	small areas along Elk River
IDFdm2/03	*Pseudotsuga Menziesii Symphoricarpos albus Balsamorhiza sagittata*	Douglas Fir - snowberry – Balsamroot	S2	Red	fairly common, ingrown with Douglas-fir
IDFdm2/02	*Purshia tridentata - Elymus spicatus*	Antelope brush - Bluebunch wheatgrass	S3’	Blue	rare, small patches

Reference: B.C. Conservation Data Centre; Rare Plant Community Tracking List, Cranbrook Forest District (FD #51), June 10,1996.

Wildlife tree data was recorded in the field but was not analysed. Large diameter wildlife trees were not common in the study area and there was very limited sign of pileated

woodpecker feeding. In contrast there were a number of prostrate large diameter CWD (eg. >30 cm dbh) featuring very old pileated woodpecker excavations. Pileated woodpecker select trees of >29 cm dbh for feeding (Gyug and Bennet 1995) and >50 cm for nesting (Thomas 1979). Preservation within stands of some large diameter Douglas-fir and western larch trees, especially, would assist in greatly enhancing the habitat for a range of small and large cavity nesters (Gyug and Bennet 1995).

There were no raptor nests recorded during field program although osprey, golden eagle, and red-tailed hawks were observed in the area.

4.6 Habitat Enhancement Recommendations

Table 10 provides a brief overview of six (6) potential habitat enhancement projects for bighorn sheep and mule deer in the Galton study area. The particular units selected were chosen based a review of project results as outlined in the methods section, historical winter range records and geographical distribution relative to each other and to escape terrain.

Implementing the suggested habitat enhancement prescriptions should significantly improve overwintering conditions for mule deer and bighorn sheep on the Galton Range. However, it should be noted that forest ingrowth and encroachment is a wide spread issue within the study area. Hence, habitat management is required throughout this landscape to re-establish ecosystem structural integrity and ecological processes. Importantly, management prescriptions should strive to increase the proportions of grasslands and open forest *versus* closed canopy forest, and re-introduce a more natural fire regime. This is especially true of the mesic to subxeric ecosystem types within the PPdh2, IDFdm2 and MSdk BEC units. Other important winter habitat which should be monitored and managed include south-facing aspects in the MSdk, ESSFdk and ESSFdku. These latter habitats become very important for the survival of ungulates during years with heavy snow falls.

Table 10. Summary of six recommended high priority wildlife habitat enhancement projects, for the Galton Range, and general treatment precriptions.

Project No.	Map Sheet	General Location	Polygon #	BEC Unit	Habitat Type	Focus Species	Suit-ability	Cap-ability (ST 2/3)	Habitat Treatment Recommendation
1	82G.005	West-facing slope south of Phillips Creek	10,12,13	IDFdm2	DS2	Bighorn Sheep	3	2	-harvest merchantable timber -thin stands and create large openings by mechanically slashing and use of controlled spring burns -monitor and control Fd encroachment using above approach introducing burns every 5-25 years (15 yr average) -monitor and control human access and livestock grazing as required
						Mule Deer	3-4	2	
2	82G.005	North-side of Phillips Creek at entrance to valley	70,71,119	IDFdm2	DS3	Bighorn Sheep	4	2	-as above
						Mule Deer	4	1	
3	82G.005	West-face upslope of McDonald's Ranch and south of Rainbow Creek	86,90	IDFdm2	DTw3	Bighorn Sheep	4	1	-as above
						Mule Deer	4	1	
4	82G.015	Benchland on west-face south of Red Canyon Creek	825	IDFdm2	DS3	Bighorn Sheep	4	2	-as above
						Mule Deer	4	1	
5	82G.005/ 015	East of Hwy #93 at Conner Creek	350	IDFdm2	DTw3	Bighorn Sheep	4	1	-as above
						Mule Deer	4	1	
6	82G.015	South of Elk River and east of Hwy #93	1329,1332 1333, 1334, 1335, 1345, 1346, 1348, 1361	PPdh2	PW2	Bighorn Sheep	3	2	-thin areas of dense Fd ingrowth not previously treated and retain Py -introduce regular spring burns every 6.5 years on average (3 –10 year range) to maintain open forest structure -retain patches of security/thermal cover and travel corridors -monitor and control human access and livestock grazing
						Mule Deer	4	2	

5.0 PERSONAL COMMUNICATIONS

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Appendix I. Common and scientific names of plant species recorded during field exercises in the Galton Range study area.

Common Name	Scientific Name
Trees	
subalpine fir	*Abies lasiocarpa*
mountain alder	*Alnus incana ssp. tenuifolia*
white birch	*Betula papyrifera*
western larch	*Larix occidentalis*
Engelmann spruce	*Picea engelmannii*
hybrid white spruce	*Picea engelmannii x glauca*
white spruce	*Picea glauca*
lodgepole pine	*Pinus contorta*
ponderosa pine	*Pinus ponderosa*
balsam poplar	*Populus balsamifera*
black cottonwood	*Populus balsamifera ssp. trichocarpa*
aspen	*Populus tremuloides*
Douglas fir	*Pseudotsuga menziesii*
Scouler's willow	*Salix scouleriana*
western redcedar	*Thuja plicata*
western hemlock	*Tsuga heterophylla*
Shrubs	
Douglas maple	*Acer glabrum*
Sitka alder	*Alnus crispa ssp. sinuata*
mountain alder	*Alnus incana ssp. tenuifolia*
saskatoon	*Amelanchier alnifolia*
spreading dogbane	*Apocynum androsaemifolium*
bog birch	*Betula glandulosa*
redstem ceanothus	*Ceanothus sanguineus*
snowbrush	*Ceanothus velutinus*
red-osier dogwood	*Cornus stolonifera*
Common juniper	*Juniperus communis*
Rocky Mountain juniper	*Juniperus scopulorum*
Utah honeysuckle	*Lonicera utahensis*
tall Oregon-grape	*Mahonia aquafolium*
creeping Oregon-grape	*Mahonia repens*
false azalea	*Menziesia ferruginea*
Devil's club	*Oplopanax horridum*
falsebox	*Pachistima myrsinites*
shrubby penstemon	*Penstemon fruticosus*
mock orange	*Philadelphus lewisii*
mallow ninebark	*Physocarpus malvaceus*
pin cherry	*Prunus pensylvanica*
cherry	*Prunus sp.*
choke cherry	*Prunus virginiana*
antelope Brush	*Purshia tridentata*

Common Name	Scientific Name
white-flowered rhododendron	*Rhododendron albiflorum*
black gooseberry	*Ribes lacustre*
northern Gooseberry	*Ribes oxyacanthoides*
gooseberry	*Ribes spp.*
sticky currant	*Ribes viscosissimum*
prickly rose	*Rosa acicularis*
baldhip rose	*Rosa gymnocarpa*
rose sp.	*Rosa sp.*
Prairie rose	*Rosa woodsii*
wild red raspberry	*Rubus idaeus*
thimbleberry	*Rubus parviflorus*
coyote willow	*Salix exigua*
tea-leaved willow	*Salix planifolia ssp. planifolia*
willow	*Salix spp.*
blue elderberry	*Sambucus caerulea*
black elderberry	*Sambucus racemosa ssp.*
red elderberry	*Sambucus racemosa*
soopolallie	*Shepherdia canadensis*
western mountain ash	*Sorbus scopulina*
Sitka mountain-ash	*Sorbus sitchensis*
birch-leaved spirea	*Spirea betulifolia*
common snowberry	*Symphoricarpos albus*
blue-leaved huckleberry	*Vaccinium membranaceum*
high-bush cranberry	*Viburnum edule*
Forbs	
yarrow	*Achillea millefolium*
baneberry	*Actaea rubra*
short-beaked agoseris	*Agoseris glauca*
hair bentgrass	*Agoseris scabra*
agoseris spp.	*Agoseris spp.*
bluebunch wheatgrass	*Agropyron spicatum*
nodding onion	*Allium cernuum*
pearly everlasting	*Anaphalis margaritacea*
fairy candelabra	*Androsace sep[tentrionalis*
cut-leaved anemone	*Anemone multifida*
sharptooth angelica	*Angelica arguta*
alpine pussytoes	*Antennaria alpina*
wooly pussytoes	*Antennaria lanata*
rosy pussytoes	*Antennaria microphylla*
field pussytoes	*Antennaria neglecta*
racemose pussytoes	*Antennaria racemosa*
umber pussytoes	*Antennaria umbrinella*
Holboell's rockcress	*Arabis holboellii*
rockcress sp.	*Arabis sp.*
wild sarsaparilla	*Aralia nudicaulis*

Common Name	Scientific Name
kinnikinnick or bearberry	*Arctostaphylos uva-ursi*
thread-leaved sandwort	*Arenaria capillaris*
alpine sandwort	*Arenaria obtusiloba*
sandwort sp.	*Arenaria sp.*
sandwort	*Arenaria sp.*
heart-leaved arnica	*Arnica cordifolia*
mountain arnica	*Arnica latifolia*
aster	*aster spp.*
Lindley's aster	*Aster ciliolatus*
showy aster	*Aster conspicuous*
smooth aster	*Aster laevis*
sunflower family	*Asteraceae*
timber milk-vetch	*Astragalus miser*
milk vetch spp.	*Astragalus spp.*
arrow-leaved balsamroot	*Balsamorhiza sagittata*
mustard family	*Brassicaceae*
nodding brome	*Bromus anomalus*
smooth brome	*Bromus inermis ssp. inermis*
pumpelly brome	*Bromus inermis ssp. pumpellianus*
cheatgrass	*Bromus tectorum*
bluejoint	*Calamagrostis canadensis*
pinegrass	*Calamagrostis rubescens*
three-spot mariposa lily	*Calochortus apiculatus*
common harebell	*Campanula rotundifolia*
Water sedge	*Carex aquatilis*
northwestern sedge	*Carex concinnoides*
bristle-leaf sedge	*Carex eburnea*
elk sedge	*Carex geyeri* ***(BC CDC: G5, S2S3, Blue Listed)***
small-awned sedge	*Carex microchaeta*
Ross' sedge	*Carex rossii*
beaked sedge	*Carex rostrata*
sedge	*Carex sp.*
common red paintbrush	*Castilleja miniata*
paintbrush	*Castilleja sp.*
Thompson's paintbrush	*Castilleja thompsonii*
field chickweed	*Cerastium arvense*
thistle sp.	*Cerastium spp.*
Prince's-pine	*Chimaphila umbellata*
Canada thistle	*Cirsium arvense*
edible thistle	*Cirsium edule*
bull thistle	*Cirsium vulgare*
blue clematis	*Clematis occidentalis*
Queen's cup	*Clintonia uniflora*
California comandra	*Comandra umbellata*
spotted coralroot	*Corallorhiza maculata*

Common Name	Scientific Name
bunchberry	*Cornus canadensis*
crepis	*Crepis acuminata*
slender hawkweed	*Crepis atrabarba*
western hawksbeard	*Crepis occidentalis*
orchard grass	*Dactylis glomerata*
tall larkspur	*Delphinium glaucum*
Hooker's fairybells	*Disporum hookeri*
fairy-bells	*Disporum spp.*
rough-fruited fairybells	*Disporum trachycarpum*
few-flowered shooting star	*Dodecatheon pulchellum*
squirreltail grass	*Elymus elymoides*
blue wildrye	*Elymus glaucus*
hairy wild rye	*Elymus innovatus*
quackgrass	*Elymus repens*
bluebunch wheatgrass	*Elymus spicatus*
slender wheatgrass	*Elymus trachycaulus*
fireweed	*Epilobium angustifolium*
fireweed	*Epilobium angustifolium*
purple-leaved willow herb	*Epilobium ciliatum*
common horsetail	*Equisetum arvense*
scouring-rush	*Equisetum hyemale*
meadow horsetail	*Equisetum pratense*
dwarf scouring-rush	*Equisetum scirpoides*
horsetail sp.	*Equisetum sp.*
cut-leaved daisy	*Erigeron compositus*
thread-leaved daisy	*Erigeron filifolius var. filifolius*
subalpine daisy	*Erigeron peregrinus*
shaggy fleabane	*Erigeron pumilus*
showy daisy	*Erigeron speciosus var. speciosus*
sulphur buckwheat	*Eriogonum umbellatum*
yellow glacier lily	*Erythronium grandiflorum*
rough fescue	*Festuca campestris*
Idaho fescue	*Festuca idahoensis*
western fescue	*Festuca occidentalis*
red fescue	*Festuca rubra*
red fescue	*Festuca rubra var. richardsonii*
Rocky Mountain fescue	*Festuca saximontana*
wood strawberry	*Fragaria vesca*
wild strawberry	*Fragaria virginiana*
brown-eyed susan	*Gaillardia aristata*
northern bedstraw	*Galium boreale*
sweet-scented bedstraw	*Galium triflorum*
four-parted gentian	*Gentianella propinqua*
water avens	*Geum rivale*
old man's wiskers	*Geum triflorum*

Common Name	Scientific Name
rattlesnake-plantain	*Goodyera oblongifolia*
yellow hedysarum	*Hedysarum sulphurescens*
cow parsnip	*Heracleum lanatum*
golden-aster	*Heterotheca villosa*
round-leaved alumroot	*Heuchera cylindrica*
white-flowered hawkweed	*Hieracium albiflorum*
slender hawkweed	*Hieracium gracile*
Scouler's hawkweed	*Hieracium scouleri*
hawkweed	*Hieracium sp.*
narrow-leaved hawkweed	*Hieracium umbellatum*
common St. John's-wort	*Hypericum perforatum*
Parry's rush	*Juncus parryi*
Kobresia sp.	*Kobresia sp.*
junegrass	*Koeleria macrantha*
creamy Pea vine	*Lathyrus ochroleucus*
prairie pepper-grass	*Lepidium densiflorum*
oxeye daisy	*Leucanthemum vulgare*
lily family	*Liliaceae*
wood lily	*Lilium philidelphicum*
twin flower	*Linnaea borealis*
western blue flax	*Linum perenne ssp. lewisii*
heart-leaved twayblade	*Listera cordata*
lemonweed gromwell	*Lithospermum ruderale*
fern-leaved desert-parsley	*Lomatium dissectum*
narrow-leaved desert-parsley	*Lomatium triternatum*
arctic lupine	*Lupinus arcticus*
small woodrush	*Luzula hitchcockii*
Piper's woodrush	*Luzula piperi*
stiff clubmoss	*Lycopodium annotinum*
fir clubmoss	*Lycopodium selago*
black medic	*Medicago lupulina*
alfalfa	*Medicago sativa*
white sweet clover	*Melilotus alba*
yellow sweet-clover	*Melilotus officinalis*
Brewer's mitrewort	*Mitella breweri*
common mitrewort	*Mitella nuda*
blunt-leaved sandwort	*Moehringia lateriflora*
horse mint	*Monarda fistulosa*
one-sided wintergreen	*Orthilia secunda*
mountain sweet-cicely	*Osmorhiza chilensis*
sweet -cicely spp.	*Osmorhiza sp.*
field locoweed	*Oxytropis campestris*
fringed grass-of parnassus	*Parnassia fimbriata*
bracted lousewort	*Pedicularis bracteosa*
yellow penstemon	*Penstemon confertus*

Common Name	Scientific Name
small-flowered penstemon	*Penstemon procerus*
thread-leaved phacelia	*Phacelia linearis*
timothy	*Phleum pratense*
phlox	*Phlox diffusa*
pink mountain heather	*Phyllodoce empetriformis*
yellow mountain heather	*Phyllodoce glanduliflora*
Alaskan rein orchid	*Piperia unalascensis*
Canada bluegrass	*Poa compressa*
Cusick's bluegrass	*Poa cusickii*
fowl bluegrass	*Poa palustris*
Kentucky bluegrass	*Poa pratensis*
Sandberg's bluegrass	*Poa secunda*
showy Jacob's-ladder	*Polemonium pulcherrimum*
sticky cinquefoil	*Potentilla glandulosa*
marsh cinquefoil	*Potentilla palustris*
Pennsylvanian cinquefoil	*Potentilla pensylvanica*
sulphur cinquefoil	*Potentilla recta*
cinquefoil spp.	*Potentilla spp.*
self-heal	*Prunella vulgaris*
common pink wintergreen	*Pyrola asarifolia*
green wintergreen	*Pyrola chlorantha*
wintergreen	*Pyrola spp.*
spotted saxifrage	*Saxifraga bronchialis*
false melic	*Schizachne purpurascens*
roseroot	*Sedum integrifolium*
lance-leaved stonecrop	*Sedum lanceolatum*
broad-leaved stonecrop	*Sedum spathulifolium*
Canadian butterweed	*Senecio pauperculus*
arrow-leaved groundsel	*Senecio triangularis*
Menzie's campion	*Silene menziesii*
night-flowered catchfly	*Silene noctiflora*
Parry's campion	*Silene parryi*
false Solomon's-seal	*Smilacina racemosa*
star-flowered false Solomon's seal	*Smilacina stellata*
Canada goldenrod	*Solidago canadensis*
spikelike goldenrod	*Solidago spathulata*
goldenrod	*Solidago spp.*
western mountainbells	*Stenanthium occidentale*
needle-and-thread grass	*Stipa comata*
stiff needlegrass	*Stipa occidentalis*
spreading needlegrass	*Stipa richardsonii*
clasping twistedstalk	*Streptopus amplexifolius*
common dandelion	*Taraxacum officinale*
western meadowrue	*Thalictrum occidentalis*
meadowrue	*Thalictrum spp.*

Common Name	Scientific Name
veiny meadowrue	*Thalictrum venulosum*
one-leaved foamflower	*Tiarella trifoliata var. unifoliata*
three-leaved foamflower	*Tiarella trifoliata*
sticky false asphodel	*Tofieldia glutinosa*
yellow salsify	*Tragopogon dubius*
alsike clover	*Trifolium hybridum*
red clover	*Trifolium pratense*
white clover	*Trifolium repens*
nodding trisetum	*Trisetum cernuum*
spike trisetum	*Trisetum spicatum*
globeflower	*Trollius laxus*
common stinging nettle	*Urtica dioica*
grouseberry	*Vaccinium scoparium*
Sitka valerian	*Valeriana sitchensis*
Indian hellebore	*Veratrum viride*
great mullein	*Verbascum thapsus*
American milk vetch	*Vicia americana*
early blue violet	*Viola adunca*
Canada violet	*Viola canadensis*
rounded-leaved violet	*Viola orbiculata*
violet	*Viola spp.*
beargrass	*Xerophyllum tenax*
meadow death-camas	*Zigadenus venenosus*
heart-leaved Alexanders	*Zizia aptera*
Ferns	
lady fern	*Athyrium felix-femina*
shield fern	*Dryopteris assimilis*
spiny wood fern	*Dryopteris expansa*
oak fern	*Gymnocarpium dryopteris*
ostrich fern	*Matteucia struthiopteris*
Mosses and Lichens	
wiry fern moss	*Abietinella abietina*
moss	*Aulacomnium androgynum*
turf mosses	*Aulocomnium palustre*
moss	*Barbilophozia*
moss	*Brachythecium acutum*
lawn moss	*Brachythecium albicans*
moss	*Brachythecium collinum*
moss	*Brachythecium leibergii*
golden ragged moss	*Brachythecium salebrosum*
moss	*Brachythecium spp.*
moss	*Bryum caespiticium*
fire moss	*Ceratodon purpureus*
lime dust	*Chrysothrix chlorina*
reindeer lichen	*Cladina spp.*

Common Name	Scientific Name
peppered pixie-cup	*Cladonia chlorophaea*
lichen	*Cladonia coniocraea*
lichen	*Cladonia crispata*
orange-footed pixie-cup	*Cladonia ecomocyna*
powdered pixie-cup	*Cladonia fimbriata*
slotted pixie-cup	*Cladonia multiformis*
carpeted pixie-cup	*Cladonia pocillium*
brown pixie-cup	*Cladonia pyxidata*
lichen	*Cladonia spp.*
sulphur cladonia	*Cladonia sulphurina*
moss	*Cratoneuron filicinum*
curly heron' -bill moss	*Dicranum fuscescens*
moss	*Dicranum muehlenbeckii*
wavy leaved moss	*Dicranum polysetum*
broom moss	*Dicranum scoparium*
moss	*Dicranum spp.*
cow pie	*Diploschistes muscorum*
sickle moss	*Drepanocladus uncunatus*
moss	*Eurhynchium pulchellum*
moss	*Homalocomium sp.*
step moss	*Hylocomnium splendens*
moss	*Lescuraea radicosa*
moss	*Lophozia sp.*
stiff-club moss	*Lycopodium annotinum*
leafy moss	*Mnium sp.*
moss	*Mnium spinosum*
red-mouthed leafy moss	*Mnium spinulosum*
moss	*Orthotrichum flexicaula*
freckle pelt lichen	*Peltigera aphthosa*
dog pelt lichen	*Peltigera canina*
temporary pelt lichen	*Peltigera didactyla*
greater frog pelt lichen	*Peltigera neopolydactyla*
frog pelt lichen	*Peltigera polydactylon*
lichen	*Peltigera rufescens*
pelt lichens	*Peltigera sp.*
moss	*Plagiothecium laetum*
red-stemmed feathermoss	*Pleurozium schreberi*
moss	*Pohlia nutans*
stiff-leaved haircap moss	*Polytrichum alpinum*
moss	*Polytrichum commune*
juniper haircap moss	*Polytrichum juniperinum*
awned haircap moss	*Polytrichum piliferum*
moss	*Polytrichum spp.*
moss	*Ptilidium pulcherrimum*
Knight's plume	*Ptillium crista-castrensis*

Common Name	Scientific Name
lanky moss	*Rhytidiadelphus loreus*
bent-leaf moss	*Rhytidiadelphus squarrosus*
electrified cat's-tail moss	*Rhytidiadelphus triquetrus*
pipecleaner moss	*Rhytidiopsis robusta*
moss	*Roellia roellii*
false-polytrichum	*Timmia austriaca*
moss	*Timmia megapolitana*
golden moss	*Tomenthypnum nitens*
moss	*Tortella inclinata*
sidewalk moss	*Tortula ruralis*
crustose lichen	*various spp.*
Colorado rockfrog	*Xanthoparmelia coloradoensis*

Latin names of vascular plants based on Douglas et al. (1990) and mosses and lichens based on Vitt et al. (1988).

Appendix II. Common names, scientific names, and management status of vertebrate species known to inhabit or potentially inhabiting the Galton Range study area.

Name		Management Status		Field Observed	Notes
Common	**Scientific**	**Provincial**	**COSEWIC**		
AMPHIBIANS					
Long-toed Salamander	*Ambystoma macrodactylum*	Yellow B	-		
Western Toad	*Bufo boreas*	Green	-		
Spotted Frog	*Rana pretiosa*	Blue	-		
Wood Frog	*Rana slvatica*	Green	-		sw edge uf range
Northern leopard Frog	*Rana pipens*	Red	-		locallized distrib
Pacific Tree Frog	*Hyla regilla*		-		one seen at Elko
REPTILES					
Western Painted Turtle	*Chrysemys picta*	Yellow B	-		
Western Skink	*Eumeces skiltonianus*		-		
Rubber Boa	*Charina bottae*		-		
Racer	*Coluber constrictor*		-		
Wandering Garter Snake	*Thammnophis elegans*	Yellow A	-		
Red-sided Garter Snake	*Thamnophis sirtalix*	Yellow A	-		
MAMMALS					
Masked Shrew	*Sorex cinereus*	Green	-		
Dusky Shrew	*Sorex monticolus*	Green	-		
Wandering Shrew	*Sorex vagrans*	Yellow B	-		
Water Shrew	*Sorex palustris*	Green	-		
Pygmy shrew	*Sorex hoyi*	Green	-		
Little Brown Bat	*Myotis lucifugus*	Green	-		
Long-eared Bat	*Myotis evotis*	SU	-		
Long-legged Bat	*Myotis volans*	SU	-		
Fringed Bat	*Myotis thysanodes*		-		
Big Brown Bat	*Eptesicus fuscus*	Green	-		
Hoary Bat	*Lasiurus cinereus*	SU	-		
Pika	*Ochotona princeps*	Green	-		
Snowshoe Hare	*Lepus americanus*	Green	-	x	few; localized distribution
Least Chipmunk	*Tamias minimus*	Green	-	x	one seen at Phillipps Creek
Yellow-pine Chipmunk	*Tamias amoenus*	Green	-		
Red-tailed Chipmunk	*Tamias ruficaudus*	Blue	-		
Woodchuck	*Marmota monax*	Green	-		
Hoary Marmot	*Marmota caligata*	Yellow B	-		
Columbian Ground Squirrel	*Spermophilus columbainus*	Green	-	x	locally common
Golden-mantled Ground Squirrel	*Spermophilus lateralis*	Green	-		
Red Squirrel	*Tamiasciurus hudsonicus*	Green	-	x	common
Northern Flying Squirrel	*Glaucomys sabrinus*	Yellow B	-		
Northern Pocket Gopher	*Thomomys talpoides*	Green	-		
Beaver	*Castor canadensis*	Green	-	x	fairly common along Elk River
Deer Mouse	*Peromyscus maniculatus*	Green	-		
Bushy-tailed Woodrat	*Neotoma cinerea*	Green	-		
Southern Red-backed	*Clethrionomys gapperi*	Green	-		

Name		Management Status		Field Observed	Notes
Common	**Scientific**	**Provincial**	**COSEWIC**		
Vole					
Heather Vole	*Phenacomys intermedius*	Green	-		
Meadow Vole	*Microtus pennsylvanicus*	Green	-		
Long-tailed Vole	*Microtus longicaudus*	Green	-		
Water Vole	*Microtus richardsoni*	YellowB	-		
Muskrat	*Ondatra zibethicus*	Green	-		
Northern Bog Lemming	*Synaptomys borealis*	Green	-		
Norway Rat	*Rattus norvegicus*	Green	-		
House Mouse	*Mus musculus*	Green	-		
Western Jumping Mouse	*Zapus princeps*	Green	-		
Porcupine	*Erethizon Dorsaatum*	Green	-		
Coyote	*Canis latrans*	Green	-	x	tracks; wide spread
Wolf	*Canis lups*	Green	-		
Red Fox	*Vulpes vulpes*	Green	-		
Black Bear	*Ursus americanus*	Green	-	x	several sightings; much sign
Grizzly Bear	*Ursus arctos*	Blue	-	x	sow/cub group at Red Canyon Ck.
Racoon	*Procyon lotor*	Green	-		
American Pine Marten	*Martes americana*	Green	-	x	tracks in snow atScherf Creek
Fisher	*Martes pennanti*	Yellow B	-		
Long-tailed Weasel	*Mustela frenata*	Yellow A	-		
Ermine	*Mustela errminea*	Green	-		
Least Weasel	*Mustela nivalis*	Green	-		
Mink	*Mustela vision*	Green	-		
Wolverine	*Gulo gulo*	Blue	-	x	tracks in snow at Scherf Creek
Badger	*Taxidea taxus*	Yellow	-	x	diggings in PPdh2 near Elk R.
Striped Skunk	*Mephitis mephitis*	Green	-		
River Otter	*Lutra canadensis*	Green	-		
Cougar	*Felis concolor*	Yellow B	-		
Canada Lynx	*Lyns canadensis*	Yellow B	-		
Bobcat	*Lyns rufus*	Yellow B	-		
Elk (Wapiti)	*Cervus elaphus*	Green	-	x	9 cows; many pellets-PPdh2
Moose	*Alces alces*	Green	-	x	few; pellets in most drainages
Mule Deer	*Odocoileus hemionus*	Green	-	x	observed; lots of pellets
White-tailed Deer	*Odocoileus virginianus*	Green	-	x	observed; lots of pellets
Bighorn sheep	*Ovis canadensis*	Green	-	x	observed; few pellets

References: Names based on Cannings and Harcombe (Eds.) 1990.

Name		Management Status		Field Observed	Notes
Common	**Scientific**	**Provincial**	**COSEWIC**		
BIRDS					
Common Loon	*Gavia immer*	Green	-		
Horned Grebe	*Podiceps auritus*	Yellow A	-		
Eared Grebe	*Podiceps nigricollis*	Greem	-		
Western Grebe	*Aechmophorus occidentalis*	Yellow B	-		
American Bittern	*Botaurus lentiginosus*	Yellow A	-		
Great Blue Heron	*Ardea herodias*	Yellow B	-		
Black-crowned Night Heron	*Nycitocorax nycticorax*	Yellow B	-		
Canada Goose	*Branta canadensis*	Green	-		
Wood duck	*Aix sponsa*	Green	-		
Green-winged Teal	*Anas crecca*	Green	-		
Mallard	*Anas platyrhynchos*	Green	-		
Northern pintail	*Anas acuta*	Green	-		
Blue-winged Teal	*Anas discors*	Green	-		
Cinnamon Teal	*Anas cyanoptera*	Green	-		
Northern Shoveler	*Anas clypeata*	Green	-		
Gadwall	*Anas strepera*	Green	-		
American Wigeon	*Anas americana*	Green	-		
Canvasback	*Aythya valisineria*	Green	-		
Redhead	*Aythya americana*	Green	-		
Ring-necked duck	*Aythya collaris*	Green	-		
Ruddy duck	*Oxyura jamaicensis*	Green	-		
Lesser Scaup	*Aythya affinis*	Green	-		
Harlequin duck	*Histrionicus histrionicus*	Yellow A	-		
Common Goldeneye	*Bucephala clangula*	Green	-		
Barrow's Goldeneye	*Bucephala islandica*	Green	-		
Bufflehead	*Bucephala albeola*	Green	-		
Hooded Merganser	*Lophodytes cucullatus*	Green	-		
Common Merganser	*Mergus merganser*	Green	-		
Turkey vulture	*Cathartes aura*	Yellow B	-		
Osprey	*Pandion haliaetus*	Yellow B	-	x	one over Elk River
Golden Eagle	*Agquila chrysaetos*	Yellow B	-		one seen soaring
Bald Eagle	*Haliaeetus leucocephalus*	Yellow B	-		
Northern Harrier	*Circus cyaneus*	Yellow A	-		
Sharp-shinned Hawk	*Accipiter Striatus*	Green	-	x	uncommon
Cooper's Hawk	*Accipiter cooperii*	Yellow B	-		
Northern Goshawk	*Accipiter gentilis*	Yellow B	-	x	uncommon
Swainson's Hawk	*Buteo swainsoni*	Yellow A	-		
Red-tailed	*Buteo Jamaicensis*	Green	-	x	several; inlc. pair with young
Rough-legged Hawk	*Buteo lagopus*	Green	-		
American Kestrel	*Falco sparverius*	Green	-		
Merlin	*Falco columbarius*	Green	-		
Peregrine Falcon	*Falco peregrinus*	Red	-		
Prairie Falcon	*Falco mexicanus*	Yellow A	-	x’	uncommon
Ring-necked Pheasant	*Phasianus colchicus*	Yellow A	-		
Spruce Grouse	*Dendragapus canadensis*	Green	-		
Blue Grouse	*Dendragapus obscurus*	Green	-		
White-tailed Ptarmigan	*Lagopus leucurus*	Green	-		
Ruffed Grouse	*Bonasa umbellus*	Green	-		few seen; many grouse pellets
Virninia Rail	*Rallus limicola*	SU	-		
Sora	*Porzana carolina*	Green	-		
American Coot	*Fulica americana*	Green	-		
Sandhill Crane	*Grus canadensis*	Yellow B	-		

Name		Management Status		Field Observed	Notes
Common	Scientific	Provincial	COSEWIC		
Killdeer	*Charadrius vociferus*	Green	-		
American Avocet	*Recurvirostra americana*	Yellow B	-		
Spotted Sandpiper	*Actitis macularia*	Green	-		One heard
Common snipe	*Gallinago gallinago*	Green	-	x	
Wilson's Phalarope	*Phalaropus tricolor*	Green	-		
Ring-billed gull	*Larus delawarensis*	Green	-		
California Gull	*Larus californicus*	Green	-		
Forster's Tern	*Sterna forsteri*	Yellow B	-		
Black Tern	*Chlidonias niger*	Yellow A	-		
Rock dove	*Columba livia*	Green	-		
Mourning Dove	*Zenaida macroura*	Green	-	x	One seen
Western Screech Owl	*Otus kennicottii*	Green	-		
Great Horned Owl	*Bubo virginianus*	Green	-		
Snowy Owl	*Nyctea scandiaca*	Green	-		
Northern Pygmy Owl	*Glaucidum gnoma*	Green	-		
Barred Owl	*Strix varia*	Yellow B	-		
Great Gray Owl	*Strix nebulosa*	Yellow B	-		
Long-eared Owl	*Asio otus*	Green	-		
Short-eared Owl	*Asio flammeus*	Blue	-		
Boreal Owl	*Aegolius funereus*	Green	-		
Northern Saw-whet Owl	*Aegolius acadicus*	Green	-		Common’
Common Nighthawk	*Chordeiles minor*	Green	-	x	
Black Swift	*Cypseloides niger*	Yellow B	-		
Black-chinned Hummingbird	*Archilochus alexandri*	Green	-		
Calliope Hummingbird	*Stellula calliope*	Green	-		
Rufous Hummingbird	*Selasphorus rufus*	Green	-		
Belted Kingfisher	*Ceryl alcyon*	Green	-		
Lewis' Woodpecker	*Melanerpes lewis*	Green	-		
Red-naped Sapsucker	*Sphyrapicus nuchalis*	Green	-		
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Green	-		
Downy Woodpecker	*Picoides pubescens*	Green	-		
Hairy Woodpecker	*Picoides villous*	Green	-		
Three-toed Woodpecker	*Picoides tridactylus*	Green	-		
Black-backed Woodpecker	*Picoides arcitcus*	Yellow B	-		
Northern Flicker	*Colaptes auratus*	Green	-	x	common
Pileated Woodpecker	*Dryocopus pileatus*	Yellow B	-	x	one seen at Elk River;some sign
Olive-sided Flycatcher	*Contopus borealis*	Green	-	x	fairly common
Western Wood-pewee	*Contopus sordidulus*	Green	-		
Willow Flycatcher	*Empidonax trailii*	SU	-		
Least Flycatcher	*Empidonax minimus*	Green	-	x	fairly common
Western Flycatcher	*Empidonax dificilis*	Green		x	fairly common
Hammond's Flycatcher	*Empidonax hammondii*	Green			
Dusky Flycatcher	*Empidonax oberholseri*	Green			
Say's Phoebe	*Sayornis saya*	Green			
Western Kingbird	*Tyrannus verticalis*	Green			
Eastern Kingbird	*Tyrannus tyrannus*	Green			
Horned Lark	*Eremophila alperstris*	Green			
Tree Swallow	*Tachycineta bicolor*	Green			
Violet-Green Swallow	*Tachycineta thalassina*	Green			
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Green			
Bank Swallow	*Riparia riparia*	Green			
Cliff Swallow	*Hirundo pyrrhonota*	Green			
Barn Swallow	*Hirundo rustica*	Green			
Gray Jay	*Perisoreus canadensis*	Green		x	common

Name		Management Status		Field Observed	Notes
Common	Scientific	Provincial	COSEWIC		
Steller's Jay	*Cyanocitta stelleri*	Yellow B			
Clark's Nutcracker	*Nucifraga columbiana*	Yellow B		x	common in ESSFdk and dku
Black-billed Magpie	*Pica pica*	Green		x	
American Crow	*Corvus brachyrhynchos*	Green		x	
Common Raven	*Corvus corax*	Green		x	
Black-capped chickadee	*Parus atricapillus*	Green		x	common
Mountain Chickadee	*Parus gambeli*	Green		x	fairly common
Boreal Chickadee	*Parus hudsonicus*	Green		x	fairly common
Chesnut-backed Chickadee	*Parus rufescens*	Green			
Red-breasted Nuthatch	*Sitta canadensis*	Green		x	
White-breasted Nuthatch	*Sitta carolinensis*	Green			
Pygmy Nuthatch	*Sitta canadensis*				
Brown Creeper	*Certhia americana*	Yellow B			
Rock Wren	*Salpinctes obsoetus*	Yellow B			
House Wren	*Troglodytes aedon*	Green			
Winter Wren	*Troglodytes troglodytes*	Green		x	fairly common
Marsh Wren	*Cistothorus palustris*	Yellow B			
American Dipper	*Cinclus mexicanus*	Yellow B			
Golden-crowned Kinglet	*Regulus satrapa*	Green		x	fairly common
Ruby-crowned Kinglet	*Regulus calendula*	Green		x	fairly common
Western bluebird	*Sialia mexicana*	Green			
Mountain bluebird	*Sialia currucoides*	Green			
Townsend's Solitaire	*Myadestes townsendi*	Green		x	common
Veery	*Catharus fuscescens*	Green		x	fairly common
Swainson's Thrush	*Catharus ustulatus*	Green		x	fairly common
Hermit Thrush	*Catharus guttatus*	Green		x	fairly common
American Robin	*Turdus migratorius*	Green		x	common
Vairied Thrush	*Lxoreus naevus*	Green		x	not common
Gray Catbird	*Dunmetella carolinensis*	Green			
American Pipit	*Anthus rubescens*	Green			
Bohemian Waxwing	*Bombycilla garrulus*	Green			
Cedar Waxwing	*Bombycilla cedrorum*	Green		x	fairly common
Loggerhead shrike	*Lanius ludovicianus*	Yellow A			
European Starling	*Sturnus vulgaris*	Green		x	common near farm yards
Solitary Vireo	*Vireo solitarius*	Green		x	fairly common
Warbling Vireo	*Vireo gilvus*	Green		x	uncommon
Red-eyed vireo	*Vireo olivaceus*	Green		x	common
Tennessee Warbler	*Vermivora peregrina*	Green			
Orange-crowned Warbler	*Vermivora celata*	Green			
Nashville Warbler	*Vermivora ruficapilla*	Green			
Yellow Warbler	*Dendrocia petechia*	Green			
Magnolia Warbler	*Dendroica magnolia*	Green			
Yellow-rumped Warbler	*Dendroica coronata*	Green		x	common
Townsend's Warbler	*Dendroica townsendi*	Yellow B		x	common
Blackpoll Warbler	*Dendroica striata*	Yellow B			
American Redstart	*Setophaga ruticilla*	Green			
Ovenbird	*Seiurus aurocapillus*	Green			
Northern Waterthrush	*Seiurus noveboracensis*	Green			
MacGillivray's Warbler	*Oporomis tolmiei*	Green			
Common Yellowthroat	*Geothlypis trichas*	Green			
Wilson's Warbler	*Wilsonia pusilla*	Green		x	uncommon
Yellow-breasted Chat	*Icteria virens*	Yellow B			
Western Tanager	*Piranga ludoviciana*	Yellow B		x	uncommon
Black-headed Grosbeak	*Pheuciticus melanocephalus*	Green		x	uncommon;in PPdh2 SS04/ST07
Laxuli Bunting	*Passerina amoena*	Green			

Name		Management Status		Field Observed	Notes
Common	Scientific	Provincial	COSEWIC		
Rufous-sided towhee	*Pipilo erythropthalmus*	Green			
American Tree Sparrow	*Spizella arborea*	Green			
Chipping Sparrow	*Spizella passerina*	Green		x	common
Clay-colored Sparrow	*Spizella ppallida*	Yellow A			
Brewer's Sparrow	*Spizella breweri*	Yellow B			
Vesper Sparrow	*Pooecetes gramineus*	Green			
Lark Sparrow	*Chodestes grammacus*	Yellow B			
Savannah sparrow	*Passerculus sandwichensis*	Green			
Grasshopper Sparrow	*Ammodramus savannarum*	Yellow B			
Fox sparrow	*Passerella iliaca*	Green			
Song Sparrow	*Melospiza melodia*	Green			
Lincoln's Sparrow	*Melospiza lincolnii*	Green			
Golden-crowned Sparrow	*Zonotrichia atricapilla*	Yellow B			
White-crowned sparrow	*Zonotrichia leucophrys*	Green		x	fairly common
Dark-eyed Junco	*Junco hyemalis*	Green		x	common
Lapland Longspur	*Calcarius lapponicus*	Green			
Snow Bunting	*Plectrophenaux nivalis*	Green			
Red-winged Blackbird	*Agelaius phoeniceus*	Green			
Western Meadowlark	*Sturnella neglecta*	Yellow A		x	common’
Yellow-Headed blackbird	*Xanthocephalus xanthocephalus*	Green			
Rusty Blackbird	*Euphagus carolinus*	Green			
Brewer's Blackbird	*Euphagus cyanocephalus*	Green			
Common Grackle	*Quiscalus quiscula*	Green			
Brown-headed Cowbird	*Molothrus ater*	Green			
Northern Oriole	*Icterus galbula*	Green			
Rosy Finch	*Leucosticte arcto*	Green			
Pine Grosbeak	*Pinicola enucleator*	Green		x	common’
Purple Finch	*Carpodacus purpureus*	SU		x	common
Cassin's Finch	*Carpodacus cassinii*	Green			
House Finch	*Carpodacus mexicanus*	Green			
Red Crossbill	*Loxia curvirostra*	Green		x	common
White-winged Crossbill	*Loxia leucoptera*	Green		x	fairly common
Common Redpoll	*Carduelis Flammed*	Green			
Hoary Redpoll	*Caarduelis Hornemanni*	Green			
Pine Siskin	*Carduelis pinus*	Green		x	common
American Goldfinch	*Carduelis tristis*	Green		x	common
Evening Grosbeak	*Coccothraustes vespertinus*	Green		x	uncommon
House Sparrow	*Passer domesticus*	Green		x	common around farmyards

References: Names based on Cannings and Harcombe (Eds.) 1990.

Appendix III. Key Galton Range forage and/or browse species rated for food value importance to ungulates in summer (S) and winter (W), and for bear species in early (E; pre/early-green up), mid (M; green up) and late(L; post green up) season. In addition animal matter is included for the bear species.

Food Item	Bighorn Sheep	Mule Deer	White-tailed Deer	Elk	Moose	Black Bear	Grizzly Bear
Plant Species Utilized							
Abies spp.		W2	W3	W2	S1W2	E3	
Acer glabrum		W2	W2	S2W2	S2W2		
Achillea spp.		W2	W3	W3		M3	M3
Agropyron spp.	S1W1	W2	W2	W2	W3		
Alnus crispa		W3	W3	W3	S3W2		
Amelanchier alnifolia	W3	S2W1	S2W1	S2W1	S2W1	M2L3	M2L3
Angelica arguta						E2M2	E2M3
Antennaria spp.	S2W3	S2W2					
Arctostaphylos uva-ursi	W3	W2	W2	W3	W3	E1M3L1	E1M3L1
Artemisia dracunculus			W2	W3			
Artemisia frigida	S3W2	S2W1	S2W2	W3	W3		
Aster spp.	S2W3	S2W2	S2W2	W3		M3	M3
Astragalus spp.	W3	S2W2	S2W2	W3			E1M2L1
Athryium spp.						E3M3	E3M3
Balsamorhiza sagittata		S2W2	W2	W3			
Betula glandulosa	W3	S3W3	S3W2	S3W2	S2W1		
Betula papyrifera	W3	W2	W3	W2	S2W1		
Bromus spp.	S2W2	S2W2	S2W3	S1W1	W3	E1M2	E1M2
Calamagrostis spp.		S3	S3	S2W2		E1M2	E1M2
Carex spp.	S2W2	S3W2	S3W3	S2W2	S2W1	E1M2	E1M2
Ceanothus spp.	S3W2	S2W2	S1W2	S3W2	S3W2		
Cirsium spp.	S3W3	S2W3	S2W3	W3			
Cornus stolonifera	W3	S2W2	S2W2	W2	S2W1	M3L2	M3L2
Eleagnus spp.					S3W2		
Elymus spicatum	S1W1	S2W3	S2W3	S2W1			
Empetrum nigrum						M2L1	M2L1
Epilobium angustifolium		S2W1	S2W1	S2W1	S3	M2	M2
Equisetum pratense				S3W3		E1M1	E1M1

Food Item	Bighorn Sheep	Mule Deer	White-tailed Deer	Elk	Moose	Black Bear	Grizzly Bear
Equisetum arvense				S3W3		E1M1	E1M1
Eriogonum spp.	S3W3			W2			
Erythronium grandiflorum							E2M1
Festuca spp.	S1W1	S3W3	S3W3	S2W1	W3		
Galium boreale	S3W3	S3W3	S3W3	W3		M3	M3
Geranium viscosissimum				S2	W2		
Gramineae	S1W1	S3W2	S3W2	S1W1	S3W2	E1M2	E1M2
Hedysarum spp.							E1M2L1
Heracleum lanatum		S2		S3		M1L3	M1L3
Juncus spp.	S2W2					E2	E2
Juniper spp.	W3	W2	W3	W3	W3	E3L2	E3L3
Koeleria cristata	S2W3	S3W2	S3W3	S2W3			
Lathyrus ochroleucus	S3W3	S2	S2	S2W3	S3	M2L3	M2L3
Lithospermum ruderale	S3W3	W3	W3	W3			
Lonicera involucrata	W3	W3	W3	W3	S3W2	M3L3	M3L3
Lupinus spp.	S3W3	W2	W2	S3W3	S2		
Mahonia spp.	W3	W2	W2	S3W3		M2L2	M2L2
Melilotus alba	S3	S2	S2	S2W2			
Oplopanax horridium		W3	W3	W2	W3		M3L3
Osmorhiza spp.				S2		M3L3	E3M3L3
Pachistima myrsinites	W3	S3W1	S3W2	S3W3	S3W1		
Penstemon spp.	S3W3	S3W2	S3W3	S3W3			
Philadelphus lewisii		W2	W2	W2	W3		
Phlox spp.	S3W3	W3	W3	W3			
Physocarpus malvaceus	W3	W3	W3	S2W3	S3W3		
Picea spp.	W3				S3	E2	
Pinus albicaulus						L3	M3L1
Pinus contorta	W3			W3	S3	E3	
Poa spp.	S3W1	S3W2	S3W2	S3W1	S3W2	E1M2	E1M2
Populus balsamifera	W3	W2	W2	W1	S2W2		
Populus tremuloides	W3	S3W2	S3W2	S2W2	S2W2		
Potentilla spp.				S3	S3W3		
Prunus virginiana	W3	S2W2	S2W2	S2W1	S2W2	M2L3	M2L3
Pseudotsuga menziesii	W3	S2W2	S3W2	W3	S3W2		

Food Item	Bighorn Sheep	Mule Deer	White-tailed Deer	Elk	Moose	Black Bear	Grizzly Bear
Purshia tridentia	W3	W1	W2	W1	W2		
Rhamnus alnifolia						M3L2	M3L 2
Ribes spp.	W3	S2W3	W3	S2W3	S2W3	M2L3	S2M2L3
Rosa spp.	W3	S2W2	S3W2	S3W2	S3W3	E3M3L3	E3M3L3
Rubus spp.	W3	S2W3	S2W2	S2W3	S3W3	M2L3	M2L3
Salix spp.	W2	S2W2	S2W2	S2W2	S1W1		
Sambucus spp.	W3	W3	W3	W2	S3W2	M2L2	M2L2
Senecio triangularis							M2L3
Shepherdia canadensis	W3	W3	W3	W3		M1L1	M1L1
Sorbus spp.		W3	W3	S3W2	S3W1	M3L1	M3L1
Spirea betulifolia		S3W3	S2W3	S3W3			
Stipa spp.	S2W2						
Symphoricarpos spp.	W3	S2W2	S1W2	S3W2	W3		
Taraxacum officinale	S3	S2W3	S2W3	S2W3	S3	E2M1	E3M3
Thalictrum spp.						M3	M3
Tragopogon dubius	S3W3	S3W2	S3W3	S2W3			
Trifolium spp.	S2W3	S2W3	S2W3	S2W3	S3	E2M1	E2M2
Trisetum cernuum						E1M2	E1M2
Urtica spp.							M2L3
Vaccinium spp.	S3W3	S2W3	S2W3	S3W3	S2W2	M1L1	M1L1
Valeriana sitchensis							M3L3
Viburnum edule		W3	W3	W3	S3W2	M2L2	M2L2
Animal Matter Utilized							
Ants						E2M1L2	E3M2L3
Ungulate Carrion/Newborns						E1M2	E1M2
Wasps						M2	

Food Value Ratings: 1 = High, 2 = Moderate, 3 = Low

Appendix IV. Correction factors used to adjust Suitability Ratings for each species of wildlife modeled. These values are based on the calculated average difference between model output rankings and the infield assessment rankings, and subjective comparison to provincial habitat benchmarks.

Ecosystem Unit	Species	Season				
		Summer	Winter	Early Spring	Summer	Fall
PPdh2	Bighorn Sheep	0	-1	-	-	-
	Mule Deer	-1	-1	-	-	-
	White-tailed Deer	-2	-2	-	-	-
	Elk	-1(SS02=-2)	-2	-	-	-
	Moose	-1	-1 SS03&04	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-2 (SS00=0)	-2 (SS00=0)	-2 (SS00=0)
	Grizzly Bear	-	-	-1	-1	-1
IDFdm2	Bighorn Sheep	-1	-2	-	-	-
	Mule deer	-1	-2	-	-	-
	White-tailed Deer	-2	-1	-	-	-
	Elk	-1	-1	-	-	-
	Moose	-2 (SS02=0)	-1(SS02=0)	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
	Grizzly Bear	-	-	0	0	0
MSdk	Bighorn Sheep	-1	-1	-	-	-
	Mule deer	-1(SS02=0)	-1	-	-	-
	White-tailed Deer	-1	-1	-	-	-
	Elk	-1	-1	-	-	-
	Moose	-1(SS02=0)	-2(SS02=0)	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-2(SS02=0)	-2(SS02=0)	-2(SS02=0)
	Grizzly Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
ESSFdk	Bighorn Sheep	-1	0	-	-	-
	Mule deer	-2(SS02=0)	0	-	-	-
	White-tailed Deer	-1	0	-	-	-
	Elk	-2	0	-	-	-
	Moose	-1(SS02=0)	-1(SS02=0)	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
	Grizzly Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
ESSFdku	Bighorn Sheep	-1	0	-	-	-
	Mule deer	-1(SS02=0)	-1(SS02=0)	-	-	-
	White-tailed Deer	-1	0	-	-	-
	Elk	-2	0	-	-	-
	Moose	-1	0	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
	Grizzly Bear	-	-	-2(SS02=0)	-2(SS02=0)	-2(SS02=0)

SS02 = Site series 02

Appendix V. Correction factors used to adjust Capability Ratings for each species of wildlife modeled. These values are based on the calculated average difference between model output rankings and the infield assessment rankings, and subjective comparison to provincial habitat benchmarks.

Ecosystem Unit	Species	Season				
		Summer	Winter	Early Spring	Summer	Fall
PPdh2	Bighorn Sheep	0	0	-	-	-
	Mule deer	-2	-1	-	-	-
	White-tailed Deer	-2	-2	-	-	-
	Elk	-2	-2	-	-	-
	Moose	-1(SS00/01=0)	-1(SS00/01=0)	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-2(SS00=0)	-2(SS00=0)	-2(SS00=0)
	Grizzly Bear	-	-	-1(SS00=0)	-1(SS00=0)	-1(SS00=0)
IDFdm2	Bighorn Sheep	0	-1	-	-	-
	Mule deer	-2	-2	-	-	-
	White-tailed Deer	-2	-1	-	-	-
	Elk	-1	-2	-	-	-
	Moose	-1 (SS02=0)	-1(SS02=0)	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
	Grizzly Bear	-	-	0	0	0
MSdk	Bighorn Sheep	0	0	-	-	-
	Mule deer	-1(SS02=0)	-1(SS02=0)	-	-	-
	White-tailed Deer	-2	0	-	-	-
	Elk	-2	0	-	-	-
	Moose	-2(SS02=0)	-2(SS02=0)	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-2(SS02=0)	-2(SS02=0)	-2(SS02=0)
	Grizzly Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
ESSFdk	Bighorn Sheep	0	0	-	-	-
	Mule deer	-2(SS02=0)	0	-	-	-
	White-tailed Deer	0	0	-	-	-
	Elk	-2	0	-	-	-
	Moose	-1(SS02=0)	0	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
	Grizzly Bear	-	-	-2(SS02=0)	-2(SS02=0)	-2(SS02=0)
ESSFdku	Bighorn Sheep	0	0	-	-	-
	Mule deer	-2(SS02=0)	0	-	-	-
	White-tailed Deer	-1	0	-	-	-
	Elk	-2(SS01=0)	0	-	-	-
	Moose	-1	0	-	-	-
	Marten	0	0	-	-	-
	Black Bear	-	-	-1(SS02=0)	-1(SS02=0)	-1(SS02=0)
	Grizzly Bear	-	-	-2(SS02=0)	-2(SS02=0)	-2(SS02=0)

SS02 = Site series 02

Appendix VI. Seasonal correction factors used to modify Galton Range wildlife habitat suitability and capability ratings for ecosystem units mapped with select modifiers.

Modifier	Bighorn Sheep		Mule Deer		White-tailed Deer		Elk		Moose		Marten		Black Bear			Grizzly Bear		
	S	W	S	W	S	W	S	W	S	W	S	W	P	S	F	P	S	F
a	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-	-	-1	-1	-1	-1	-1	-1
g	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-	-	-1	-1	-1	-1	-1	-1
k	+1	+1	+1	+1	+1	+1	+1	+1	-	-	-	-	-	-	-	-	-	-
n	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-	-	-1	-1	-1	-1	-1	-1
m	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-	-	-1	-1	-1	-1	-1	-1
r	-1	-1	-1	-1	-	-	-1	-1	-	-	-	-	-	-	-	-	-	-
s	-	-	+1	+1	+2	+2	+1	+1	+2	+2	+2	+2	+1	+1	+1	-1	+1	-1
t	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-	-	-1	-1	-1	-1	-1	-1
v	+1	+1	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+1	+2	+1	-1	+1	-1
w	-1	-1	-1	-1	-1	-1	-1	-1	-	-	-	-	-1	-1	-	-1	-1	-

Note: Negative correction factors improve an ecosystem units' habitat rating while positive ones decrease the units' rating (e.g. -1 results in a low rating changing to a moderate rating). No correction factor applied to PPdh2 BEC units with warm aspects.

Appendix VII. Descriptions of the Galton Range modified ecosystem units included in the expanded legend to the BEC PPdh2 map units. Correlation to the MOF site series are provided. Refer to the expanded legend and RIC (1998) for further details regarding each ecosystem type.

Map Code	Vegetation Community	Ecosystem Description	Site Series
AW	Antelope-brush - Bluebunch wheatgrass	typic ecosystem unit	00
PW	Py -Bluebunch wheatgrass - Junegrass	typic ecosystem unit	01
PWc	Py -Bluebunch wheatgrass - Junegrass	coarse-textured ecosystem unit	01
PWck	Py -Bluebunch wheatgrass - Junegrass	coarse-textured, cool aspect ecosystem unit	01
PWct	Py -Bluebunch wheatgrass - Junegrass	coarse textured, terrace ecosystem unit	01
PWcw	Py -Bluebunch wheatgrass - Junegrass	coarse textured, warm aspect ecosystem unit	01
PWh	Py -Bluebunch wheatgrass - Junegrass	hummocky ecosystem unit	01
AR	PyAt - Bluebunch wheatgrass - Junegrass	typic ecosystem unit	03
ARac	PyAt - Bluebunch wheatgrass - Junegrass	coarse-textured floodplain ecosystem unit	03
ARc	PyAt - Bluebunch wheatgrass - Junegrass	coarse-textured ecosystem unit	03
ARck	PyAt - Bluebunch wheatgrass - Junegrass	coarse-textured, cool aspect ecosystem unit	03
ARcn	PyAt - Bluebunch wheatgrass - Junegrass	coarse-textured fan ecosystem unit	03
ARct	PyAt - Bluebunch wheatgrass - Junegrass	coarse textured, terrace ecosystem unit	03
ARcw	PyAt - Bluebunch wheatgrass - Junegrass	coarse textured, warm aspect ecosystem unit	03
ARmn	PyAt - Bluebunch wheatgrass - Junegrass	medium-textured fan ecosystem unit	03
CD	Act - Dogwood - Nootka rose	typic ecosystem unit	04
CDc	Act - Dogwood - Nootka rose	coarse-textured ecosystem unit	04
CDct	Act - Dogwood - Nootka rose	coarse textured, terrace ecosystem unit	04
CDt	Act - Dogwood - Nootka rose	terrace ecosystem unit	04
CF	Non-vegetated	Cultivated Field: hay fields, pasture land	na
ES	Sparsely Vegetated	Exposed Soil: sparsely vegetated exposed soil	na
GB	Sparsely Vegetated	Gravel Bar: herb and shrub growth on active gravel bar	na
GP	Non-vegetated	Gravel Pit: active gravel pit	na
RP	Non-vegetated	Road Surface: paved and gravel roads	na

Appendix VIII. Colour plates of representative ecosystem units located in the PPdh2 of the Galton Range study area.

PPdh2 (01) PW5 ecosystem south of the Elk River showing the ingrowth of Fd and resulting impairment of forage productivity.

PPdh2 (01) PW5 unit which has been recently thinned. Note the high fuel loads and improved forage productivity.

Appendix VIII. Colour plates of representative ecosystem units located in the PPdh2 of the Galton Range study area.

PPdh2 (01) PW5 habitat which has been effectively managed to create a more productive habitat. Although there was no evidence of recent fire the tree spacing here is more similar to natural pre-historic conditions.

PPdh2 (00) AW2 unit which is grading to a (01) PW2 ecosystem type.

Appendix VIII. Colour plates of representative ecosystem units located in the PPdh2 of the Galton Range study area.

PPdh2 (03) AR6 ecosystem on a glacio-fluvial fan located in the Elk River valley bottom. Snowberry cover dominated the shrub layer.

Level glacio-fluvial site located at the PPdh2 (03/AR) and IDFdm2 (01/DT) interface.

Appendix IX. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC PPdh2 map units. Species are listed in diminishing order of dominance progressing from tree layer through shrub, forb and finally moss/lichen layers. The tree regeneration component of the shrub layer is denoted by a (B).

Map Unit	**Description**	**BEC**
AW	Antelope brush - Bluebunch wheatgrass AA Typically occurs on gentle slopes with deep medium textured soils.	PPdh2/00
Occurs on raised areas with level to gentle slopes (0-5%) and deep soiled glacio-fluvial plains modified by glacial melt water channels. Soils at the plots sampled (n=2) consisted of silty to clayey loams with low coarse fragment contents and submesic moisture regimes. Of the two sites sampled both occurred on well drained small elevated plateau-like areas.		

Map Symbol	AW2	AW3a
Plant Species	Grass-Forb	Low Shrub
Dominants	antelope brush[sm] Kentucky bluegrass[sm] junegrass[sm] cheatgrass yarrow sulphur cinquefoil stiff needlegrass	antelope brush[SM] Idaho fescue[SM] bluebunch wheatgrass[sm] stiff needlegrass[s] junegrass bearberry white hawkweed sulphur cinquefoil
Associates	common snowberry prickly rose common St. John's-wort shaggy daisy Rocky Mountain fescue rough fescue	paintbrush spp.
Forage Rating	**3**	3
Browse Rating	**5**	5
Security Cover	**5**	5
Plots	G268	G358

[SM] Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
PW	Ponderosa pine - Bluebunch wheatgrass - Junegrass AA Typically occurs on gentle slopes with deep medium textured soils.	PPdh2/01

Predominately occurs on level to gentle lower slopes, occasionally on moderate mid slope positions, and less frequently on steep cool slopes where it is transitional to SS03. The majority of sites are on glacio-fluvial plains which feature glacial meltwater channelization and humocky terrain. Can also occur on undifferentiated/glacio-fluvial material complexs. Soils are deep and of variable texture ranging from commonly medium textured matrices, such as silty clay loams, silt loams and loams, to more coarse matrix sandy loams. The Orthic Eutric Brunisolic soils have mainly submesotrophic to mesotrophic nutrient regimes, and generally low coarse fragment contents. The moisture regime is predominately submesic to mesic. Mineral soil and humus layers pH levels are 5.5 to 6.5 and 6.0 to 7.0, respectively. Humus forms are variable but are most commonly mulls, xeromoders and occasionally mors, such as hemimors and humimors.

Map Symbol	PW2 +ck	PW3 +c,cw,h	PW4 +c	PW5 +ck,cw,h	PW6 +ct,cw	PW7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	prairie rose[sm] antelope brush[sm] bluebunch wheatgrass[SM] Idaho fescue[SM] junegrass[sm] yarrow great mullein sulphur cinquefoil white hawkweed bearberry rosy pussytoes prairie pepper-grass	Douglas-fir ponderosa pine Douglas-fir(B)[sm] prairie rose[sm] antelope brush[sm] junegrass[sm] bluebunch wheatgrass sulphur cinquefoil white hawkweed wild bergamot bearberry rosy pussytoes yarrow showy aster field pussytoes prairie pepper-grass	Douglas-fir Douglas-fir(B)[sm] common snowberry common juniper prairie rose spreading dogbane blue wildrye[SM] saskatoon[sm] pinegrass[SM] junegrass[sm] wild bergamot bluebunch wheatgrass yarrow showy aster field pussytoes rosy pussytoes	Douglas-fir ponderosa pine antelope brush prairie rose saskatoon spreading dogbane pinegrass[SM] bluebunch wheatgrass[SM] junegrass[sm] slender wheatgrass[sm] Idaho fescue[sm] false melic rough fescue cut-leaved anemone smooth aster rosy pussytoes bearberry spreading phlox	Douglas-fir ponderosa pine antelope brush[sm] common juniper[sm] common snowberry[sm] spreading dogbane saskatoon rose spp. bluebunch wheatgrass[SM] pinegrass[sm] junegrass[sm] rough fescue Idaho fescue cheatgrass bearberry yarrow wild strawberry cut-leaved anemone	Douglas-fir Tall Oregon-grape[sm] common juniper pinegrass[sm] bluebunch wheatgrass[sm] yarrow Northwestern sedge Rosy pussytoes Field pussytoes
Associates	ponderosa pine red fescue **Predicted** Douglas-fir saskatoon prairie crocus	great mullein **Predicted** saskatoon prairie crocus	creamy peavine American vetch **Predicted** ponderosa pine prairie crocus	birch-leaved spirea Rocky Mountain fescue alkali bluegrass fire moss **Predicted** yarrow prairie crocus	tall Oregon-grape birch-leaved spirea red fescue heart-leaved arnica **Predicted** rosy pussytoes prairie crocus	creamy peavine sulphur cinquefoil rough-leaved alumroot dog pelt lichen **Predicted** Ponderosa pine Prairie rose Saskatoon Prairie crocus
Forage Rating	3	3	4	**4**	**4**	4
Browse Rating	5	4	4	**5**	**5**	5
Security Cover	5	5	5	**5**	**5**	5
Plots	G271,G341	na	G67,G338	D1,D23,G44,G267,G269, G335,G336,G337,G33	D47,D270,G272,G301, G342,T343,G344,G357	G305

[SM] Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
AR	Ponderosa pine/Trembling aspen - Rose – Solomon's seal AA Typically occurs on gentle lower slopes with deep fine textured materials.	PPdh2/03
This site series occurs on cool steep aspects extending from lower slope positions to upper slopes. In the study area it is largely confined to the steep north facing embankment of the Elk River. Surficial materials consist of undifferentiated and glacio-fluvial complexes. Soils are Orthic Eutric Brunisols which are deep well drained and predominately coarse textured sandy loams but also include medium textured silt loams and loams. Coarse fragment contents are often high. The soils have submesic to mesic moisture regimes and a mesotrophic nutrient regime. Humus forms are variable and can be mors (hemimors), moders or mulls. Soil and humus profile pH's were determined to be 7.5 and 6.5, respectively.		

Map Symbol	AR2	AR3 +ac,c,ck	AR4	ARc5 +ac,cn,ck	AR6 +c,ck,ct,cw,mn	AR7
Plant Species	Grass-Forb	Low Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	saskatoon[sm] common snowberry[sm] prairie rose prickly rose soopolallie common juniper Rocky Mountain juniper heart-leaved arnica common dandelion Kentucky bluegrass bearberry yarrow pinegrass northern bedstraw	balsam poplar[SM] black cottonwood(B) Douglas-fir (B)[sm] saskatoon[sm] common snowberry[sm] prairie rose prickly rose soopolallie coyote willow common juniper Rocky Mountain juniper tall Oregon-grape heart-leaved arnica pinegrass common dandelion Kentucky bluegrass bearberry yarrow	black cottonwood Douglas-fir saskatoon[sm] common snowberry[sm] birch-leaved spirea[m] prairie rose soopolallie common juniper Rocky Mountain juniper tall Oregon-grape heart-leaved arnica common dandelion Kentucky bluegrass red-stemmed feathermoss	black cottonwood Douglas-fir saskatoon[sm] common snowberry[sm] birch-leaved spirea[m] prairie rose soopolallie common juniper Rocky Mountain juniper tall Oregon-grape heart-leaved arnica common dandelion Kentucky bluegrass red-stemmed feathermoss	Douglas-fir common snowberry[SM] mallow ninebark[SM] tall Oregon-grape[sm] Douglas maple saskatoon birch-leaved spirea common juniper rose spp. Rocky Mountain juniper pinegrass[sm] Kentucky bluegrass heart-leaved arnica red-stemmed feathermoss	Douglas-fir common juniper[sm] soopolallie[sm] Douglas maple[m] hybrid spruce Rocky Mountain juniper common snowberry choke cherry saskatoon mallow ninebark heart-leaved arnica
Associates	black cottonwood(B) Douglas-fir(B) showy aster black medic star-flowered false Solomon's-seal	birch-leaved spirea golden-aster showy aster black medic star-flowered false Solomon's-seal stiff needlegrass white sweet-clover smooth aster cut-leaved anemone	bearberry yarrow showy aster black medic **Predicted** prickly rose pinegrass northern bedstraw star-flowered false Solomon's-seal	bearberry yarrow showy aster black medic pearly everlasting **Predicted** prickly rose pinegrass northern bedstraw star-flowered false Solomon's-seal	hybrid spruce quackgrass stiff needlegrass nodding onion step moss **Predicted** northern bedstraw common dandelion star-flowered false Solomon's-seal	blue clematis rough-fruited fairybells round-leaved alumroot step moss **Predicted** rose spp. Kentucky bluegrass pinegrass northern bedstraw common dandelion star-flowered false Solomon's-seal
Forage Rating	3	**5**	5	**5**	**4**	5
Browse Rating	4	**4**	4	**5**	**5**	5
Security Cover	5	**2**	3	**4**	**4**	4
Plots	na	G333	na	G44,G334, G340	D6,G66,G274,G276,G277,	G302

Map Unit	Description	BEC
AR	Ponderosa pine/Trembling aspen - Rose – Solomon's seal AA Typically occurs on gentle lower slopes with deep fine textured materials.	PPdh2/03
This site series occurs on cool steep aspects extending from lower slope positions to upper slopes. In the study area it is largely confined to the steep north facing embankment of the Elk River. Surficial materials consist of undifferentiated and glacio-fluvial complexes. Soils are Orthic Eutric Brunisols which are deep well drained and predominately coarse textured sandy loams but also include medium textured silt loams and loams. Coarse fragment contents are often high. The soils have submesic to mesic moisture regimes and a mesotrophic nutrient regime. Humus forms are variable and can be mors (hemimors), moders or mulls. Soil and humus profile pH's were determined to be 7.5 and 6.5, respectively.		

Map Symbol	AR2	AR3 +ac,c,ck	AR4	ARc5 +ac,cn,ck	AR6 +c,ck,ct,cw,mn	AR7
Plant Species	Grass-Forb	Low Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
					G303,G304,G353	

Map Unit	Description	BEC
CD	Black cottonwood - Red-osier dogwood - Nootka rose AA Typically occurs on medium textured soils within active floodplains.	PPdh2/04
Level fluvial sites on active flood plains subjected to periodic flooding. Soils are Orthic Regosols and have higher loam contents on the less active terraces, and more clayey loamy sand and clayey sand on active sites. Coarse fragment content are generally high and soils on active sites have subxeric to submesic moisture regimes and a oligotrophic nutrient regime reflecting the high coarse content, coarse textured soil matrix and poor soil development. More stable sites which experience less frequent flooding and greater deposition of loam and fine sandy loams tend to havea mesic soil moisture regime and permesotrophic nutrient regimes. Vegetation on these latter sites is quite dense. Humus forms are variable as well ranging from hemimors on active sites to rhizomulls on more stable sites. Soils are calcareous with pH's on active and stable sites registering 8.0.		

Map Symbol	CDc2	CD3 +c,ct,t	CD4	CD5	CDc6 +ct,t	CD7
Plant Species	Grass-Forb	Low Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	black cottonwood(B) Douglas-fir(B)[sm] soopolallie juniper spp. red-osier dogwood saskatoon Kentucky bluegrass[sm] oxeye daisy common St. John's-wort junegrass pumpelly brome graminoids black medic quackgrass field locoweed	Black cottonwood(B)[sm] Douglas-fir(B)[sm] soopolallie juniper spp. red-osier dogwood saskatoon Kentucky bluegrass[sm] oxeye daisy common St. John's-wort junegrass pumpelly brome graminoids black medic quackgrass field locoweed	hybrid spruce black cottonwood common snowberry[SM] prickly rose saskatoon choke cherry soopolallie red-osier dogwood common juniper wild sarsaparilla northern bedstraw false melic rough-fruited fairybells star-flowered false Solomon's-seal American vetch creamy peavine	hybrid spruce black cottonwood white spruce common snowberry[SM] tall Oregon-grape[sm] prickly rose saskatoon choke cherry soopolallie red-osier dogwood common juniper wild sarsaparilla northern bedstraw false melic rough-fruited fairybells star-flowered false Solomon's-seal American vetch creamy peavine	Hybrid spruce black cottonwood white spruce common snowberry[SM] tall Oregon-grape[sm] prickly rose saskatoon choke cherry soopolallie red-osier dogwood common juniper wild sarsaparilla northern bedstraw false melic rough-fruited fairybells star-flowered false Solomon's-seal American vetch creamy peavine	hybrid spruce black cottonwood common snowberry[SM] tall Oregon-grape[sm] prickly rose saskatoon choke cherry soopolallie red-osier dogwood common juniper wild sarsaparilla northern bedstraw false melic rough-fruited fairybells star-flowered false Solomon's-seal American vetch creamy peavine
Associates	ponderosa pine(B) fire moss **Predicted** prairie rose bluebunch wheatgrass common dandelion	white spruce(B) ponderosa pine(B) prairie rose bluebunch wheatgrass common dandelion fire moss	white spruce ponderosa pine Douglas-fir prairie rose blue wildrye common dandelion	ponderosa pine Douglas-fir prairie rose blue wildrye common dandelion	ponderosa pine Douglas-fir prairie rose blue wildrye common dandelion	ponderosa pine Douglas-fir blue wildrye **Predicted** prairie rose common dandelion
Forage Rating	**3**	3	4	4	5	**5**
Browse Rating	**5**	5	5	5	3	**3**
Security Cover	**5**	5	5	5	3	**3**
Plots	D46	na	na	na	na	D45

[SM] Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Appendix X. Descriptions of the Galton Range modified ecosystem units included in the expanded legend to the BEC IDFdm2 map units. Correlation to the MOF site series are provided. Refer to the expanded legend and RIC (1998) for further details regarding each ecosystem type.

Map Code	Vegetation Community	Ecosystem Description	Site Series
DT	Fd-Pl - Pinegrass - twinflower	typic ecosystem unit	01
DTc	Fd-Pl - Pinegrass - twinflower	coarse-textured ecosystem unit	01
DTch	Fd-Pl - Pinegrass - twinflower	coarse-textured, hummocky ecosystem unit	01
DTck	Fd-Pl - Pinegrass - twinflower	coarse-textured, cool aspect ecosystem unit	01
DTcn	Fd-Pl - Pinegrass - twinflower	coarse-textured fan ecosystem unit	01
DTct	Fd-Pl - Pinegrass - twinflower	coarse textured, terrace ecosystem unit	01
DTcv	Fd-Pl - Pinegrass - twinflower	coarse-textured, very shallow soil ecosystem unit	01
DTcw	Fd-Pl - Pinegrass - twinflower	coarse textured, warm aspect ecosystem unit	01
DTgw	Fd-Pl - Pinegrass - twinflower	gullied, warm aspect ecosystem unit	01
DTk	Fd-Pl - Pinegrass - twinflower	cool aspect ecosystem unit	01
DTn	Fd-Pl - Pinegrass - twinflower	fan ecosystem unit	01
DTnw	Fd-Pl - Pinegrass - twinflower	fan, warm aspect ecosystem unit	01
DTt	Fd-Pl - Pinegrass - twinflower	terrace ecosystem unit	01
DTw	Fd-Pl - Pinegrass - twinflower	warm aspect ecosystem unit	01
AW	Antelope-brush - Bluebunch wheatgrass	typic ecosystem unit	02
AWg	Antelope-brush - Bluebunch wheatgrass	gullied ecosystem unit	02
AWgs	Antelope-brush - Bluebunch wheatgrass	shallow soil, gullied ecosystem unit	02
AWm	Antelope-brush - Bluebunch wheatgrass	medium-textured ecosystem unit	02
AWn	Antelope-brush - Bluebunch wheatgrass	fan ecosystem unit	02
AWs	Antelope-brush - Bluebunch wheatgrass	shallow soil ecosystem unit	02
DS	Fd - Snowberry - balsamroot	typic ecosystem unit	03
DSc	Fd - Snowberry - balsamroot	coarse-textured ecosystem unit	03
DScg	Fd - Snowberry - balsamroot	coarse-textured, gullied ecosystem unit	03
DScj	Fd - Snowberry - balsamroot	coarse-textured, gentle slope ecosystem unit	03
DSck	Fd - Snowberry - balsamroot	coarse-textured, cool aspect ecosystem unit	03
DScn	Fd - Snowberry - balsamroot	coarse-textured fan ecosystem unit	03
DScs	Fd - Snowberry - balsamroot	coarse-textured, shallow soil ecosystem unit	03

Map Code	Vegetation Community	Ecosystem Description	Site Series
DSgs	Fd - Snowberry - balsamroot	gullied, shallow soil ecosystem unit	03
DSj	Fd - Snowberry - balsamroot	gentle slope ecosystem unit	03
DSk	Fd - Snowberry - balsamroot	cool aspect ecosystem unit	03
DSs	Fd - Snowberry - balsamroot	shallow soil ecosystem unit	03
DSv	Fd - Snowberry - balsamroot	very shallow soil ecosystem unit	03
SP	FdLw - Spruce - Pinegrass	typic ecosystem unit	04
SPc	FdLw - Spruce - Pinegrass	coarse-textured ecosystem unit	04
SPck	FdLw - Spruce - Pinegrass	coarse-textured, cool aspect ecosystem unit	04
SPcw	FdLw - Spruce - Pinegrass	coarse textured, warm aspect ecosystem unit	04
SPk	FdLw - Spruce - Pinegrass	cool aspect ecosystem unit	04
SPw	FdLw - Spruce - Pinegrass	warm aspect ecosystem unit	04
SS	SxwAt - Sarsaparilla	typic ecosystem unit	05
SSc	SxwAt - Sarsaparilla	coarse-textured ecosystem unit	05
SScn	SxwAt - Sarsaparilla	coarse-textured fan ecosystem unit	05
SH	Sx - Horsetail	typic ecosystem unit	07
CF	Non-vegetated	Cultivated Field: hay fields, pasture land	na
ES	Sparsely Vegetated	Exposed Soil: sparsely vegetated exposed soil	na
TA	Talus	Talus Slope: sparsely vegetated talus slope	na

Appendix XI. Colour plates of representative ecosystem units located in the IDFdm2 of the Galton Range study area.

IDFdm2 (03) DS5 ecosystem unit positioned on a glacio-fluvial terrace north of Phillips Creek. Dense canopy closure typical of these stands results in virtual elimination of forage production.

IDF dm2 (03) DS3 ecosystem unit located on west facing slopes at the southern end of the study area. Forest cover has invaded much of this habitat type.

Appendix XI. Colour plates of representative ecosystem units located in the IDFdm2 of the Galton Range study area.

IDFdm2 (01) DT5 ecosystem unit located on the west-facing slopes of the Galton Range south of Bowman Creek. Openings in the forest canopy allows for favourable forage production of *Festuca* spp. (*F. altaica /F. scabrella)* and other grasses and forbs.

IDF dm2 (03) DS3 ecosystem unit on the lower west-facing slopes of the Galton Range near the USA border. This area has been reverted to early successional vegetation through recent logging.

Appendix XII. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC IDFdm2 map units. Species are listed in diminishing order of dominance progressing from tree layer through shrub, forb and finally moss/lichen layers. The tree regeneration component of the shrub layer is denoted by a (B).

Map Unit	**Description**	**BEC**
DT	Douglas-fir/Lodgepole pine - Pinegrass - Twinflower AA Typically occurs on deep medium textured soils on gentle slopes.	IDFdm2/01
Predominately located on gentle to moderate, warm or sometimes cool, lower and toe to mid slope positions. Occurs on a variety of surficial materials including mainly colluvial blankets and veneers, and on fluvial and glacio-fluvial materials. Soils are mostly Brunisols, such as Orthic Eutric Brunisols, Eluviated Eutric Brunisols and less frequently Orthic Melanic Brunisols, Orthic Regosols and Luvisols such as Brunisolic Gray Luvisols and Orthic Gray Luvisols. The medium textured soil matrices are most commonly silty clay loams, silty loams, loams, clay loams, less frequently sandy clays and sandy loams. Coarse fragment content is typically high resulting in well drained conditions and mesic moisture regimes. The nutrient regime is predominately mesotrophic but ranges between submesotrophic and permesotrophic. The pH of the soil profile ranges between 5.5 to 7.8, for the humus profile between 5.5 and 7.5. Humus forms are commonly variable and include mors such as hemimors, moders such as lignomoders, mullmoders and mormoders, and mulls.		

Map Symbol	DTc2 +cn,ct	DT3 +c,ck,cn,ct,cw,k,n, nw,w	DT4 +c,ck,ct,gw,k,n, nw,v	DT5 +c,cg,ck,cn,ct,cw, gw,k,t,n,nw,w	DT6 +c,ch,ck,ct,cw, gw,k,t,w	DTc7 +cw,k,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	common snowberry^{sm} Douglas-fir(B)^{sm} Canada bluegrass^{SM} timothy^{sm} Idaho fescue^{SM} blue wildrye^{sm} quackgrass^{sm} smooth brome^{sm} yarrow^{m} orchardgrass^{sm} cheatgrass black medic yellow salsify	Douglas-fir(B)^{SM} saskatoon^{SM} birch-leaved spirea^{m} sticky currant^{sm} rose spp. common juniper antelope brush redstem ceanothus pinegrass^{SM} blue wildrye^{sm} timothy^{sm} orchardgrass^{sm} red clover^{sm} yarrow^{m}	Douglas-fir western larch common snowberry Douglas maple^{m} tall Oregon-grape^{sm} pinegrass^{SM}	Douglas-fir common snowberry^{SM} birch-leaved spirea^{m} Douglas-fir(B)^{sm} Douglas maple^{m} rose spp.^{sm} common juniper tall Oregon-grape soopolallie pinegrass^{SM} heart-leaved arnica	Douglas-fir western larch common snowberry^{sm} birch-leaved spirea^{m} tall Oregon-grape^{sm} prickly rose^{sm} saskatoon Douglas maple common juniper soopolallie pinegrass^{SM} heart-leaved arnica wild strawberry showy aster bronze bells	Douglas-fir common snowberry^{SM} birch-leaved spirea^{m} Douglas maple saskatoon tall Oregon-grape pinegrass^{SM} heart-leaved arnica bronze bells wild strawberry
Associates	prickly rose saskatoon great mullein red clover alfalfa aster spp. rosy pussytoes fire moss **Predicted** lodgepole pine(B) birch-leaved spirea tall Oregon-grape soopolallie sticky currant grasses^{sm}	Trembling aspen western larch ponderosa pine willow spp. black medic wild strawberry yellow salsify stiff needlegrass three-spot mariposa lily **Predicted** lodgepole pine(B) common snowberry tall Oregon-grape^{sm} soopolallie	trembling aspen ponderosa pine lodgepole pine sticky currant^{sm} mallow ninebark prairie rose grasses^{SM} showy aster American vetch creamy peavine fern-leaved desert-parsley **Predicted** lodgepole pine birch-leaved spirea	Lodgepole pine Trembling aspen western larch mallow ninebark Utah honeysuckle blue wildrye quackgrass aster spp. yarrow wild strawberry western meadowrue grouseberry **Predicted** ponderosa pine saskatoon	ponderosa pine Lindley's aster white hawkweed bearberry redstemed feathermoss haircap moss spp. **Predicted** lodgepole pine twin flower	Sticky currant squirreltail grass false Solomon's-seal **Predicted** western larch common juniper soopollalie showy aster bearberry

Map Unit	Description	BEC
DT	Douglas-fir/Lodgepole pine - Pinegrass - Twinflower AA Typically occurs on deep medium textured soils on gentle slopes.	IDFdm2/01
Predominately located on gentle to moderate, warm or sometimes cool, lower and toe to mid slope positions. Occurs on a variety of surficial materials including mainly colluvial blankets and veneers, and on fluvial and glacio-fluvial materials. Soils are mostly Brunisols, such as Orthic Eutric Brunisols, Eluviated Eutric Brunisols and less frequently Orthic Melanic Brunisols, Orthic Regosols and Luvisols such as Brunisolic Gray Luvisols and Orthic Gray Luvisols. The medium textured soil matrices are most commonly silty clay loams, silty loams, loams, clay loams, less frequently sandy clays and sandy loams. Coarse fragment content is typically high resulting in well drained conditions and mesic moisture regimes. The nutrient regime is predominately mesotrophic but ranges between submesotrophic and permesotrophic. The pH of the soil profile ranges between 5.5 to 7.8, for the humus profile between 5.5 and 7.5. Humus forms are commonly variable and include mors such as hemimors, moders such as lignomoders, mullmoders and mormoders, and mulls.		

Map Symbol	DTc2 +cn,ct	DT3 +c,ck,cn,ct,cw,k,n, nw,w	DT4 +c,ck,ct,gw,k,n, nw,v	DT5 +c,cg,ck,cn,ct,cw, gw,k,t,n,nw,w	DT6 +c,ch,ck,ct,cw, gw,k,t,w	DTc7 +cw,k,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
	showy aster	sticky currant[sm] grasses[sm] showy aster	saskatoon common juniper soopollalie bearberry	showy aster bearberry twin flower		
Forage Rating	2	2	**3**	**4**	**4**	**2**
Browse Rating	5	3	**4**	**4**	**4**	**5**
Security Cover	4	4	**5**	**4**	**5**	**5**
Plots	D39,G71,T133	G73,G95,G256,G418	D65,G69b,G80,G82,G84, G86,G101,D132,T134,G135,G156,T169,G257,S376, G377	D42,D56,G81,S253,G286, G350,G356,S359,S368,G379,G384,S387	D2,G3,G4,D25,D68,G70, G77,G83,T96,T139,S142, G161,S227,G261,T262,T263,G351,D354,G355,S361,G382,G385,H396,G398,G438	D40

[SM] Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
AW	Antelope brush - Bluebunch wheatgrass AA Typically on steep warm aspects with deep coarse textured soils.	IDFdm2/02
Warm steep to very steep slopes in upper to mid meso-slope positions. Sites are well to rapidly drained and soil moisture regimes are xeric to subxeric, or possibly submesic on sites transitional to SS03. Can occur on a variety of surficial materials predominated by colluvial veneers and less frequently colluvial blankets, morainal blankets or occasionally glacio-fluvial materials. From the limited data available (n=3) soils appear to be mainly Orthic Regosols and Brunisolic Gray Luvisols with medium textured matrices, including loams and silty clay loams, however, all sites have high coarse fragment contents. Soil nutrient regimes are mesotrophic to permesotrophic and the soils are generally quite alkaline reflecting the underlying calcareous dolomite bedrock. Soil pH's of the mineral soil are 7.0 to 8.0 and for the humus form 6.0 to 8.0. Humus forms (n=2) sampled were a mull and leptomoder.		

Map Symbol	AW2 +g,m,n	AW3 +n,s	AW4	AW5	AWs6 +gs,m,s	AW7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	Douglas-fir ponderosa pine antelope brush[sm] saskatoon common snowberry common juniper bluebunch wheatgrass[SM] cheatgrass[sm] spreading needlegrass[s] nodding brome[sm] junegrass yellow salsify arrow-leaved balsam root great mullein wild bergamot yarrow	Douglas-fir ponderosa pine antelope brush[SM] saskatoon[sm] bluebunch wheatgrass[sm] stiff needlegrass cheatgrass grasses arrow-leaved balsam root great mullein yellow salsify	Douglas-fir ponderosa pine common juniper antelope brush[sm] Douglas maple prairie rose saskatoon bluebunch wheatgrass[SM] junegrass bearberry yarrow nodding onion rosy pussytoes	Douglas-fir ponderosa pine common juniper antelope brush[sm] common snowberry Douglas maple prairie rose saskatoon bluebunch wheatgrass[SM] junegrass bearberry yarrow nodding onion rosy pussytoes	Douglas-fir ponderosa pine Douglas maple[M] common snowberry[sm] saskatoon bluebunch wheatgrass[SM] nodding onion	Douglas-fir ponderosa pine common juniper antelope brush[sm] common snowberry Douglas maple prairie rose saskatoon bluebunch wheatgrass[SM] junegrass bearberry yarrow nodding onion rosy pussytoes
Associates	smooth aster black medic prairie pepper-grass white clover brown-eyed Susan **Predicted** nodding onion rosy pussytoes	sticky currant soopolallie common snowberry spreading dogbane yellow sweet-clover prairie pepper-grass **Predicted** yarrow nodding onion rosy pussytoes	smooth aster wild strawberry arrow-leaved balsam root	smooth aster wild strawberry arrow-leaved balsam root	choke cherry mock-orange fern-leaved desert-parsley common harebell **Predicted** common juniper antelope brush[sm] junegrass bearberry yarrow	smooth aster wild strawberry arrow-leaved balsam root
Forage Rating	**1**	**2**	4	3	**3**	3
Browse Rating	**5**	**4**	3	5	**5**	5
Security Cover	**5**	4	3	4	**4**	4
Plots	D74,G175,S224,G239,G419	G92,S99,G173,G177,S184,S233,S234	na	na	G91	Na

Map Unit	Description	BEC
DS	Douglas-fir - Snowberry - Balsamroot AA Typically occurs on steep warm aspects with deep medium textured soils.	IDFdm2/03
Warm steep lower to upper slope positions which are well to rapidly drained. Occurs on a variety of surficial materials including colluvial veneers, colluvial blankets, morainal blankets and glacio-fluvial materials. Soils are Orthic Eutric Brunisols and Orthic Regosols with medium textured matrices, including sandy loams, sandy silts and sandy silt loams. Less frequently represented are silty loams, silty clay loams, clay silt loams and loams. Coarse fragment contents are high resulting in subxeric to submesic soil conditions. Nutrient regimes tend to be submesotrophic to mesotrophic. Mineral soil pH's were measured at 7.5 and humus form pH's were 6.5 to 7.5. Humus forms sampled for this site series included mulls, moders, hemimors and humimors.		

Map Symbol	DS2	DS3 +c,cg,cj,cs,j,s	DS4 +cg,cj,j	DS5 +c,cg,cs,g,j,s,v	DS6 +c,cg,cn,s,v	DSc7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	wild bergamot brown-eyed Susan Kentucky bluegrass^{sm} arrow-leaved balsam root^{sm}	Douglas fir(B)^{sm} ponderosa pine saskatoon^{sm} sticky currant^{SM} common snowberry spreading dogbane prairie rose Rocky Mountain juniper common juniper soopolallie birch-leaved spirea pinegrass^{SM} bluebunch wheatgrass^{sm} stiff needlegrass^{s} rough fescue^{sm} arrow-leaved balsam root bluegrass spp. yarrow	Douglas-fir ponderosa pine Douglas maple^{m} common snowberry^{sm} saskatoon^{sm} birch-leaved spirea common juniper spreading dogbane prairie rose soopolallie Rocky Mountain juniper bluebunch wheatgrass^{sm} pinegrass^{SM} Idaho fescue yarrow arrow-leaved balsam root great mullein wild bergamot	Douglas-fir ponderosa pine common snowberry^{sm} saskatoon^{sm} trembling aspen(B)^{sm} birch-leaved spirea^{m} Douglas maple common juniper spreading dogbane pinegrass^{SM} bluebunch wheatgrass^{sm} junegrass yarrow wild bergamot smooth aster arrow-leaved balsam root great mullein	Douglas-fir ponderosa pine saskatoon^{sm} sticky currant^{sm} common snowberry^{sm} birch-leaved spirea^{m} common juniper spreading dogbane Douglas maple bluebunch wheatgrass^{SM} pinegrass^{SM} great mullein arrow-leaved balsam root smooth aster brown-eyed Susan bearberry wild strawberry	Douglas-fir trembling aspen(B)^{SM} Douglas-fir(B)^{sm} Douglas maple^{m} prickly rose black gooseberry saskatoon Rocky Mountain juniper great mullein arrow-leaved balsam root smooth aster brown-eyed Susan bearberry wild strawberry
Associates	ponderosa pine Douglas-fir(B)^{sm} prickly rose prairie rose choke cherry **Predicted** saskatoon common snowberry antelope brush common juniper soopolallie Rocky Mountain juniper sticky currant bluebunch wheatgrass^{sm} pinegrass^{sm} bluegrass spp. great mullein junegrass	Douglas maple^{m} trembling aspen(B) western larch Mallow ninebark junegrass nodding onion great mullein bearberry racemose pussytoes brown-eyed Susan pearly everlasting rosy pussytoes prairie pepper-grass slender hawksbeard **Predicted** smooth aster	sticky currant redstem ceanothus blue wildrye smooth aster showy aster American vetch narrow-leaved hawkweed northern bedstraw **Predicted** junegrass nodding onion bearberry	choke cherry antelope brush prairie rose small-flowered penstemon Ross's sedge Kentucky bluegrass cheatgrass rough fescue red clover heart-leaved arnica wild strawberry spp. feathermoss dog pelt lichen **Predicted** soopolallie bearberry nodding onion	mallow ninebark ^{SM} Rocky Mountain juniper antelope brush soopolallie mock-orange prairie pepper-grass white sweet-clover common dandelion Kentucky bluegrass yarrow nodding onion **Predicted** junegrass	red raspberry shrubby penstemon wild sarsaparilla showy Jacob's ladder Oregon woodsia showy aster **Predicted** ponderosa pine common juniper common snowberry soopolallie birch-leaved spirea yarrow junegrass nodding onion

Map Unit	Description	BEC
DS	Douglas-fir - Snowberry - Balsamroot AA Typically occurs on steep warm aspects with deep medium textured soils.	IDFdm2/03
Warm steep lower to upper slope positions which are well to rapidly drained. Occurs on a variety of surficial materials including colluvial veneers, colluvial blankets, morainal blankets and glacio-fluvial materials. Soils are Orthic Eutric Brunisols and Orthic Regosols with medium textured matrices, including sandy loams, sandy silts and sandy silt loams. Less frequently represented are silty loams, silty clay loams, clay silt loams and loams. Coarse fragment contents are high resulting in subxeric to submesic soil conditions. Nutrient regimes tend to be submesotrophic to mesotrophic. Mineral soil pH's were measured at 7.5 and humus form pH's were 6.5 to 7.5. Humus forms sampled for this site series included mulls, moders, hemimors and humimors.		

Map Symbol	DS2	DS3 +c,cg,cj,cs,j,s	DS4 +cg,cj,j	DS5 +c,cg,cs,g,j,s,v	DS6 +c,cg,cn,s,v	DSc7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
	bearberry yarrow nodding onion					
Forage Rating	2	**5**	**3**	**4**	**4**	**5**
Browse Rating	4	**3**	**5**	**4**	**5**	**5**
Security Cover	5	**3**	**4**	**4**	**4**	**4**
Plots	G174,G419	G85,G87,G97, G143, G172,G255, S390,S391	G136,G14,S225,G258 G260	D41,D55,D64,G141,S178,S228,S367,S373,S375,G380	G69a,D76,T98,G137,G138,T140,G176,S226,S237,S365,S381,G283,G439	D154

SM Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
SP	Douglas-fir/Western larch/Spruce - Pinegrass AA Typically on gentle slopes with fine textured soils.	IDFdm2/04
Gentle to moderately steep lower slope and toe positions which are moderately well drained. Usually found on colluvial blankets but may be found on morainal blankets and fluvial sites. Soils are medium textured, predominately, sandy loams or silty loams. These moisture receiving sites have mesic to subhygric moisture regimes. The only humus form plot sampled was determined to be a moder.		

Map Symbol	SP2	SPck3	SPc4 +w	SP5 +c,ck,cw,k	SPc6 +ck	SPc7 +ck,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	pinegrass[sm] wild sarsaparilla showy aster twinflower	Douglas-fir(B)[sm] trembling aspen(B)[sm] common snowberry[SM] saskatoon[sm] Douglas maple[m] sticky currant[sm] tall Oregon-grape birch-leaved spirea red-osier dogwood pinegrass[sm] wild sarsaparilla showy aster twinflower bunchberry	Douglas-fir trembling aspen common snowberry[SM] Douglas maple[m] sticky currant[sm] tall Oregon-grape birch-leaved spirea pinegrass[sm] wild sarsaparilla	trembling aspen Douglas-fir	Douglas-fir lodgepole pine Douglas maple rattlesnake-plantain heart-leaved arnica red-stemmed feathermoss	Douglas-fir hybrid spruce western larch trembling aspen common snowberry[SM] saskatoon[sm] tall Oregon-grape[sm] birch-leaved spirea red-osier dogwood Douglas maple soopolallie pinegrass[sm] wild sarsaparilla red-stemmed feathermoss
Associates	trembling aspen common snowberry saskatoon Douglas maple red-osier dogwood Douglas-fir(B) soopolallie tall Oregon-grape birch-leaved spirea sticky currant	soopolallie **Predicted** hybrid spruce(B) western larch	**Predicted** hybrid spruce(B) western larch(B) saskatoon[sm] red-osier dogwood soopolallie showy aster twinflower bunchberry	black cottonwood Douglas maple **Predicted** hybrid spruce western larch common snowberry[sm] saskatoon[sm] birch-leaved spirea[sm] red-osier dogwood soopolallie pinegrass[sm] showy aster wild sarsaparilla twinflower bunchberry	western redcedar Queen's cup one-sided wintergreen step moss electrified cat's tail moss **Predicted** trembling aspen hybrid spruce western larch common snowberry[sm] tall Oregon-grape[sm] saskatoon[sm] birch-leaved spirea red-osier dogwood soopollalie pinegrass[sm] showy aster wild sarsaparilla twinflower bunchberry	rattlesnake-plantain heart-leaved arnica showy aster bunchberry one-sided wintergreen twinflower step moss

Map Unit	Description	BEC
SP	Douglas-fir/Western larch/Spruce - Pinegrass ^{aA} Typically on gentle slopes with fine textured soils.	IDFdm2/04
Gentle to moderately steep lower slope and toe positions which are moderately well drained. Usually found on colluvial blankets but may be found on morainal blankets and fluvial sites. Soils are medium textured, predominately, sandy loams or silty loams. These moisture receiving sites have mesic to subhygric moisture regimes. The only humus form plot sampled was determined to be a moder.		

Map Symbol	SP2	SPck3	SPc4 +w	SP5 +c,ck,cw,k	SPc6 +ck	SPck7 +w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Forage Rating	3	4	**5**	**5**	5	4
Browse Rating	4	4	**5**	**5**	4	4
Security Cover	5	5	4	**5**	4	4
Plots	na	na	G148,G149	S165,S183	G281,H397,	na

^{SM} Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
SS	Hybrid white spruce/Trembling aspen - Wild sarsparilla ᴀA Typically occurring on lower slope positions with fine textured materials.	IDFdm2/05
Moderately well to well drained moisture receiving sites on gentle lower slopes, level sites and toe slope positions with variuos aspects. Surficial materials are predominately colluvial blankets and fluvial terraces, but it may also occur on glacio-fluvial materials. Soils include are Orthic Eutric Brunisols, Orthic Regosols and Gleyed Cumulic Regosols consisting of sandy loams, fine sandy loam, sandy silts, loamy sand, sand and clay loams. Typically soils contain high coarse fragment contents. The soil moisture regime is mesic to subhgric and the nutrient regime is mainly eutrophic but can range to mesotrophic. Humus forms are variable and consist of mors (hemimors), .moders (leptomoders) and mulls (rhizomulls). Both soil and humus profile pH's are commonly about 6.5 with a range of 5.3 to 7.7.		

Map Symbol	SS2	SS3	SS4	SSc5 +cn	SS6 +c	SSc7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	thimbleberry red raspberry red-osier dogwood wild sarsaparilla western meadowrue fairybells spp. mountain sweet-cicely one-sided wintergreen rattlesnake plantain common mitrewort Queen's cup bunchberry oak fern	choke cherry thimbleberry Douglas maple red raspberry red-osier dogwood wild sarsaparilla	Douglas-fir Western larch Black cottonwood Trembling aspen Common snowberry^{sm} tall Oregon-grape^{sm} Douglas maple^{M} Sitka alder^{sm} Wild sarsaparilla Sweet-scented bedstraw Rough-fruited fairybells	Engelmann spruce Douglas-fir black cottonwood trembling aspen Douglas maple^{m} birch-leaved spirea tall Oregon-grape thimbleberry^{sm} highbush cranberry wild sarsaparilla sweet-scented bedstraw^{sm} heart-leaved arnica	black cottonwood Douglas-fir Engelmann spruce trembling aspen thimbleberry^{SM} Douglas maple^{m} red-osier dogwood^{sm} Sitka alder^{sm} common snowberry^{sm} black gooseberry^{sm} birch-leaved spirea devil's club highbush cranberry saskatoon wild sarsaparilla bunchberry heart-leaved arnica sweet-scented bedstraw oak fern	hybrid spruce Douglas-fir subalpine fir(B) mountain alder hybrid spruce(B) devil's club^{b} thimbleberry red-osier dogwood gooseberry sp. heart-leaved arnica wild sarsaparilla bunchberry common mitrewort sweet-scented bedstraw oak fern

Map Unit	Description	BEC
SS	Hybrid white spruce/Trembling aspen - Wild sarsparilla ᴀA Typically occurring on lower slope positions with fine textured materials.	IDFdm2/05
Moderately well to well drained moisture receiving sites on gentle lower slopes, level sites and toe slope positions with variuos aspects. Surficial materials are predominately colluvial blankets and fluvial terraces, but it may also occur on glacio-fluvial materials. Soils include are Orthic Eutric Brunisols, Orthic Regosols and Gleyed Cumulic Regosols consisting of sandy loams, fine sandy loam, sandy silts, loamy sand, sand and clay loams. Typically soils contain high coarse fragment contents. The soil moisture regime is mesic to subhgric and the nutrient regime is mainly eutrophic but can range to mesotrophic. Humus forms are variable and consist of mors (hemimors), .moders (leptomoders) and mulls (rhizomulls). Both soil and humus profile pH's are commonly about 6.5 with a range of 5.3 to 7.7.		

Map Symbol	SS2	SS3	SS4	SSc5 +cn	SS6 +c	SSc7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Associates	choke cherry Douglas maple birch-leaved spirea Sitka alder black gooseberry devil's club highbush cranberry saskatoon	Baldhip rose smooth aster white hawkweed night-flowering catchfly bull thistle **Predicted** birch-leaved spirea Sitka alder[sm] black gooseberry[sm] devil's club highbush cranberry saskatoon western meadowrue fairybells spp. mountain sweet-cicely one-sided wintergreen rattlesnake plantain common mitrewort Queen's cup Bunchberry oak fern	False Solomon's-seal Mountain sweet-cicely pink wintergreen dog pelt lichen **Predicted** hybrid spruce thimbleberry[SM] birch-leaved spirea red-osier dogwood[sm] black gooseberry[sm] devil's club highbush cranberry saskatoon western meadowrue fairybells spp. one-sided wintergreen rattlesnake plantain common mitrewort Queen's cup bunchberry oak fern	Paper birch hybrid spruce lodgepole pine western larch twinflower western meadowrue pinegrass false Solomon's-seal mountain sweet-cicely one-sided wintergreen rattlesnake plantain common horsetail common mitrewort Queen's cup **Predicted** red osier-dogwood common snowberry[sm] saskatoon fairybells spp. bunchberry oak fern	subalpine fir western redcedar falsebox scouring-rush fowl bluegrass fireweed fairybells spp. common horsetail wintergreen spp. common mitrewort false Solomon's-seal mountain sweet-cicely clasping twisted stalk Queen's cup baneberry western meadowrue one-leaved foamflower **Predicted** western larch	Stinging nettle blue clematis one-leaved foamflower **Predicted** trembling aspen western larch saskatoon common snowberry tall Oregon-grape Douglas maple[m] birch-leaved spirea highbush cranberry western meadowrue fairybells spp. mountain sweet-cicely Queen's cup one-sided wintergreen rattlesnake plantain baneberry
Forage Rating	2	**2**	3	**4**	**4**	4
Browse Rating	4	**4**	4	**4**	**4**	4
Security Cover	4	**1**	2	**2**	**2**	2
Plots	na	G259	G94,G146	G78,D79,G347	D43,D63,D72,G279,G294 ,G383	G352

[SM] Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	**Description**	**BEC**
SH	Hybrid white spruce - Horsetail Typically on level sites with coarse textured soils.	IDFdm2/07
This site series is or limited areal extent in the study area and is restricted to level riparian fluvial sites. It may also occur in small localized moisture receiving seepage sites at the base of toe slopes. Soil moisture regimes are hygric to subhygric and it is expected that nutrient regime is eutrophic. Soils have high sand contents and are expected to have high coarse fragment contents. Humus forms are typically moders and mors.		

Map Symbol	SH2	SH3	SH4	SH5	SH6	SH7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	common snowberry[sm] common horsetail[b] oak fern meadow horsetail[be] scouring-rush western meadowrue[b] wild sarsaparilla sweet-scented bedstraw one-sided wintergreen electrified cat's tail moss	black cottonwood(B) Douglas maple[M] Devil's club[M] common snowberry[sm] common horsetail[b] oak fern meadow horsetail[be] scouring-rush western meadowrue[b] wild sarsaparilla sweet-scented bedstraw one-sided wintergreen electrified cat's tail moss	Black cottonwood Engelmann spruce Mountain alder Douglas maple[M] Devil's club[M] red osier-dogwood[SM] thimbleberry[SM] red raspberry[SM] common snowberry[sm] wild sarsaparilla common horsetail[b] oak fern meadow horsetail[be] western meadowrue[b] sweet-scented bedstraw one-sided wintergreen scouring-rush	black cottonwood Engelmann spruce mountain alder Douglas maple[M] Devil's club[M] red osier-dogwood[SM] thimbleberry[SM] red raspberry[SM] common snowberry[sm] wild sarsaparilla common horsetail[b] oak fern meadow horsetail[be] western meadowrue[b] sweet-scented bedstraw one-sided wintergreen scouring-rush	black cottonwood Engelmann spruce mountain alder Douglas maple[M] Devil's club[M] red osier-dogwood[SM] thimbleberry[SM] red raspberry[SM] common snowberry[sm] wild sarsaparilla common horsetail[b] oak fern meadow horsetail[be] western meadowrue[b] sweet-scented bedstraw one-sided wintergreen scouring-rush	black cottonwood Engelmann spruce Douglas maple[M] Devil's club[M] common snowberry[sm] common horsetail[b] oak fern meadow horsetail[be] scouring-rush western meadowrue[b] wild sarsaparilla sweet-scented bedstraw one-sided wintergreen
Associates	black cottonwood Engelmann spruce Devil's club Douglas maple green wintergreen	Engelmann spruce(B) green wintergreen	paper birch green wintergreen electrified cat's tail moss	paper birch green wintergreen electrified cat's tail moss	paper birch green wintergreen electrified cat'	green wintergreen electrified cat's tail moss
Forage Rating	2	3	4	4	4	**4**
Browse Rating	4	3	3	4	4	4
Security Cover	4	2	1	2	2	**2**
Plots	na	Na	na	na	na	G345

[SM] Superscripts denote bighorn sheep(S), mule deer(M), bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Appendix XIII. Descriptions of the Galton Range modified ecosystem units included in the expanded legend to the BEC MSdk map units. Correlation to the MOF site series are provided. Refer to the expanded legend and RIC (1998) for further details regarding each ecosystem type.

Map Code	Vegetation Community	Ecosystem Description	Site Series
SG	Sxw - Soopolallie - Grouseberry	typic ecosystem unit	01
SGc	Sxw - Soopolallie - Grouseberry	coarse-textured ecosystem unit	01
SGck	Sxw - Soopolallie - Grouseberry	coarse-textured, cool aspect ecosystem unit	01
SGcn	Sxw - Soopolallie - Grouseberry	coarse-textured fan ecosystem unit	01
SGcw	Sxw - Soopolallie - Grouseberry	coarse-textured, warm aspect ecosystem unit	01
SGgk	Sxw - Soopolallie - Grouseberry	gullied, cool aspect ecosystem unit	01
SGk	Sxw - Soopolallie - Grouseberry	cool aspect ecosystem unit	01
SGw	Sxw - Soopolallie - Grouseberry	warm aspect ecosystem unit	01
SW	Saskatoon - Bluebunch wheatgrass	typic ecosystem unit	02
SWc	Saskatoon - Bluebunch wheatgrass	coarse-textured ecosystem unit	02
SWcs	Saskatoon - Bluebunch wheatgrass	coarse-textured, shallow soil ecosystem unit	02
SWs	Saskatoon - Bluebunch wheatgrass	shallow soil ecosystem unit	02
LJ	Pl - Juniper - pinegrass	typic ecosystem unit	03
LJc	Pl - Juniper - pinegrass	coarse-textured ecosystem unit	03
LJcg	Pl - Juniper - pinegrass	coarse-textured, gullied ecosystem unit	03
LJcs	Pl - Juniper - pinegrass	coarse-textured, shallow soil ecosystem unit	03
LJcv	Pl - Juniper - pinegrass	coarse-textured, very shallow soil ecosystem unit	03
LJgs	Pl - Juniper - pinegrass	gullied, shallow soil ecosystem unit	03
LJgv	Pl - Juniper - pinegrass	gullied, very shallow soil ecosystem unit	03
LJrs	Pl - Juniper - pinegrass	ridge, shallow soil ecosystem unit	03
LJs	Pl - Juniper - pinegrass	shallow soil ecosystem unit	03
LJsz	Pl - Juniper - pinegrass	shallow soil, very steep warm aspect ecosystem unit	03
LJv	Pl - Juniper - pinegrass	very shallow soil ecosystem unit	03
LP	Pl - Oregon grape - Pinegrass	typic ecosystem unit	04
LPc	Pl - Oregon grape - Pinegrass	coarse-textured ecosystem unit	04
LPck	Pl - Oregon grape - Pinegrass	coarse-textured, cool aspect ecosystem unit	04
LPcn	Pl - Oregon grape - Pinegrass	coarse-textured, fan ecosystem unit	04
LPcs	Pl - Oregon grape - Pinegrass	coarse-textured, shallow soil ecosystem unit	04
LPcw	Pl - Oregon grape - Pinegrass	coarse textured, warm aspect ecosystem unit	04

Map Code	Vegetation Community	Ecosystem Description	Site Series
LPgk	Pl - Oregon grape - Pinegrass	gullied, cool aspect ecosystem unit	04
LPgs	Pl - Oregon grape - Pinegrass	gullied, shallow soil ecosystem unit	04
LPgw	Pl - Oregon grape - Pinegrass	gullied, warm aspect ecosystem unit	04
LPk	Pl - Oregon grape - Pinegrass	cool aspect ecosystem unit	04
LPks	Pl - Oregon grape - Pinegrass	cool aspect, shallow soil ecosystem unit	04
LPnw	Pl - Oregon grape - Pinegrass	fan, warm aspect ecosystem unit	04
LPr	Pl - Oregon grape - Pinegrass	ridge ecosystem unit	04
LPs	Pl - Oregon grape - Pinegrass	shallow soil ecosystem unit	04
LPsw	Pl - Oregon grape - Pinegrass	shallow soil, warm aspect ecosystem unit	04
LPw	Pl - Oregon grape - Pinegrass	warm aspect ecosystem unit	04
SS	Sxw - Soopolallie - Snowberry	typic ecosystem unit	05
SSc	Sxw - Soopolallie - Snowberry	coarse-textured ecosystem unit	05
SScn	Sxw - Soopolallie - Snowberry	coarse-textured, fan ecosystem unit	05
SH	Sxw - Dogwood - Horsetail	typic ecosystem unit	06
SHc	Sxw - Dogwood - Horsetail	coarse-textured ecosystem unit	06
ES	Sparsely Vegetated	Exposed Soil: sparsely vegetated exposed soil	na
TA	Sparsely Vegetated	Talus: non/sparsely vegetated talus slope	na
RO	Sparsely Vegetated	Rock: non/sparsely vegetated exposed rock	na

Appendix XIV. Colour plates of representative ecosystem units located in the MSdk of the Galton Range study area.

MSdk BEC subzone in the Galton Range study area with a gradient of ecosystem types ranging from SG6 (01) on the lower slopes to predominately LJ6 (03) on mid to upper slopes.

MSdk (01) SG6 mature seral ecosystem type on a colluvial blanket at the end of the Meff Gorie road. Lodgepole pine stand (over 94 years old) with an alder dominated shrub layer and herb layer of arnica and

beargrass.

Appendix XIV. Colour plates of representative ecosystem units located in the MSdk of the Galton Range study area.

MSdk (01) SG3 ecosystem type on morainal blanket in the Conner Creek drainage. Recent logging has created an opening of early successional herb/shrub vegetation with high habitat ratings for most ungulate and bear species.

MSdk (02) on colluvial veneer in the Maguire Creek drainage. The exposed soils have very high coarse

fragment contents and support mainly shrubs, including Saskatoon, Douglas maple and redstem ceanothus.

Appendix XV. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC MSdk map units. Species are listed in diminishing order of dominance progressing from tree layer through shrub, forb and finally moss/lichen layers. The tree regeneration component of the shrub layer is denoted by a (B).

Map Unit	**Description**	**BEC**
SG	Hybrid white spruce - Soopolallie – Grouseberry AA Typically occurs on gentle slopes with deep medium textured soils.	MSdk/01
Moderate slopes on lower to mid-slope meso positions on mainly cool aspects. Surficial materials include colluvial blankets and veneers, and morainal blankets. Sites are well drained with mesic moisture regimes. The Orthic Eutric Brunisolic soils are deep medium textured loams including clay loams, silty clay loams, loams and silty loams and less frequently more coarse fine sandy loams. Soils nutrient regimes are mesotrophic to permesotrophic grading towards eutrophic. Humus forms are predominately mors, such as lignomors, and less frequently mulls and moders. Mineral soil pH's are 5.5 to 7.0 and humus layer pH's range from 5.0 to 7.0.		

Map Symbol	SG2	SG3 +c,cn,gk	SGck4	SGc5 +ck,cn,k	SGc6 +cw,gk	SG7 +c,ck,k,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	grouseberry^{SM} pinegrass^{sm} showy aster heart-leaved arnica sweet-scented bedstraw western meadowrue	willow spp.^{sm} Sitka alder^{M} thimbleberry^{sm} false azalea Douglas maple^{m} birch-leaved spirea blue-leaved huckleberry black gooseberry soopolallie saskatoon grouseberry^{SM} pinegrass^{sm} showy aster heart-leaved arnica sweet-scented bedstraw western meadowrue	Douglas-fir Sitka alder^{M} false azalea Douglas maple willow spp.^{sm} tall Oregon-grape pinegrass^{SM} grouseberry^{SM} red-stemmed feathermoss	Douglas-fir lodgepole pine trembling aspen subalpine fir(B)^{m} Douglas maple tall Oregon-grape false azalea prickly rose soopolallie saskatoon birch-leaved spirea grouseberry^{SM} pinegrass^{SM} heart-leaved arnica prince's pine rattlesnake-plantain one-sided wintergreen racemose pussytoes bunchberry	Douglas-fir subalpine fir lodgepole pine Engelmann spruce Sitka alder^{sm} false azalea blue-leaved huckleberry^{sm} Douglas maple thimbleberry falsebox black gooseberry pinegrass^{sm} heart-leaved arnica grouseberry one-sided wintergreen rattlesnake-plantain western meadowrue	Douglas-fir subalpine fir lodgepole pine Engelmann spruce Sitka alder^{sm} false azalea blue-leaved huckleberry^{sm} Douglas maple thimbleberry falsebox black gooseberry pinegrass^{sm} heart-leaved arnica grouseberry one-sided wintergreen rattlesnake-plantain western meadowrue
Associates	Douglas-fir willow spp. Sitka alder thimbleberry Douglas maple birch-leaved spirea black gooseberry soopolallie saskatoon fireweed small-flower. woodrush	Douglas-fir fireweed small-flowered woodrush **Predicted** subalpine fir(B)^{m} prickly rose common snowberry prince's pine bunchberry red-stemmed feathermoss	western larch lodgepole pine **Predicted** subalpine fir(B)^{m} prickly rose soopolallie saskatoon birch-leaved spirea common snowberry showy aster prince'spine bunchberry step moss	western larch **Predicted** common snowberry showy aster red-stemmed feathermoss step moss	western larch Queen's cup one-leaved foamflower **Predicted** prickly rose soopolallie saskatoon birch-leaved spirea common snowberry showy aster prince's pine bunchberry red-stem. feathermoss step moss	western larch Queen's cup one-leaved foamflower **Predicted** prickly rose soopolallie saskatoon birch-leaved spirea common snowberry showy aster prince's pine bunchberry red-stem. feathermoss step moss

Map Unit	Description	BEC
SG	Hybrid white spruce - Soopolallie – Grouseberry AA Typically occurs on gentle slopes with deep medium textured soils.	MSdk/01
Moderate slopes on lower to mid-slope meso positions on mainly cool aspects. Surficial materials include colluvial blankets and veneers, and morainal blankets. Sites are well drained with mesic moisture regimes. The Orthic Eutric Brunisolic soils are deep medium textured loams including clay loams, silty clay loams, loams and silty loams and less frequently more coarse fine sandy loams. Soils nutrient regimes are mesotrophic to permesotrophic grading towards eutrophic. Humus forms are predominately mors, such as lignomors, and less frequently mulls and moders. Mineral soil pH's are 5.5 to 7.0 and humus layer pH's range from 5.0 to 7.0.		

Map Symbol	SG2	SG3 +c,cn,g,gk,	SGck4	SGc5 +ck,cn,gk	SGc6 +cw,g,gk	SG7 +c,ck,gk,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Forage Rating	1	2	3	3	4	4
Browse Rating	4	3	3	5	4	4
Security Cover	4	2	2	4	3	3
Plots	na	D59,G60,G61,S188, S290,G291,G297	S210,G348	G9,D61,S151,G292, S363	G212,G295,G298,S323H4 00,G433	na

SM Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (High), 2 (M oderately High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
SW	Saskatoon - Bluebunch wheatgrass ᴀA Typically on steep warm aspects with deep medium textured soils.	MSdk/02
Steep warm slopes in upper to mid level meso-slope positions. Surficial materials are composed of colluvial veneers and colluvial lithic veneers. Soils are Orthic Eutric Brunisols, consisting of sandy loams and loams, and typically contain high coarse fragment contents (65-80%). The soil moisture regime is very xeric to subxeric and the nutrient regime is submesotrophic. The soil profile has pH's'of approximately 6.5 (n=1). Humus forms are expected to be predominately mulls and moders and on the one site sampled was a rhizomull.		

Map Symbol	SWc2 +s	SW3 +cs,s	SW3b
Plant Species	Grass-Forb	Low Shrub	Tall Shrub
Dominants	Saskatoon^{SM} redstem ceanothus^{sm} Douglas maple^{m} rough fescue wild bergamot Kentucky bluegrass smooth aster cheatgrass nodding onion round-leaved alumroot yarrow bluebunch wheatgrass	Douglas-fir(B)^{SM} soopolallie^{sm} saskatoon^{sm} prickly rose Douglas maple bluebunch wheatgrass^{sm} Thompson's paintbrush smooth aster yarrow lance-leaved stonecrop common harebell	Douglas-fir saskatoon^{SM} Douglas maple^{M} spreading dogbane trembling aspen(B) soopolallie sticky currant wild bergamot nodding onion arrow-leaved balsam root bluebunch wheatgrass^{sm}
Associates	spreading dogbane choke cherry^{sm} mock-orange^{sm} prickly rose soopolallie fern-leaved desert-parsley **Predicted** lance-leaved stonecrop common harebell	birch-leaved spirea black gooseberry three-spot mariposa lily draba sp. Showy Jacob's'ladder **Predicted** Cheatgrass round-leaved alumroot fern-leaved desert-parsley	**Predicted** Douglas-fir(B)^{SM} prickly rose smooth aster cheatgrass round-leaved alumroot fern-leaved desert-parsley yarrow lance-leaved stonecrop common harebell
Forage Rating	2	2	2
Browse Rating	5	4	3
Security Cover	5	5	4
Plots	D162	G211	S89,G159

^{SM} Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (High), 2 (M oderately High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
LJ	Lodgepole pine - Juniper – Pinegrass AA Typically occurs on steep warm aspects with deep medium textured soils.	MSdk/03
Warm aspects with significant slopes on colluvial veneers. The deep soils have a coarse textured matrix and include sandy loams, loamy sands, silty sands and occasionally medium textured clay loams. Commonly, the soils also have high coarse fragment contents resulting in rapid to well drained moisture drainage patterns and a xeric to submesic moisture regime. Humus forms are expected to be variable but were determined to be mulls on the sites sampled.		

Map Symbol	LJc2	LJ3 +c,cg,cs,cv,gs,rs,v	LJcs4 +cg	LJc5 +cs,cv,cw,s	LJ6 +c,cs,cv,gv,v	LJ7 +c,cg,cs,cv,gs,s,sz,v
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	common juniper^{sm} saskatoon^{sm} Douglas maple^{m} grasses^{SM} common bearberry	Douglas-fir^{sm} Common juniper^{SM} saskatoon^{sm} Douglas maple^{m} soopolallie	Douglas-fir lodgepole pine trembling aspen Douglas maple pinegrass saskatoon common juniper grasses	Douglas-fir lodgepole pine aspen(B)^{SM} Douglas maple^{m} common juniper^{sm} subalpine fir(B)^{m} saskatoon^{sm} common snowberry^{sm} Rocky Mountain juniper^{sm} tall Oregon-grape pinegrass^{sm}	Douglas-fir lodgepole pine whitebark pine common snowberry^{SM} Douglas maple^{m} mallow ninebark^{sm} spreading dogbane soopolallie^{sm} Rocky Mountain juniper	Douglas-fir Douglas maple^{m} common juniper^{sm} common snowberry^{sm} prickly rose^{sm}
Associates	trembling aspen lodgepole pine soopolallie **Predicted** common juniper Rocky Mountain juniper prickly rose pinegrass showy aster nodding onion	lodgepole pine(B) trembling aspen Engelmann spruce Utah honeysuckle grouseberry bearberry **Predicted** Rocky Mountain juniper prickly rose pinegrass bearberry showy aster nodding onion	western larch blue-leaved huckleberry Scouler's'willow Thimbleberry red elderberry **Predicted** Subalpine fir(B)^{m} hybrid spruce(B) Rocky Mountain juniper prickly rose bearberry showy aster nodding onion red-stemmed feathermoss	birch-leaved spirea Sitka alder veiny meadowrue **Predicted** hybrid spruce(B) prickly rose bearberry showy aster nodding onion red-stemmed feathermoss	western larch ponderosa pine **Predicted** hybrid spruce subalpine fir subalpine fir(B)^{m} common juniper^{sm} prickly rose pinegrass bearberry showy aster nodding onion red-stemmed feathermoss	birch-leaved spirea showy aster nodding onion **Predicted** hybrid spruce subalpine fir Rocky Mountain juniper soopolallie pinegrass bearberry red-stemmed feathermoss
Forage Rating	5	5	**5**	5	5	5
Browse Rating	5	4	4	4	4	4
Security Cover	5	5	4	4	4	4
Plots	na	H22,S113b,G252	S114,G155,H416	H21,S238,G244,S288, S369,H392,H395,G434	S287	G436

Map Unit	Description	BEC
LP	Lodgepole pine - Oregon grape - Pinegrass AA Typically occurs on gentle slopes with deep medium textured soils.	MSdk/04

Mainly steep (50 - 60%) to gentle warm aspects at mid to upper meso-slope positions and occasionally occurring on lower slopes. Surficial materials are most often colluvial veneers and colluvial blankets. The medium textured soils are predominately Orthic Eutric Brunisols and less frequently Elluviated Eutric Brunisols consisting medium textured matrices of silty loams, silty loams and silty clay loams. Occasionally soil textures are fine such as sandy clays or coarse such as sandy loams. Frequently the soils have high coarse fragment contents and were commonly recorded greater than 40% to over 70%. Moisture regimes are typically submesic to mesic and the nutrient regime ranges from submesotrophic to eutrophic with sites expressing mesotrophic conditions being most common. Humus forms are typically mors, such as hemimors and leptomors, and less frequently mormoders (lignomoder) and mulls (rhizomulls). Mineral layer pH's'are typically between 5.3 and 6.5, but ranging up to 7.7, with the humus layer pH's registering in the 5.0 to 6.5 and ranging to 7.7.

Map Symbol	LP1	LPcs2 +cw	LPc3+ck,cs,cw,k,,ks,sw,w	LPc4 +ck,cw,k,ks,nw,s	LP5 +c,ck,cn,cw,gk,gs,k,ks,nw,r,sw,w	LPc6 +ck,cs,cw,gk,k,nw,s,sw,w	LPc7 +cs,ck,cw,gw,k,ks,nw,r,sw
Plant Species	Sparsely vegetated	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	Sitka alder[sm] common snowberry pinegrass[sm] grouseberry pumpelly brome white hawkweed heart-leaved arnica prince's pine	saskatoon[sm] common snowberry pinegrass[SM] grouseberry heart-leaved arnica showy aster bunchberry prince's pine racemose pussytoes bearberry	Douglas-fir trembling aspen(B)[SM] saskatoon[sm] Douglas maple[m]	Douglas-fir lodgepole pine common snowberry[sm] Douglas-fir(B) trembling aspen saskatoon[sm] tall Oregon-grape Douglas maple soopolallie prickly rose pinegrass[SM] grouseberry heart-leaved arnica showy aster racemose pussytoes mountain sweet-cicely	Douglas-fir lodgepole pine common snowberry[SM] Douglas-fir(B)[sm] soopolallie[sm] tall Oregon-grape[sm] Douglas maple[m] choke cherry[sm] saskatoon[sm] pinegrass[SM] grouseberry showy aster rough-fruited fairybells one-sided wintergreen rattlesnake-plantain heart-leaved arnica	Douglas-fir western larch lodgepole pine subalpine fir Engelmann spruce Sitka alder[sm] Douglas maple[m] birch-leaved spirea tall Oregon-grape soopolallie saskatoon showy aster false Solomon's-seal smooth aster racemose pussytoes prince's pine	Douglas-fir birch-leaved spirea[m] saskatoon[sm] Douglas-fir(B)[sm] prickly rose soopolallie common juniper Douglas maple
Associates	lodgepole pine(B) birch-leaved spirea thimbleberry orchardgrass fireweed beargrass mountain sweet-cicely alsike clover	lodgepole pine(B) Douglas-fir(B) tall Oregon-grape common juniper soopolallie prickly rose beargrass white hawkweed mosses	western larch **Predicted** lodgepole pine(B) Douglas-fir(B)[sm] subalpine fir(B) common snowberry[sm] tall Oregon-grape common juniper soopolallie prickly rose pinegrass grouseberry heart-leaved arnica showy aster bunchberry racemose pussytoes bearberry red-stemmed feathermoss mosses	western larch Sitka alder mosses **Predicted** hybrid spruce(B) subalpine fir(B)[m] bunchberry bearberry red-stemmed feathermoss	western larch trembling aspen Scouler's willow birch-leaved spirea wild strawberry glacier lily mountain sweet-cicely red-stemmed feathermoss **Predicted** hybrid spruce subalpine fir subalpine fir(B)[m] common juniper bunchberry bearberry	Scouler's willow thimbleberry false azalea common juniper field pussytoes **Predicted** lodgepole pine common snowberry[sm] pinegrass heart-leaved arnica grouseberry bunchberry bearberry red-stemmed feathermoss	ponderosa pine creeping Oregon-grape smooth aster blue wildrye Sandberg bluegrass small-flowered penstemon showy Jacob's ladder nodding onion common bearberry round-leaved alumroot Kentucky bluegrass **Predicted** hybrid spruce subalpine fir common snowberry[sm] tall Oregon-grape pinegrass showy aster heart-leaved arnica grouseberry

Map Unit	Description	BEC
LP	Lodgepole pine - Oregon grape - Pinegrass ^{aA} Typically occurs on gentle slopes with deep medium textured soils.	MSdk/04
Mainly steep (50 - 60%) to gentle warm aspects at mid to upper meso-slope positions and occasionally occurring on lower slopes. Surficial materials are most often colluvial veneers and colluvial blankets. The medium textured soils are predominately Orthic Eutric Brunisols and less frequently Elluviated Eutric Brunisols consisting medium textured matrices of silty loams, silty loams and silty clay loams. Occasionally soil textures are fine such as sandy clays or coarse such as sandy loams. Frequently the soils have high coarse fragment contents and were commonly recorded greater than 40% to over 70%. Moisture regimes are typically submesic to mesic and the nutrient regime ranges from submesotrophic to eutrophic with sites expressing mesotrophic conditions being most common. Humus forms are typically mors, such as hemimors and leptomors, and less frequently mormoders (lignomoder) and mulls (rhizomulls). Mineral layer pH's'are typically between 5.3 and 6.5, but ranging up to 7.7, with the humus layer pH's registering in the 5.0 to 6.5 and ranging to 7.7.		

Map Symbol	LP1	LPcs2 +cw	LPc3+ck,cs,cw,k,,ks,sw,w	LPc4 +ck,cw,k,ks,nw,s	LP5 +c,ck,cn,cw,gk,gs,k,ks,nw,r,sw,w	LPc6 +ck,cs,cw,gk,k,nw,s,sw,w	LPc7 +cs,ck,cw,gw,k,ks,nw,r,sw
Plant Species	Sparsely vegetated	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
							bunchberry red-stem. feathermoss
Forage Rating	**2**	2	3	**3**	**4**	4	**4**
Browse Rating	**5**	4	4	**5**	**5**	5	**5**
Security Cover	**3**	3	3	**4**	**4**	4	**4**
Plots	D27	na	S163	D26,G144,S150,S158,S181,S196,D203,G204,G284,D349,H420,H421	D7,D57,G58,S153,S160,S166,S180,G190,G241,G242,G243,G245,G280,G282,S289,H399,H422,H424,G437	H19,S90,G111,S145,S157,G164,S182,G193,S229,S231,G240,G246,S247,S248,S285,S293,S324,S372,G378,S386,S388,H393,G435	S179,D202,S230,S232

^{SM} Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (High), 2 (Moderately High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
SS	Hybrid white spruce - Soopolallie - Snowberry AA Typically on gentle lower slopes with deep moderately textured soils.	MSdk/05
Level to gentle lower to mid slope riparian sites or toe positions and localized receiving sites on steep cool slopes typically situated on colluvial blankets. Soils are predominantly Orthic Regosols, consisting of medium textured silt loams to coarse textured sandy loams. The moisture regime is most often subhygric and sites are eutrophic in nutrient conditions. Humus forms sampled were mormoders and mors (n=1).		

Map Symbol	SS2	SS3 +c,cn	SS4	SSc5	SS6 +c	SSc7
Plant Species	Grass-Forb	Tall Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	common snowberry[sm] thimbleberry[sm] heart-leaved arnica grouseberry western meadowrue pinegrass bunchberry common horsetail meadow horsetail showy aster	subalpine fir(B) hybrid spruce(B) Sitka alder[M] fern spp.[SM] moss	hybrid spruce Douglas-fir common snowberry[sm] thimbleberry[sm] subalpine fir(B)[m] black gooseberry red-osier dogwood heart-leaved arnica grouseberry western meadowrue pinegrass bunchberry common horsetail meadow horsetail showy aster red-stemmed feathermoss	Engelmann spruce subalpine fir Sitka alder thimbleberry[SM] black gooseberry[sm] cow-parsnip[m] fireweed[sm] blue elderberry[sm] clasping twisted stalk mountain sweet-cicely western meadowrue	hybrid spruce Douglas-fir common snowberry[sm] thimbleberry[sm] black gooseberry red-osier dogwood heart-leaved arnica grouseberry western meadowrue pinegrass bunchberry common horsetail meadow horsetail showy aster red-stemmed feathermoss	Engelmann spruce paper birch mountain alder thimbleberry common snowberry[sm] subalpine fir(B)[m] devil's club[m] red elderberry[sm] Douglas maple[m] black gooseberry red-osier dogwood Queen's cup oak fern heart-leaved arnica common horsetail lady fern western meadowrue meadow horsetail
Associates	Douglas-fir lodgepole pine black gooseberry red-osier dogwood Sitka alder false azalea red elderberry Utah honeysuckle sweet-scented bedstraw oak fern lady fern twinflower arrow-leaved groundsel clasping twisted stalk grasses red-stemmed feathermoss step moss	**Predicted** black gooseberry[sm] blue elderberry[sm] false azalea red elderberry Utah honeysuckle cow-parsnip[m] fireweed[sm] clasping twisted stalk mountain sweet-cicely western meadowrue sweet-scented bedstraw fern spp. twinflower clasping twisted stalk grasses	western larch subalpine fir lodgepole pine Sitka alder false azalea red elderberry Utah honeysuckle sweet-scented bedstraw oak fern lady fern twinflower arrow-leaved groundsel clasping twisted stalk grasses step moss	stinging nettle pearly everlasting **Predicted** western larch Douglas-fir common snowberry[sm] subalpine fir(B)[m] red-osier dogwood false azalea heart-leaved arnica grouseberry pinegrass bunchberry horsetail spp. showy aster sweet-scented bedstraw fern spp. twinflower clasping twisted stalk step moss red-stemmed feathermoss	western larch subalpine fir lodgepole pine Sitka alder false azalea subalpine fir(B)[m] red elderberry Utah honeysuckle sweet-scented bedstraw oak fern lady fern twinflower arrow-leaved groundsel clasping twisted stalk grasses step moss	sweet-scented bedstraw arrow-leaved groundsel clasping twisted stalk grasses *Rhytidiadelphus squarrosus*

Map Unit	Description	BEC
SS	Hybrid white spruce - Soopolallie - Snowberry AA Typically on gentle lower slopes with deep moderately textured soils.	MSdk/05
Level to gentle lower to mid slope riparian sites or toe positions and localized receiving sites on steep cool slopes typically situated on colluvial blankets. Soils are predominantly Orthic Regosols, consisting of medium textured silt loams to coarse textured sandy loams. The moisture regime is most often subhygric and sites are eutrophic in nutrient conditions. Humus forms sampled were mormoders and mors (n=1).		

Map Symbol	SS2	SS3 +c,cn	SS4	SSc5	SS6 +c	SSc7
Plant Species	Grass-Forb	Tall Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Forage Rating	2	3	3	3	3	**3**
Browse Rating	4	2	3	3	4	**5**
Security Cover	5	3	2	2	2	2
Plots	na	H401	na	G251	na	D346

SM Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (High), 2 (Moderately High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
SH	Hybrid white spruce - Dogwood - Horsetail AA Typically on level moisture receiving slopes and deep medium textured soils.	MSdk/06
Mostly level and lower slope fluvial sites that are moisture receiving and imperfectly drained. Soils are Humic Luvic Gleysols and at the one site sampled were medium textured silty loams. Coarse fragment content is expected to be low and the soil moisture regime is subhygric to hygric. Sites are rich in nutrients and are expected to have eutrophic to permesotrophic nutrient regimes. The humus form at the one site sampled was a moder although mors are expected to be more common.		

Map Symbol	SH2	SH3	SH4	SH5	SH6 +c	SH7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	thimbleberry^{sm} red-osier dogwood^{sm} gooseberry spp.^{sm} common horsetail^{sm} carex spp.^{sm} fern spp.^{sm} western meadowrue bunchberry sweet-cicely spp. one-sided wintergreen step moss	trembling aspen Douglas maple^{M} gooseberry spp.^{sm} devil's club^{m} red-osier dogwood fern spp.^{sm}	hybrid spruce black cottonwood paper birch mountain alder thimbleberry^{SM} red-osier dogwood^{sm} subalpine fir(B)^{m} gooseberry spp.^{sm} common horsetail^{sm} carex spp.^{sm} fern spp.^{sm} western meadowrue bunchberry sweet-cicely spp. one-sided wintergreen step moss	hybrid spruce subalpine fir black cottonwood paper birch mountain alder thimbleberry^{SM} subalpine fir(B)^{m} red-osier dogwood^{sm} gooseberry spp.^{sm} common horsetail^{sm} carex spp.^{sm} fern spp.^{sm} western meadowrue bunchberry sweet-cicely spp. one-sided wintergreen step moss	hybrid spruce subalpine fir black cottonwood paper birch mountain alder thimbleberry^{SM} subalpine fir(B)^{m} red-osier dogwood^{sm} gooseberry spp.^{sm} common horsetail^{sm} carex spp.^{sm} fern spp.^{sm} western meadowrue bunchberry sweet-cicely spp. one-sided wintergreen step moss	hybrid spruce subalpine fir paper birch mountain alder thimbleberry^{SM} red-osier dogwood^{sm} subalpine fir(B) gooseberry spp.^{sm} common horsetail^{sm} carex spp.^{sm} fern spp.^{sm} western meadowrue bunchberry sweet-cicely spp. one-sided wintergreen step moss
Associates	black cottonwood paper birch mountain alder devil's club pinegrass grouseberry red-stemmed feathermoss	**Predicted** black cottonwood paper birch mountain alder thimbleberry^{SM} subalpine fir(B)^{m} common horsetail^{sm} carex spp.^{sm} western meadowrue bunchberry one-sided wintergreen step moss sweet-cicely spp.	subalpine fir Douglas-fir devil's club pinegrass grouseberry red-stemmed feathermoss	Douglas-fir devil's club pinegrass grouseberry red-stemmed feathermoss	Douglas-fir devil's club pinegrass grouseberry red-stemmed feathermoss	black cottonwood devil's club pinegrass grouseberry red-stemmed feathermoss
Forage Rating	2	2	3	4	4	4
Browse Rating	4	2	2	3	3	3
Security Cover	4	2	1	2	2	2

Map Unit	Description	BEC
SH	Hybrid white spruce - Dogwood - Horsetail AA Typically on level moisture receiving slopes and deep medium textured soils.	MSdk/06
Mostly level and lower slope fluvial sites that are moisture receiving and imperfectly drained. Soils are Humic Luvic Gleysols and at the one site sampled were medium textured silty loams. Coarse fragment content is expected to be low and the soil moisture regime is subhygric to hygric. Sites are rich in nutrients and are expected to have eutrophic to permesotrophic nutrient regimes. The humus form at the one site sampled was a moder although mors are expected to be more common.		

Map Symbol	SH2	SH3	SH4	SH5	SH6 +c	SH7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Plots	na	G8	na	na	na	na

Appendix XVI. Descriptions of the Galton Range modified ecosystem units included in the expanded legend to the BEC ESSFdk map units. Correlation to the MOF site series are provided. Refer to the expanded legend and RIC (1998) for further details regarding each ecosystem type.

Map Code	Vegetation Community	Ecosystem Description	Site Series
FA	Bl - Azalea - Foamflower	typic ecosystem unit	01
FAc	Bl - Azalea - Foamflower	coarse-textured ecosystem unit	01
FAck	Bl - Azalea - Foamflower	coarse-textured, cool aspect ecosystem unit	01
FAgk	Bl - Azalea - Foamflower	gullied, cool aspect ecosystem unit	01
FAgw	Bl - Azalea - Foamflower	gullied, warm aspect ecosystem unit	01
FAk	Bl - Azalea - Foamflower	cool aspect ecosystem unit	01
FAw	Bl - Azalea - Foamflower	warm aspect ecosystem unit	01
DM	Fd - Douglas maple - Soopolallie	typic ecosystem unit	02
DMcs	Fd - Douglas maple - Soopolallie	coarse-textured, shallow soil ecosystem unit	02
DMcv	Fd - Douglas maple - Soopolallie	coarse-textured, very shallow soil ecosystem unit	02
DMr	Fd - Douglas maple - Soopolallie	ridge ecosystem unit	02
DMs	Fd - Douglas maple - Soopolallie	shallow soil ecosystem unit	02
DMv	Fd - Douglas maple - Soopolallie	very shallow soil ecosystem unit	02
FG	Bl - False azalea - Grouseberry	typic ecosystem unit	03
FGc	Bl - False azalea - Grouseberry	coarse-textured ecosystem unit	03
FGck	Bl - False azalea - Grouseberry	coarse-textured, cool aspect ecosystem unit	03
FGg	Bl - False azalea - Grouseberry	gullied ecosystem unit	03
FGgk	Bl - False azalea - Grouseberry	gullied, cool aspect ecosystem unit	03
FGgw	Bl - False azalea - Grouseberry	gullied, warm aspect ecosystem unit	03
FGk	Bl - False azalea - Grouseberry	cool aspect ecosystem unit	03
FGks	Bl - False azalea - Grouseberry	cool aspect, shallow soil ecosystem unit	03
FGkv	Bl - False azalea - Grouseberry	cool aspect, very shallow soil ecosystem unit	03
FGr	Bl - False azalea - Grouseberry	ridge ecosystem unit	03
FGsw	Bl - False azalea - Grouseberry	shallow soil, warm aspect ecosystem unit	03
FGv	Bl - False azalea - Grouseberry	very shallow soil ecosystem unit	03
FGvw	Bl - False azalea - Grouseberry	very shallow soil, warm aspect ecosystem unit	03
FGw	Bl - False azalea - Grouseberry	warm aspect ecosystem unit	03
FM	Bl - Azalea -Step Moss	typic ecosystem unit	05
FMc	Bl - Azalea -Step Moss	coarse-textured ecosystem unit	05

Map Code	Vegetation Community	Ecosystem Description	Site Series
FH	Bl - False Azalea - Horsetail	typic ecosystem unit	06
ES	Sparsely Vegetated	Exposed Soil: sparsely vegetated exposed soil	na
MO	Sparsely Vegetated	Moraine: non/sparsely vegetated moraine	na
TA	Sparsely Vegetated	Talus: non/sparsely vegetated talus slope	na
RO	Sparsely Vegetated	Rock: non/sparsely vegetated exposed rock	na

Appendix XVII. Colour plates of representative ecosystem units located in the ESSFdk of the Galton Range study area.

ESSFdk subzone looking towards the headwaters of Red Canyon Creek. Recently logged unit in foreground is ESSFdk (01) FA2 and in the background are warm aspect ecosystem types dominated by ESSFdk (03) FG5/FG7.

ESSFdk (01) FA showing typical stand structures found within the ESSFdk subzone. Note the closed canopy forest and shrub layer dominated by dense cover of false azalea and Bl regeneration.

Appendix XVII. Colour plates of representative ecosystem units located in the ESSFdk of the Galton Range study area.

South-facing exposure in the ESSFdk subzone mid-way up the Red Canyon Creek drainage. Progressing from valley bottom to the upper slopes, ecosystem types here grade from FA (01) through FGw (03) to DM (02). This portion of the study area has many rock outcroppings and potential bighorn sheep escape terrain.

Recent logging in the ESSFdk (01) FA7 located in the Willie Phillips Creek headwaters. These are productive sites situated on predominantly morainal blankets.

Appendix XVIII. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC ESSFdk map units. Species are listed in diminishing order of dominance progressing from tree layer through shrub, forb and finally moss/lichen layers. The tree regeneration component of the shrub layer is denoted by a (B).

Map Unit	**Description**	**BEC**
FA	Subalpine fir - Azalea - Foamflower AA Typically occurs on gentle slopes with deep medium textured soils.	ESSFdk/01
Occurs on gentle to steep slopes on cool lower to mid slope postions. Principally found on colluvial blankets and veneers, and often on morainal blankets in valley headwaters. The deep medium textured soils are well drained and exhibit a mesic moisture regime. Soils are commonly Orthic Dystric Brunisols, OrthicHumo-Ferric Podzols and Brunisolic Gray Luvisols. Soil textures are predominately of medium matrices including silty loams, and loams, although some sites may have more coarse textures such as sandy loams and silty sands. Typically most sites have high coarse fragment contents although sites on morainal materials may have low coarse fragment content. The nutrient regime can vary and may range from submesotrophic to eutrophic. The soil profile is non-calcareous and pH's range between 4.7 and 6.5 while the humus layer pH's range between 4.5 and 6.0. Humus forms are commonly mors, such as hemimors, lignomors and humimors, or occasionally moders.		

Map Symbol	FA2	FA3 +c,ck,gk,gw,k,w	FA4	FA5 +c,ck,gk,gw,k,w	FA6 +c,ck,gw,k,w	FA7 +c,ck,gk,gw,k,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	fireweed[SM] mountain arnica grouseberry Ross's sedge Piper's wood-rush one-leaved foamflower	subalpine fir subalpine fir(B)[M] false azalea white-flowered rhododendron subalpine fir(B)[m] black gooseberry thimbleberry Sitka alder grouseberry[SM] Piper's wood-rush heart-leaved arnica Ross's sedge[sm]	subalpine fir Sitka alder[M] false azalea subalpine fir(B)[m] thimbleberry[sm] black gooseberry grouseberry[SM] heart-leaved arnica sweet-scented bedstraw one-leaved foamflower	lodgepole pine subalpine fir Sitka alder[M] subalpine fir(B)[m] black gooseberry birch-leaved spirea blue-leaved huckleberry grouseberry[SM] heart-leaved arnica beargrass western meadowrue one-leaved foamflower	subalpine fir false azalea Sitka alder[m] thimbleberry[sm] subalpine fir(B) grouseberry[sm] beargrass heart-leaved arnica western meadowrue[b] one-leaved foamflower	hybrid spruce subalpine fir false azalea Sitka alder[m] subalpine fir(B)[m] blue-leaved huckleberry[sm] grouseberry[SM] beargrass heart-leaved arnica one-leaved foamflower Piper's wood-rush common mitrewort rattlesnake-plantain
Associates	white-flowered rhododendron blue-leaved huckleberry black gooseberry Utah honeysuckle Sitka alder thimbleberry Brewer's mitrewort juniper haircap moss **Predicted** Pinegrass one-sided wintergreen western meadowrue	Engelmann spruce(B) Douglas-fir western larch lodgepole pine blue-leaved huckleberry red raspberry red elderberry Utah honeysuckle pinegrass one-sided wintergreen western meadowrue one-leaved foamflower heart-leaved arnica oak fern Indian hellebore clasping twisted stalk cow-parsnip	Engelmann spruce Utah honeysuckle prince's pine juniper haircap moss mountain arnica	lodgepole pine Douglas-fir red elderberry false azalea falsebox blue wildrye bronze bells blue clematis one-sided wintergreen round-leaved violet	Engelmann spruce lodgepole pine Douglas fir black gooseberry falsebox blue-leaved huckleberry one-sided wintergreen Indian hellebore ferns rattlesnake-plantain	whitebark pine mountain alder white-flowered rhododendron black gooseberry hawkweed mountain arnica cow-parsnip heart-leaved twayblade pipecleaner moss
Forage Rating	**2**	**3**	**4**	**1**	**3**	**4**
Browse Rating	**5**	**1**	**3**	**4**	**4**	**2**
Security Cover	4	3	**1**	**2**	**2**	**2**

Map Unit	Description	BEC
FA	Subalpine fir - Azalea - Foamflower AA Typically occurs on gentle slopes with deep medium textured soils.	ESSFdk/01
Occurs on gentle to steep slopes on cool lower to mid slope postions. Principally found on colluvial blankets and veneers, and often on morainal blankets in valley headwaters. The deep medium textured soils are well drained and exhibit a mesic moisture regime. Soils are commonly Orthic Dystric Brunisols, OrthicHumo-Ferric Podzols and Brunisolic Gray Luvisols. Soil textures are predominately of medium matrices including silty loams, and loams, although some sites may have more coarse textures such as sandy loams and silty sands. Typically most sites have high coarse fragment contents although sites on morainal materials may have low coarse fragment content. The nutrient regime can vary and may range from submesotrophic to eutrophic. The soil profile is non-calcareous and pH's range between 4.7 and 6.5 while the humus layer pH's range between 4.5 and 6.0. Humus forms are commonly mors, such as hemimors, lignomors and humimors, or occasionally moders.		

Map Symbol	FA2	FA3 +c,ck,gk,gw,k,w	FA4	FA5 +c,ck,gk,gw,k,w	FA6 +c,ck,gw,k,w	FA7 +c,ck,gk,gw,k,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Plots	D53,G112	G31,G110, G129, G201,H214	G124,G130	D30,G207,G209	G5,D28,G29,G264, G299,G430	D34,D54,G296,G431

Map Unit	Description	BEC
DM	Douglas-fir - Douglas maple -Soopolallie AA Typically on steep warm aspects with deep medium textured soils.	ESSFdk/02
Steep to very steep warm upper to mid slopes with negligible surficial material over rock, or colluvial lithic veneers to colluvial veneers. Soils are Orthic Regosols consisting of medium textured matrices, including silty loams. Commonly there are high coarse fragment contents and the sites are rapidly drained resulting in xeric to subxeric moisture regimes. Nutrient regimes are submesotrophic and humus forms are mulls, such as rhizomulls, and moders. The mineral soil has pH's of approximately 7.0 and the humus layer has pH's of about 6.0.		

Map Symbol	DM1a	DM2	DM3 +cs,cv,s,v	DM4	DMcs5 +cv,r,s,v	DM6	DMs7
Plant Species	Non-vegetated	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	saskatoon prairie rose Kentucky bluegrass showy Jacob's ladder common bearberry yarrow	Douglas-fir subalpine fir(B)^{m} whitebark pine(B) grouseberry^{SM} heart-leaved arnica pinegrass wild strawberry yarrow	Douglas-fir (B)^{sm} trembling aspen(B)^{sm} common juniper^{sm} subalpine fir(B)^{m} false azalea red elderberry^{sm} Douglas maple soopolallie^{sm} saskatoon prairie rose bluebunch wheatgrass yarrow nodding onion	Douglas-fir common juniper^{sm} Douglas maple^{m} Rocky Mountain juniper saskatoon	whitebark pine Douglas-fir subalpine fir	Douglas-fir whitebark pine common juniper^{sm} Douglas maple^{m} Rocky Mountain juniper saskatoon	Douglas-fir whitebark pine common juniper^{sm} Douglas maple^{m} Rocky Mountain juniper Saskatoon
Associates	spikelike goldenrod	Engelmann spruce false azalea common juniper sticky currant birch-leaved spirea shrubby penstemon	Douglas-fir Engelmann spruce lodgepole pine showy Jacob's ladder **Predicted** lodgepole pine	Engelmann spruce **Predicted** lodgepole pine subalpine fir black gooseberry pinegrass	**Predicted** lodgepole pine subalpine fir black gooseberry pinegrass wild strawberry	lodgepole pine subalpine fir black gooseberry pinegrass wild strawberry yarrow	lodgepole pine subalpine fir black gooseberry pinegrass wild strawberry yarrow

Map Unit	Description	BEC
DM	Douglas-fir - Douglas maple -Soopolallie AA Typically on steep warm aspects with deep medium textured soils.	ESSFdk/02
Steep to very steep warm upper to mid slopes with negligible surficial material over rock, or colluvial lithic veneers to colluvial veneers. Soils are Orthic Regosols consisting of medium textured matrices, including silty loams. Commonly there are high coarse fragment contents and the sites are rapidly drained resulting in xeric to subxeric moisture regimes. Nutrient regimes are submesotrophic and humus forms are mulls, such as rhizomulls, and moders. The mineral soil has pH's of approximately 7.0 and the humus layer has pH's of about 6.0.		

Map Symbol	DM1a	DM2	DM3 +cs,cv,s,v	DM4	DMcs5 +cv,r,s,v	DM6	DMs7
Plant Species	Non-vegetated	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
		round-leaved alumroot racemose pussytoes	subalpine fir black gooseberry pinegrass wild strawberry shrubby penstemon round-leaved alumroot pussytoe spp.	wild strawberry yarrow shrubby penstemon round-leaved alumroot pussytoe spp.	yarrow shrubby penstemon round-leaved alumroot pussytoe spp.	shrubby penstemon round-leaved alumroot pussytoe spp.	shrubby penstemon round-leaved alumroot pussytoe spp.
Forage Rating	5	**3**	4	4	4	4	4
Browse Rating	5	**5**	4	4	5	5	5
Security Cover	5	**4**	4	4	4	4	4
Plots	G208	D52,S121,S123	S115,S118,G206	S116	S167,S199,H415	na	na

SM Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (High), 2 (Moderately High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.

Map Unit	Description	BEC
FG	Subalpine fir - Azalea - Grouseberry AA Typically on gentle slopes with deep medium textured soils.	ESSFdk/03
Cool aspect upper to mid slope sites occurring on colluvial veneers and blankets, or sometimes on morainal blankets. Soils are deep and tend to be Orthic Humo-Ferric Podzols consisting of both medium and coarse textured matrices. The dominant medium textured soils include silty loams, silty clay loams, loams, silty clays and sandy clay loams, while the coarse textured matrices include sandy loams and fine sandy loams. Moisture regimes are subxeric to mesic and nutrient regimes are submesotrophic to mesotrophic. Soiils are non-calcareous with the mineral soil pH's are 6.0 to 6.5. Humus forms are predominately mors including humimors and humus pH's are 4.5 to 6.0.		

Map Symbol	FGv2	FG3 +c,ck,cw,k,ks kv,sw,w	FGkv4	FG5 +c,ck,cw,gw,k,ks r,sw,v,vw,w	FG6 +c,ck,cw,gw,k, ks,sw,v,vw,w	FG7 +c,ck,cw,gw,k ks,r,sw,v,vw,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	false azalea white-flowered rhododendron beargrass grouseberry^{sm} northwestern sedge	whitebark pine(B) subalpine fir subalpine fir(B)^{m} Engelmann spruce(B)^{s} false azalea white-flowered rhododendron	subalpine fir Douglas-fir false azalea subalpine fir(B)^{m} white-flowered rhododendron grouseberry^{sm}	lodgepole pine subalpine fir false azalea subalpine fir(B) blue-leaved huckleberry grouseberry^{sm}	subalpine fir hybrid spruce false azalea blue-leaved huckleberry Sitka alder subalpine fir(B)	subalpine fir Engelmann spruce false azalea Sitka alder^{sm} subalpine fir(B)^{m} black gooseberry

Map Unit	Description	BEC
FG	Subalpine fir - Azalea - Grouseberry AA Typically on gentle slopes with deep medium textured soils.	ESSFdk/03
Cool aspect upper to mid slope sites occurring on colluvial veneers and blankets, or sometimes on morainal blankets. Soils are deep and tend to be Orthic Humo-Ferric Podzols consisting of both medium and coarse textured matrices. The dominant medium textured soils include silty loams, silty clay loams, loams, silty clays and sandy clay loams, while the coarse textured matrices include sandy loams and fine sandy loams. Moisture regimes are subxeric to mesic and nutrient regimes are submesotrophic to mesotrophic. Soiils are non-calcareous with the mineral soil pH's are 6.0 to 6.5. Humus forms are predominately mors including humimors and humus pH's are 4.5 to 6.0.		

Map Symbol	FGv2	FG3 +c,ck,cw,k,ks kv,sw,w	FGkv4	FG5 +c,ck,cw,gw,k,ks r,sw,v,vw,w	FG6 +c,ck,cw,gw,k, ks,sw,v,vw,w	FG7 +c,ck,cw,gw,k ks,r,sw,v,vw,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
		common juniper[sm] beargrass grouseberry[sm] northwestern sedge	beargrass	heart-leaved arnica beargrass	white-flowered rhododendron grouseberry	heart-leaved arnica grouseberry[sm]
Associates	whitebark pine(B) subalpine fir(B) shrubby penstemon racemose pussytoes glacier lily thread-leaved sandwort Ross's sedge fireweed heart-leaved arnica juniper haircap moss	lodgepole pine shrubby penstemon racemose pussytoes glacier lily thread-leaved sandwort Ross's sedge fireweed heart-leaved arnica mountain arnica juniper haircap moss	whitebark pine western larch lodgepole pine Engelmann spruce birch-leaved spirea Sitka alder soopolallie saskatoon spike-like goldenrod nodding onion common bearberry yarrow	Engelmann spruce western larch whitebark pine Douglas-fir common juniper Douglas maple Rocky Mountain juniper one-sided wintergreen broom moss pipecleaner moss	lodgepole pine whitebark pine Douglas-fir common juniper heart-leaved arnica beargrass Piper's wood-rush round-leaved violet juniper haircap moss *Dicranum* spp. *Brachythecium* spp. Pipecleaner moss	western larch Douglas-fir whitebark pine lodgepole pine red-stemmed feathermoss knight's plume broom moss juniper haircap moss
Forage Rating	2	**2**	**3**	**5**	**2**	**5**
Browse Rating	5	**4**	**5**	4	**4**	**4**
Security Cover	5	**4**	**3**	2	**2**	**1**
Plots	na	D35,G104 ,G186 H216,S307	G103,G 205,S213,H215,H423	H12,S119,H20,S120,S122,S309,S315,G331,G332,H405,H425	H11,H18,D36,D49,G102,S106,S107,S108,S109,G126,G127,G128,G131,D187,G191,G192,S197,G250,G266,S316,S389,G402,H406,H407,H408,H427,G428,G429	D48,G125,G200,S308,S370,H426

Map Unit	Description	BEC
FM	Subalpine fir - Azalea - Step moss $_{AA}$ Typically occurs on gentle lower slopes with medium textured soils.	ESSFdk/05
Level to gentle lower and toe slope moisture receiving sites on colluvial and morainal blankets. Soils are imperfectly to moderately drained with a subhygric moisture regime. They are mostly very rich Gleyed Eutric Brunisols and Orthic Humo-Ferric Podzols consisting of medium textured matrices of silty clay loams and loams, to more coarse textures such as sandy loams. The higher organic content produces permesotrophic to eutrophic nutrient regimes. Humus forms are variable and can be mors, such as hemimors and resimors, or mulls including rhizomulls. Soil profile pH's are acidic and range between 5.0 and 7.0, while pH levels of the humus layer are 4.5 to 6.5.		

Map Symbol	FM2	FM3	FM4	FMc5	FMc6	FMc7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	grouseberry^{SM} one-leaved foamflower common mitrewort	false azalea Engelmann spruce(B)^{s} subalpine fir(B)^{m} blue-leaved huckleberry grouseberry^{SM} one-leaved foamflower common mitrewort one-sided wintergreen	subalpine fir Engelmann spruce false azalea Engelmann spruce(B)^{s} subalpine fir(B)^{m} blue-leaved huckleberry grouseberry^{SM} one-leaved foamflower common mitrewort one-sided wintergreen	subalpine fir Engelmann spruce false azalea subalpine fir(B)^{sm} Engelmann spruce(B)^{s} blue-leaved huckleberry grouseberry^{SM} one-leaved foamflower common mitrewort one-sided wintergreen	subalpine fir Engelmann spruce false azalea subalpine fir(B)^{sm} blue-leaved huckleberry grouseberry^{SM} one-leaved foamflower common mitrewort one-sided wintergreen	subalpine fir Engelmann spruce false azalea subalpine fir(B)^{sm} blue-leaved huckleberry grouseberry^{SM} one-leaved foamflower common mitrewort one-sided wintergreen
Associates	false azalea blue-leaved huckleberry Engelmann spruce subalpine fir white-flowered rhododendron one-sided wintergreen stiff clubmoss heart-leaved arnica bunchberry western meadowrue red-stemmed feather moss	white-flowered rhododendron stiff clubmoss heart-leaved arnica bunchberry western meadowrue red-stemmed feather moss step moss *Dicranum scoparium* freckle pelt lichen	white-flowered rhododendron stiff clubmoss heart-leaved arnica bunchberry western meadowrue red-stemmed feather moss step moss *Dicranum scoparium* freckle pelt lichen	white-flowered rhododendron stiff clubmoss heart-leaved arnica bunchberry western meadowrue red-stemmed feather moss step moss *Dicranum scoparium* freckle pelt lichen	Engelmann spruce(B) white-flowered rhododendron beargrass stiff clubmoss heart-leaved arnica step moss *Dicranum scoparium* freckle pelt lichen	Engelmann spruce(B) white-flowered rhododendron stiff clubmoss heart-leaved arnica bunchberry western meadowrue red-stemmed feather moss step moss *Dicranum scoparium* freckle pelt lichen
Forage Rating	3	3	4	4	3	4
Browse Rating	4	2	2	3	4	2
Security Cover	4	3	2	2	4	3
Plots	na	na	na	na	D6,D32,G33	na

^{SM} Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (High), 2 (Moderately High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
FH	Subalpine fir - Azalea - Horsetail ᴬᴬ Typically on gentle slopes to level sites with medium textured soils.	ESSFdk/06
Level to gentle lower to mid slope fluvial sites, often on cool aspects, and adjacent to riparian areas. Surficial materials are predominated by colluvial blankets supporting soils which are imperfectly drained. Soil moisture regimes are subhygric to hygric and nutrient regimes are eutrophic to permesotrophic. Soil matrices are coarse or medium textured and include sandy loams and clay loams. Humus forms are primarily mors or moders.		

Map Symbol	FH2	FH3	FH4	FH5	FH6	FH7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	false azalea Sitka alder^{m} black gooseberry^{sm} thimbleberry^{sm} blue-leaved huckleberry^{sm} common horsetail cow-parsnip^{m} carex spp. fireweed one-leaved foamflower	Engelmann spruce(B) false azalea Sitka alder^{m} black gooseberry^{sm} thimbleberry^{sm} blue-leaved huckleberry^{sm} common horsetail cow-parsnip^{m} carex spp. one-leaved foamflower	subalpine fir Engelmann spruce false azalea Sitka alder^{m} black gooseberry^{sm} thimbleberry^{sm} blue-leaved huckleberry^{sm} common horsetail cow-parsnip^{m} carex spp. one-leaved foamflower	subalpine fir Engelmann spruce false azalea Sitka alder^{m} black gooseberry^{sm} one-leaved foamflower oak fern	subalpine fir Engelmann spruce false azalea Sitka alder^{m} black gooseberry^{sm} thimbleberry^{sm} blue-leaved huckleberry^{sm} common horsetail cow-parsnip^{m} carex spp. one-leaved foamflower	subalpine fir Engelmann spruce Sitka alder^{m} black gooseberry^{sm} thimbleberry^{sm} one-leaved foamflower cow-parsnip^{m}
Associates	subalpine fir(B) Engelmann spruce(B) sweet-scented bedstraw arrow-leaved groundsel heart-leaved arnica bunchberry oak fern	subalpine fir(B) sweet-scented bedstraw fireweed arrow-leaved groundsel heart-leaved arnica bunchberry oak fern	subalpine fir(B)^{m} Engelmann spruce(B)^{s} sweet-scented bedstraw arrow-leaved groundsel heart-leaved arnica bunchberry oak fern	whitebark pine **Predicted** subalpine fir(B)^{m} blue-leaved huckleberry^{sm} cow-parsnip^{m} sweet-scented bedstraw arrow-leaved groundsel bunchberry heart-leaved arnica common horsetail carex spp. red-stemmed feathermoss	sweet-scented bedstraw arrow-leaved groundsel heart-leaved arnica bunchberry oak fern	sweet-scented bedstraw arrow-leaved groundsel **Predicted** false azalea blue-leaved huckleberry^{sm} bunchberry heart-leaved arnica common horsetail carex spp. red-stemmed feathermoss
Forage Rating	2	3	4	4	4	4
Browse Rating	4	2	2	3	3	3
Security Cover	4	3	2	2	2	2
Plots	na	na	na	G249	na	G432

^{SM} Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (High), 2 (Moderately High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Appendix XIX. Descriptions of the Galton Range modified ecosystem units included in the expanded legend to the BEC ESSFdku map units. Correlation to the MOF site series are provided. Refer to the expanded legend and RIC (1998) for further details regarding each ecosystem type.

Map Code	Vegetation Community	Ecosystem Description	Site Series[a]
FG	Bl - Grouseberry	typic ecosystem unit	01
FGc	Bl - Grouseberry	coarse-textured ecosystem unit	01
FGcv	Bl - Grouseberry	coarse-textured, very shallow soil ecosystem unit	01
FGcw	Bl - Grouseberry	coarse-textured, warm aspect ecosystem unit	01
FGg	Bl - Grouseberry	gullied ecosystem unit	01
FGgw	Bl - Grouseberry	gullied, warm aspect ecosystem unit	01
FGv	Bl - Grouseberry	very shallow soil ecosystem unit	01
FGw	Bl - Grouseberry	warm aspect ecosystem unit	01
PJ	Open PaBl - Common Juniper - Grouseberry	typic ecosystem unit	02
PJv	Open PaBl - Common Juniper - Grouseberry	very shallow soil ecosystem unit	02
PJgv	Open PaBl - Common Juniper - Grouseberry	gullied, very shallow soil ecosystem unit	02
PJv	Open PaBl - Common Juniper - Grouseberry	very shallow soil ecosystem unit	02
PB	BlPa - Beargrass - Grouseberry	typic ecosystem unit	03
WG	Pa - Grouseberry	typic ecosystem unit	04
WGc	Pa - Grouseberry	coarse-textured ecosystem unit	04
WGgv	Pa - Grouseberry	gullied, very shallow soil ecosystem unit	04
WGj	Pa - Grouseberry	gentle slope ecosystem unit	04
WGkv	Pa - Grouseberry	cool aspect, very shallow soil ecosystem unit	04
WGr	Pa - Grouseberry	ridge ecosystem unit	04
WGrv	Pa - Grouseberry	ridge, very shallow soil ecosystem unit	04
WGv	Pa - Grouseberry	very shallow soil ecosystem unit	04
HG	Bl - Pink Mountain-heather	typic ecosystem unit	05
HGc	Bl - Pink Mountain-heather	coarse-textured ecosystem unit	05
ES	Sparsely Vegetated	Exposed Soil: sparsely vegetated exposed soil	na
MO	Sparsely Vegetated	Moraine: non/sparsely vegetated moraine	na
TA	Sparsely Vegetated	Talus: non/sparsely vegetated talus slope	na
RO	Sparsely Vegetated	Rock: non/sparsely vegetated exposed rock	na

Site Series[a]: ESSFdku site series are uncorrelated and numbers are provided only as a guide to relative occurrence on the edatopic grid.

Appendix XX. Colour plates of representative ecosystem units located in the ESSFdku of the Galton Range study area.

ESSFdku subzone on the north side of Galton Pass. The ESSFdku (02) PB is a common ecosystem type in this area. Tree growth consists of Pa, Bl, Sw and Pl with a herb layer dominated by grouseberry and beargrass.

ESSFdku (02) PB7 ecosystem type on colluvial veneer, near Galton Pass, supporting predominately Pa and Bl forest cover with a shrub layer of Bl regen and a herb layer dominated by beargrass.

Appendix XX. Colour plates of representative ecosystem units located in the ESSFdku of the Galton Range study area.

ESSFdku (03) FG avalanche ecosystem type on a cool aspect in the Red Canyon Creek headwaters. Pa and Bl are the dominant tree types and grouseberry is the dominate forb.

ESSFdku (03) PG2 located on the wind swept Galton Range ridgeline near the north fork of Phillips Creek. Soils are very shallow and the vegetation includes alpine spieces such as *Antennaria lanata* and E*rigeron*

peregrinus.

Appendix XXI. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC ESSFdku map units. Species are listed in diminishing order of dominance progressing from tree layer through shrub, forb and finally moss/lichen layers. The tree regeneration component of the shrub layer is denoted by a (B).

Map Unit	Description	BEC
FG	Subalpine fir - Grouseberry AA Typically occurs on steep cool aspects with shallow medium textured soils.	ESSFdku (01) [a]
Well to rapidly drained colluvial lithic or colluvial veneer sites typically on steep to very steep cool upper slopes extending to ridge crests. May also exist on the less common gentle slopes found in this subzone and occasionally on warm aspects where moisture conditions are favourable. Soils are shallow to very shallow Orthic Regolsols or Orthic Dystric Brunisols which are medium textured, including silty clay loams, silty loams and loams, with typically high coarse fragment contents. Moisture regimes are submesic to mesic and the nutrient regime is submesotrophic. Hhumus forms are variable ranging from mors to mulls but tending towards mors, especially hemimors. Humus and soil profile pH's are relatively low at 4.5 - 6.0 and 4.5 - 6.5, respectively.		

Map Symbol	FG2	FG3 +c,v,w	FG4 +c,v	FG5 +c,cw,w	FG6 +c,cv,cw,w	FG7 +c,cw,g,gw,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	grouseberry Ross's sedge yarrow beargrass mountain arnica small-flowered penstemon racemose pussytoes wild strawberry Sitka valerian common red paintbrush yellow glacier lily	subalpine fir whitebark pine subalpine fir(B)^{m} white-flowered rhododendron black huckleberry^{sm} sedge spp. grouseberry mountain arnica bracted lousewort [b] common red paintbrush heart-leaved arnica Piper's wood-rush hawkweed sp. pussytoes sp.	Engelmann spruce subalpine fir subalpine fir(B)^{M} false azalea black huckleberry grouseberry^{SM} mountain arnica beargrass heart-leaved arnica bracted lousewort	subalpine fir whitebark pine grouseberry	subalpine fir whitebark pine Engelmann spruce subalpine fir(B)^{m} whitebark pine(B) white-flowered rhododendron grouseberry^{SM} heart-leaved arnica beargrass yellow glacier lily smooth wood-rush bracted lousewort com. red paintbrush mountain arnica	subalpine fir Engelmann spruce subalpine fir(B)^{M} Engelmann spruce(B) whitebark pine(B) false azalea mountain arnica grouseberry^{SM} heart-leaved arnica bracted lousewort subalpine daisy Sitka valerian beargrass
Associates	subalpine fir(B) whitebark pine(B) black huckleberry white-flowered rhododendron red elderberry sticky currant birch-leaved spirea black gooseberry fireweed Thompson's paintbrush lance-leaved stonecrop spike trisetum	Engelmann spruce birch-leaved spirea common juniper racemose pussytoes solidago sp. round-leaved alumroot woolly pussytoes yarrow Sitka valerian Parry's campion **Predicted** false azalea smooth wood-rush	**Predicted** whitebark pine whitebark pine(B) false azalea white-flowered rhododendron yellow glacier lily smooth wood-rush common red paintbrush mountain arnica	**Predicted** Engelmann spruce lodgepole pine subalpine fir(B)^{m} whitebark pine(B) white-flowered rhododendron heart-leaved arnica smooth wood-rush yellow glacier lily bracted lousewort common red paintbrush mountain arnica	lodgepole pine hybrid white spruce Douglas fir western larch round-leaved violet *Polytrichum piliferum* juniper haircap moss cladonia spp. **Predicted** false azalea	**Predicted** whitebark pine white-flowered rhododendron yellow glacier lily smooth wood-rush common red paintbrush
Forage Rating	**3**	**3**	3	3	**2**	3
Browse Rating	**5**	**5**	4	5	**5**	5
Security Cover	**3**	**3**	3	3	**3**	4
Plots	D50	G16,G326,G219	G319	S194,S195	G221,D37,S198,H403,H410,H412,H413	G318

Map Unit	Description	BEC
FG	Subalpine fir - Grouseberry AA Typically occurs on steep cool aspects with shallow medium textured soils.	ESSFdku (01) [a]
Well to rapidly drained colluvial lithic or colluvial veneer sites typically on steep to very steep cool upper slopes extending to ridge crests. May also exist on the less common gentle slopes found in this subzone and occasionally on warm aspects where moisture conditions are favourable. Soils are shallow to very shallow Orthic Regolsols or Orthic Dystric Brunisols which are medium textured, including silty clay loams, silty loams and loams, with typically high coarse fragment contents. Moisture regimes are submesic to mesic and the nutrient regime is submesotrophic. Hhumus forms are variable ranging from mors to mulls but tending towards mors, especially hemimors. Humus and soil profile pH's are relatively low at 4.5 - 6.0 and 4.5 - 6.5, respectively.		

Map Symbol	FG2	FG3 +c,v,w	FG4 +c,v	FG5 +c,cw,w	FG6 +c,cv,cw,w	FG7 +c,cw,g,gw,w
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Comments	Sites are often subjected to scouring as a result of snow avalanching. Increasing amounts of beargrass in the southern portion of the study area.					

[a] Proposed un-correlated site series designation.

Map Unit	Description	BEC
PJ	Open whitebark pine/Subalpine fir - Common juniper - Grouseberry AA Typically occurs on steep warm slopes with shallow course textured soils.	ESSFdku/(02) [a]
Rapidly drained steep warm upper slopes with lithic colluvial veneers over bedrock featuring rock outcroppings. The coarse textured soils have high coarse fragment contents and typically exhibit xeric to sub-xeric moisture regimes. Soils and humus form development is extremely limited.		

Map Symbol	PJ1b +v	PJ2	PJ3a	PJ4	PJ5 +gv,v	PJ6	PJ7
Plant Species	Sparsely vegetated	Grass-Forb	Low Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	Douglas fir subalpine fir common juniper	bearberry *Solidago* spp. aster spp. potentilla spp. pussy toe spp. grouseberry mountain arnica nodding onion lance-leaved stonecrop wild strawberry prickly saxifrage common harebell common red paintbrush graminoids	whitebark pine Rocky Mountain juniper Douglas fir subalpine fir common juniper bearberry *Solidago* spp. aster spp. potentilla spp. pussy toe spp. grouseberry mountain arnica nodding onion	whitebark pine Rocky Mountain juniper Douglas fir subalpine fir common juniper bearberry *Solidago* spp. aster spp. potentilla spp. Pussy toe spp. Grouseberry Mountain arnica nodding onion	whitebark pine Rocky Mountain juniper Douglas fir subalpine fir common juniper bearberry *Solidago* spp. aster spp. potentilla spp. pussy toe spp. grouseberry mountain arnica nodding onion	whitebark pine Rocky Mountain juniper Douglas fir subalpine fir common juniper bearberry *Solidago* spp. aster spp. potentilla spp. pussy toe spp. grouseberry mountain arnica nodding onion	Douglas fir subalpine fir whitebark pine Rocky Mountain juniper common juniper bearberry *Solidago* spp. aster spp. potentilla spp. pussy toe spp. grouseberry mountain arnica nodding onion
Associates	**Predicted** whitebark pine Rocky Mountain juniper bearberry *Solidago* spp. aster spp. potentilla spp. pussy toe spp. grouseberry mountain arnica nodding onion lance-leaved stonecrop wild strawberry prickly saxifrage common harebell common red paintbrush graminoids	whitebark pine Rocky Mountain juniper	lance-leaved stonecrop wild strawberry prickly saxifrage common harebell common red paintbrush graminoids	lance-leaved stonecrop wild strawberry prickly saxifrage common harebell common red paintbrush graminoids	lance-leaved stonecrop wild strawberry prickly saxifrage common harebell common red paintbrush graminoids	lance-leaved stonecrop wild strawberry prickly saxifrage common harebell common red paintbrush graminoids	lance-leaved stonecrop wild strawberry prickly saxifrage common harebell common red paintbrush graminoids
Forage	5	5	5	5	5	5	5
Browse	5	5	4	4	4	5	5

Map Unit	Description	BEC
PJ	Open whitebark pine/Subalpine fir - Common juniper - Grouseberry ^{AA} Typically occurs on steep warm slopes with shallow course textured soils.	ESSFdku/(02) [a]
Rapidly drained steep warm upper slopes with lithic colluvial veneers over bedrock featuring rock outcroppings. The coarse textured soils have high coarse fragment contents and typically exhibit xeric to sub-xeric moisture regimes. Soils and humus form development is extremely limited.		

Map Symbol	PJ1b +v	PJ2	PJ3a	PJ4	PJ5 +gv,v	PJ6	PJ7
Plant Species	Sparsely vegetated	Grass-Forb	Low Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Security Cover	5	5	5	4	4	4	4
Plots	S117	na	na	na	na	na	Na
Comments	Predicted species are based on the similar types described in Montana (Pfister et al. 1977), Waterton Lakes National Park (Achuff et al. 1996), Kootenay National Park (Achuff et al. 1984), Brewer Creek (Kernaghan et al. 1999) and Stoddart Creek (Marcoux et al. 1997).						

[a] Proposed un-correlated site series designation.

^{SM} Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.

Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.

Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
PB	Subalpine fir/Whitebark pine - Beargrass - Grouseberry AA Typically on steep warm aspects with shallow medium textured soils.	ESSFdku/(03) [a]
Open forest stands on predominately warm upper slopes ranging from steep to very steep (25% to over 70%). Sites are underlain by colluvial veneers with mainly shallow soils ranging to very shallow. Soils are well drained with high coarse fragment contents (>60%) and are typically Othic Eutric Brunisols consisting of silt loams, silt clay loams and less frequently sandy loams. The soil moisture regime is subxeric to submesic and the nutrient regime is submesotrophic. Soils are acidic with pH's of approximately 5.5. Humus forms are most often xeromoders, mormoders, and less frequently hemimors.		

Map Symbol	PB2	PB3a	PB3b	PB4	PB5	PB6	PB7
Plant Species	Grass-Forb	Low Shrub	Tall Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	whitebark pine subalpine fir common juniper beargrass grouseberry yarrow common harebell rosy pussytoes spike trisetum alpine lupine	subalpine fir whitebark pine(B) beargrass grouseberry yarrow	whitebark pine(B) grouseberry common red paintbrush shrubby penstemon saxifrage fairy candelabra	whitebark pine subalpine fir subalpine fir (B) beargrass grouseberry common harebell sedge spp. arnica spp. common red paintbrush shrubby penstemon wood-rush sp. yarrow common harebell alpine lupine	whitebark pine subalpine fir beargrass grouseberry common harebell	Engelmann spruce beargrass subalpine fir whitebark pine grouseberry wood-rush sp.	subalpine fir Engelmann spruce whitebark pine beargrass grouseberry mountain arnica northwestern sedge bracted lousewort alpine lupine smooth wood-rush
Associates	Engelmann spruce Cusick's bluegrass **Predicted** sedge spp. arnica spp. saxifrage fairy candelabra common red paintbrush shrubby penstemon	Engelmann spruce white-flowered rhododendron bracted lousewort Parry's campion fireweed **Predicted** sedge spp. arnica spp. saxifrage fairy candelabra common red paintbrush shrubby penstemon common harebell	**Predicted** subalpine fir (B) sedge spp. arnica spp. wood-rush sp. yarrow common harebell	saxifrage fairy candelabra bracted lousewort	Sitka mountain-ash **Predicted** subalpine fir (B) sedge spp. arnica spp. saxifrage fairy candelabra common red paintbrush shrubby penstemon wood-rush sp. yarrow common harebell bracted lousewort alpine lupine	white-flowered rhododendron yellow glacier lily **Predicted** subalpine fir (B) sedge spp. arnica spp. common red paintbrush shrubby penstemon yarrow common harebell bracted lousewort alpine lupine	**Predicted** subalpine fir (B) sedge spp. arnica spp. common red paintbrush shrubby penstemon yarrow common harebell
Forage Rating	**5**	3	3	3	2	2	**1**
Browse Rating	**5**	5	5	5	5	5	**5**
Security Cover	5	4	3	3	3	3	**2**
Plots	G311	G314	G224	na	G317,S329	G38	G310
Comments	Site series occurs in well to rapidly drained areas with large seasonal variances in moisture conditions. Often located on leeward sides of ridges and other semi-protected areas with some snow pack accumulation and resulting favorable early season moisture availability. Soil moisture levels then appear to rapidly diminish as the growing season progresses.						

[a] Proposed un-correlated site series designation.

[SM] Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.
Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Map Unit	Description	BEC
WG	Whitebark pine - Grouseberry AA Typically on steep slopes with shallow soils.	ESSFdku/(04) [a]
Warm moderate to more typically steep upper slopes extending to ridge crests. Colluvial lithic or colluvial veneers supporting very shallow to shallow soils. Soils are mainly Orthic Dystric Brunisols and Orthic Eutric Brunisols that are rapid to well drained. Soils are predominately silt or clay loams and less frequently sandy loams. Coarse fragment contents are typically high (>60%), moisture regimes are subxeric to submesic and nutrient regimes are consistently submesotrophic. Humus forms are generally moders, especially xeromoders, such as amphixeromoders, but can include mors, especially hemimors. Humus form and soil pH levels are quite low at 4.5 to 5.0 for either profile.		

Map Symbol	WG2 +c,cw,j,jv,v	WG3 +v	WG4 +j,kv,rv	WG5 +j,kv,v	WG6 +gv,v	WG7 +kv,r,v
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	whitebark pine common juniper beargrass grouseberry[sm] northwestern sedge spotted saxifrage round-leaved alumroot rosy pussytoes yarrow common harebell spike trisetum Piper's wood-rush mountain arnica small-flower. penstemon nodding onion juniper haircap moss	whitebark pine grouseberry saxifrage common red paintbrush shrubby penstemon	whitebark pine subalpine fir lodgepole pine common juniper grouseberry[sm] beargrass	whitebark pine subalpine fir lodgepole pine whitebark pine(B) subalpine fir(B)[m] common juniper grouseberry[sm] beargrass sedge spp. white hawkweed mountain arnica common harebell slender hawkweed Piper's wood-rush northwestern sedge	subalpine fir whitebark pine lodgepole pine grouseberry[SM] beargrass sedge spp. white hawkweed junegrass yarrow common harebell slender hawkweed small-flower. penstemon nodding onion juniper haircap moss	subalpine fir whitebark pine grouseberry[SM] beargrass sedge spp. white hawkweed junegrass yarrow common harebell slender hawkweed small-flower. penstemon nodding onion juniper haircap moss
Associates	subalpine fir subalpine fir(B) subalpine daisy field pussytoes Scouler's hawkweed sulphur buckwheat crustose lichen **Predicted** saxifrage common red paintbrush shrubby penstemon white hawkweed mountain arnica slender hawkweed	fairy candelabra **Predicted** whitebark pine(B) subalpine fir(B) common juniper beargrass northwestern sedge spotted saxifrage round-leaved alumroot rosy pussytoes yarrow common harebell spike trisetum Piper's wood-rush mountain arnica small-flower. penstemon nodding onion	**Predicted** whitebark pine(B) subalpine fir(B) northwestern sedge spotted saxifrage round-leaved alumroot rosy pussytoes yarrow common harebell spike trisetum Piper's wood-rush mountain arnica slender hawkweed small-flower. penstemon nodding onion juniper haircap moss	western larch Parry's campion bracted lousewort mosses **Predicted** northwestern sedge spotted saxifrage round-leaved alumroot rosy pussytoes yarrow spike trisetum slender hawkweed small-flower. penstemon nodding onion juniper haircap moss	Engelmann spruce Douglas fir yellow glacier lily heart-leaved arnica subalpine daisy Ross's sedge spike trisetum *Kobresia* sp. bracted lousewort **Predicted** subalpine fir(B) common juniper northwestern sedge round-leaved alumroot rosy pussytoes spike trisetum Piper's wood-rush	Engelmann spruce Douglas fir yellow glacier lily heart-leaved arnica subalpine daisy Ross's sedge spike trisetum *Kobresia* sp. bracted lousewort **Predicted** common juniper northwestern sedge spotted saxifrage round-leaved alumroot rosy pussytoes spike trisetum Piper's wood-rush
Forage Rating	**4**	**4**	3	**3**	**3**	3
Browse Rating	**5**	**5**	5	**5**	**5**	5
Security Cover	**5**	**3**	3	**2**	**3**	3
Plots	D222,S313,G320	G233	S327	G14,G312,G322b,S328,H409	D10,D217,G321	na

Map Unit	Description	BEC
WG	Whitebark pine - Grouseberry AA Typically on steep slopes with shallow soils.	ESSFdku/(04) [a]
Warm moderate to more typically steep upper slopes extending to ridge crests. Colluvial lithic or colluvial veneers supporting very shallow to shallow soils. Soils are mainly Orthic Dystric Brunisols and Orthic Eutric Brunisols that are rapid to well drained. Soils are predominately silt or clay loams and less frequently sandy loams. Coarse fragment contents are typically high (>60%), moisture regimes are subxeric to submesic and nutrient regimes are consistently submesotrophic. Humus forms are generally moders, especially xeromoders, such as amphixeromoders, but can include mors, especially hemimors. Humus form and soil pH levels are quite low at 4.5 to 5.0 for either profile.		

Map Symbol	WG2 +c,cw,j,jv,v	WG3 +v	WG4 +j,kv,rv	WG5 +j,kv,v	WG6 +gv,v	WG7 +kv,r,v
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Comments	Vegetation in this ecosystem is often affected by wind and insolation exposure resulting in deformed and stunted growth forms, especially of the trees.					

Map Unit	**Description**	**BEC**
HG	Subalpine fir - Pink mountain-heather ᴀA Typically on steep cool slopes with shallow medium textured soils.	ESSFdku/(05) [a]
Cool gentle to very steep upper slopes supporting colluvial veneers. The Humo-ferric Podzols soils are typically well drained medium to coarse textured matrices, typically loam to sandy loams. Soil depths can vary in depth between very shallow (10 - 50 cm) and deep (>50 cm). Typically the soil moisture regimes vary between submesic and subhygric and the soil nutrient regime is permesotrophic. Humus forms are expected to be moders and mors although the humus form for the one site indicated a rhizomull. Both soil and humus forms are quite acidic and range between pH 4.5 to 5.0.		

Map Symbol	HG2	HG3	HGc4	HG5	HG6	HG7
Plant Species	Grass-Forb	Shrub	Pole Sapling	Young Forest	Mature Forest	Old Forest
Dominants	subalpine fir whitebark pine grouseberry[SM] pink mountain-heather yellow glacier lily[b] woolly pussytoes[sm] bracted lousewort mountain arnica	subalpine fir Engelmann spruce subalpine fir(B)[M] whitebark pine(B) Engelmann spruce(B) white-flowered rhododendron false azalea grouseberry[sm] pink mountain-heather Piper's wood-rush woolly pussytoes[sm] bracted lousewort yellow glacier lily	subalpine fir Engelmann spruce subalpine fir(B)[M] whitebark pine(B) Engelmann spruce(B) white-flowered rhododendron false azalea grouseberry[sm] pink mountain-heather Piper's wood-rush woolly pussytoes[sm] bracted lousewort yellow glacier lily	subalpine fir Engelmann spruce subalpine fir(B)[M] Engelmann spruce(B) white-flowered rhododendron false azalea grouseberry[sm] pink mountain-heather Piper's wood-rush woolly pussytoes[sm] bracted lousewort yellow glacier lily	subalpine fir Engelmann spruce subalpine fir(B)[M] Engelmann spruce(B) white-flowered rhododendron false azalea grouseberry[sm] pink mountain-heather Piper's wood-rush woolly pussytoes[sm] bracted lousewort yellow glacier lily	subalpine fir Engelmann spruce subalpine fir(B)[M] white-flowered rhododendron false azalea grouseberry[sm] pink mountain-heather Piper's wood-rush woolly pussytoes[sm] bracted lousewort yellow glacier lily
Associates	western larch **<u>Predicted</u>** Engelmann spruce(B) white-flowered rhododendron broom moss juniper haircap moss *Mnium* sp.	heart-leaved twayblade broom moss juniper haircap moss *Mnium* sp. **<u>Predicted</u>** western larch mountain arnica	heart-leaved twayblade broom moss juniper haircap moss *Mnium* sp **<u>Predicted</u>** western larch mountain arnica	heart-leaved twayblade broom moss juniper haircap moss *Mnium* sp. **<u>Predicted</u>** western larch whitebark pine mountain arnica	heart-leaved twayblade broom moss juniper haircap moss *Mnium* sp. **<u>Predicted</u>** western larch whitebark pine mountain arnica	heart-leaved twayblade broom moss juniper haircap moss *Mnium* sp. **<u>Predicted</u>** western larch whitebark pine mountain arnica
Forage Rating	5	**5**	5	4	4	4
Browse Rating	4	**3**	3	3	4	4
Security Cover	**4**	**4**	3	3	4	4
Plots	G220	D218	na	na	na	na
Comments	Stands occur on cool aspects which accumulate significant snow packs resulting in adequate moisture levels being maintained well into the growing season.					

[a] Proposed un-correlated site series designation.
[SM] Superscripts denote bighorn sheep(S), mule deer(M) and bear(B) forage/browse species. Upper case letters indicate >20% ground cover and lower case letters indicate 5-20% cover.
Ratings equivalents: 1 (Very High), 2 (High), 3 (Moderate), 4 (Low), 5 (Very Low) and 6 (Nil); Ratings in bold are based on empirical data and non-bold are estimated.

Initial letter of plot numbers indicates plot type as follows: D=detailed; G= ground visual; S= visual using 40x scope; H=helicopter visual; T=polygon assessment while traveling

Appendix XXII. Galton Range seasonal wildlife suitability ratings (Living) for ungulates, bears and marten, by ecosystem type.

Appendix XXIII. Galton Range seasonal wildlife capability ratings (Living) for ungulates, bears and marten, by ecosystem type.

Appendix XXIV. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC PPdh2 Wildlife Habitat Treatment Units. Present habitat limitations and considerations are provided for ungulates, and recommendations are provided for ungulates, bears and marten, by dominant aspect. Structural stages have been grouped into Group 1 (stages 1,2 & 3), Group 2 (stages 4 & 5) and Group 3 (stages 6 & 7).

Map Unit	**Description**	**BEC**
AW	Antelope brush - Bluebunch wheatgrass	PPdh2/00
Map Symbol	AW1	
Description	Grass-Forb/Shrub	
Present Limitations for Ungulates	-limited security/thermal cover -competition with livestock -reduced habitat effectiveness due to human disturbance -no adjacent escape terrain for bighorn sheep	
Habitat Considerations	-limited areal extent -dry soils -does not support forest cover -seedbanked species will dominate after fire	
HABITAT TREATMENT RECOMMENDATIONS		
Rocky Mountain Bighorn Sheep	-introduce early spring low intensity burns every 3 to 10 years (6.5 year average) -thin surrounding forested areas for visibility -monitor and control livestock grazing and access as required	
Mule Deer	-introduce early spring low intensity burns every 3 to 10 years (6.5 year average) -thin surrounding forested areas for visibility -retain adjacent security/thermal cover patches and travel corridors -monitor and control livestock grazing and access as required	
White-tailed Deer	-introduce early spring low intensity burns every 3 to 10 years (6.5 year average) -retain adjacent security/thermal cover and travel corridors -create a mosaic of closed canopy forest and openings	
Elk	-introduce early spring low intensity burns every 3 to 10 years (6.5 year average) -thin surrounding forested areas for visibility -retain adjacent security/thermal cover patches and travel corridors	
Moose	-none practical	
Marten	-none practical	
Black Bear	-infrequent use -no treatment required	
Grizzly Bear	-infrequent use -no treatment required	

Map Unit	**Description**					**BEC**
PW	Ponderosa pine - Bluebunch wheatgrass - Junegrass					PPdh2/01
Map Symbol	PW1	PW2	PWk2	PWw2	PW3	PWw3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Pole Sapling/Young Forest cool aspect	Pole Sapling/Young Forest warm aspect	Mature/Old Forest	Mature/Old Forest warm aspect
Present Limitations for Ungulates	-forest encroachment by Fd and reduced productivity -limited security/thermal cover -livestock competition -no sheep escape terrain -human access	-ingrowth by Fd and reduced productivity -limited visibility for predator detection -livestock competition -no sheep escape terrain -human access	-ingrowth by Fd and reduced productivity -limited visibility for predator detection -livestock competition -no sheep escape terrain -human access	-ingrowth by Fd and reduced productivity -dry sites -limited security cover -livestock competition -no sheep escape terrain -human access	-ingrowth by Fd and reduced productivity -limited security cover -livestock competition -no sheep escape terrain -human access	-ingrowth by Fd and reduced productivity -dry sites -limited security cover -livestock competition -no sheep escape terrain -human access
Habitat Considerations	-compaction hazard on silty soils -seedbanked species dominate after fire	-high fuel loads -compaction hazard on silty soils -seedbanked species dominate after fire	-high fuel loads -compaction hazard on silty soils -seedbanked species dominate after fire	-high fuel loads -compaction hazard on silty soils -seedbanked species dominate after fire	-high fuel loads -soil compaction hazard -wildlife tree potential -seedbanked species dominate after fire	-high fuel loads -soilcompaction hazard -wildlife tree potential -seedbanked species dominate after fire
HABITAT TREATMENT RECOMMENDATIONS						
Rocky Mountain Bighorn Sheep	-early spring burn every 3-10 years (6.5 yr average) -thin surrounding areas for improved visibility -monitor and control livestock grazing/human access	-thin for improved visibility, productivity -light early spring burn every 3-10 years (6.5 yr average) after thinned -retain some security/ thermal cover -monitor and control livestock grazing/human access	-thin for improved visibility and productivity -light early spring burn every 3-10 years (6.5 yr average) after thinned -retain some security/ thermal cover -monitor and control livestock grazing/human access	-thin for improved visibility and productivity -light early spring burn every 3-10 years (6.5 yr average) after thinned -retain some security/ thermal cover -monitor and control livestock grazing/human access	- selectively log to maintain even age structure at low density -early spring burn every 3-10 years (6.5 yr average) - retain some security/thermal cover -monitor and control livestock grazing/human access	- selectively log to maintain even age structure at low density -early spring burn every 3-10 years (6.5 yr average) - retain some security/thermal cover -monitor and control livestock grazing/human access
Mule Deer	-early spring burn every 3-10 years (6.5 yr average) -thin surrounding areas for visibility -retain adjacent security/thermal cover and travel corridors -monitor and control livestock grazing/human access	-thin for improved visibility, productivity -light early spring burn every 3-10 years (6.5 yr average) after thinned -retain patches of security/ thermal cover -monitor and control livestock grazing/human access	-thin for improved visibility, productivity -light early spring burn every 3-10 years (6.5 yr average) after thinned -retain patches of security/ thermal cover -monitor and control livestock grazing/human access	-thin for improved visibility, productivity -light early spring burn every 3-10 years (6.5 yr average) after thinned -retain patches of security/ thermal cover -monitor and control livestock grazing/human access	- selectively log to maintain even age structure at low density -early spring burn every 3-10 years (6.5 yr average) - preserve travel corridors and security/thermal cover -monitor and control livestock grazing/human access	- selectively log to maintain even age structure at low density -early spring burn every 3-10 years (6.5 yr average) - preserve travel corridors and security/thermal cover -monitor and control livestock grazing/human access
White-tailed Deer	-as above for mule deer -retain more security cover adjacent to Stage 1	-as above for mule deer -preserve higher interspersions of closed canopy forest	-as above for mule deer -preserve higher interspersions of closed canopy forest	-as above for mule deer -preserve higher interspersions of closed canopy forest	-as above for mule deer -preserve higher interspersions of closed canopy forest	-as above for mule deer -preserve higher interspersions of closed canopy forest
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-infrequent use -allow to succeed to Stage 2 and 3	-infrequent use -thin and create openings -retain security/thermal cover and travel corridors	-infrequent use -thin and create openings -retain security/thermal cover and travel corridors	-infrequent use -thin and create openings -retain security/thermal cover and travel corridors	-infrequent use -thin and create openings -retain security/thermal cover and travel corridors	-infrequent use -thin and create openings -retain security/thermal cover and travel corridors
Marten	-PW habitat little used -allow succession to Stage 3	-preserve any CWD -retain dense tree cover	-preserve any CWD -retain dense tree cover	-preserve any CWD -retain dense tree cover	-preserve CWD -preserve dense tree cover	-preserve CWD -preserve dense tree cover
Black Bear	-infrequent use	-preserve CWD for anting -introduce burns as above -retain high level of	-preserve CWD for anting -introduce burns as above -retain high level of	-preserve CWD for anting -introduce burns as above -retain high level of	-preserve CWD for anting -introduce burns as above -retain high level of	-preserve CWD for anting -introduce burns as above -retain high level of

		security/thermal cover -maintain travel corridors	security/thermal cover -maintain travel corridors	security/thermal cover -maintain travel corridors	security/thermal cover -maintain travel corridors	security/thermal cover -maintain travel corridors
Grizzly Bear	-same as black bear;low use	-same as black bear;low use	-same as black bear;low use	-same as black bear;low use	-same as black bear;low use	-same as black bear;low use

Map Unit	**Description**					**BEC**
AR	Ponderosa pine/Trembling aspen - Rose - Solomon's seal					PPdh2/03
Map Symbol	AR1	AR2	ARk2	AR3	ARk3	ARw3
Description	Grass-Forb/Shrub	Pole Sapling/Young forest	Pole Sapling/Young forest cool aspect	Mature/Old Forest	Mature/Old Forest cool aspect	Mature/Old Forest warm aspect
Present Limitations for Ungulates	-Fd encroachment and reduced site productivity -livestock competition -human access -lacks nearby sheep escape terrain	-Fd ingrowth and reduced site productivity -livestock competition -human access -lacks nearby sheep escape terrain	-Fd ingrowth and reduced site productivity -livestock competition -human access -lacks nearby sheep escape terrain -snow pack may limit winter foraging	-Fd ingrowth and reduced site productivity -livestock competition -human access -lacks nearby sheep escape terrain	-Fd ingrowth and reduced site productivity -livestock competition -human access -lacks nearby sheep escape terrain -snow pack may limit winter foraging	-Fd ingrowth and reduced site productivity -livestock competition -human access -lacks nearby sheep escape terrain
Habitat Manipulation Considerations	-erosion and compaction hazard -seedbanked species proliferate after fire	-erosion and compaction hazard -seedbanked species proliferate after fire	-erosion and compaction hazard -seedbanked species proliferate after fire	-erosion and compaction hazard -wildlife trees present -seedbanked species proliferate after fire	-erosion and compaction hazard -wildlife trees present -seedbanked species proliferate after fire	-erosion and compaction hazard -wildlife trees present -seedbanked species proliferate after fire
HABITAT TREATMENT RECOMMENDATIONS						
Rocky Mountain Bighorn Sheep	-early spring burn every 3-10 years (8.5 yr average) -thin surrounding areas for improved visibility -monitor and control livestock grazing/human access	-thin and create openings to improve visibility/productivity -consider controlled burns every 10-15 years -retain contiguous cover along travel corridors -monitor/control livestock grazing & human access	-thin to improve visibility and productivity -retain contiguous cover along travel corridors -monitor and control livestock grazing/human access	-selectively log and thin to maintain open understory -consider early spring under-burn every 10-15 years -retain contiguous cover along travel corridors -monitor/control livestock grazing and human access	-selectively log and thin to maintain open understory -retain contiguous cover along travel corridors -monitor and control livestock grazing/human access	-selectively log and thin to maintain open understory -consider early spring burn every 10-15 years -retain contiguous cover along travel corridors -monitor and control livestock grazing/human access
Mule Deer	-early spring burn every 3-10 years (8.5 yr average) -retain security/thermal cover in the area and travel corridors -monitor/control livestock grazing and human access	-thin and create openings to improve visibility and productivity -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access	-thin and create openings for visibility and improved productivity -retain as security/thermal cover and travel corridors -monitor/control livestock grazing and human access	-selectively log and create openings to improve productivity -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access	-selectively log and create openings to improve productivity -retain as security/thermal cover and travel corridors -monitor/control livestock grazing and human access	-selectively log and create openings to improve productivity -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access
White-tailed Deer	-as above for mule deer	-create openings to improve forage/browse production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors	-create openings to improve forage/browse production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors	-selectively log and create openings to improve forage/browse production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors	-selectively log and create openings to improve forage/browse production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors	-selectively log and create openings to improve forage/browse production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-allow to succeed to shrub -early spring burn every 3-10	-create openings to improve browse production	-create openings to improve browse production	-selectively log to thin and create small openings to	-selectively log to create openings to improve browse	-selectively log to thin and create small openings to

	years (8.5 yr average) -retain security/thermal cover in the area and travel corridors -monitor/control livestock grazing and human access	-consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access	-consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access	improve browse production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access	production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access	improve browse production -consider controlled burns every 10-15 years -retain security/thermal cover and travel corridors -monitor/control livestock grazing and human access
Map Unit	**Description**					**BEC**
AR	Ponderosa pine/Trembling aspen - Rose - Solomon's seal					PPdh2/03
Map Symbol	AR1	AR2	ARk2	AR3	ARk3	ARw3
Description	Grass-Forb/Shrub	Pole Sapling/Young forest	Pole Sapling/Young forest cool aspect	Mature/Old Forest	Mature/Old Forest cool aspect	Mature/Old Forest warm aspect
Marten	-allow to succeed to Stage 3 -retain any CWD	-allow to succeed to Stage 3 -retain any CWD	-allow to succeed to Stage 3 -retain any CWD	-maintain understory growth -retain wildlife trees/CWD	-maintain understory growth -retain wildlife trees/CWD	-maintain understory growth -retain wildlife trees/CWD
Black Bear	-maintain a mosaic of Stage 1 for forage/berries -preserve CWD for anting -preserve travel corridors	-create mosaic of Stages -retain as security/thermal and travel corridors -preserve CWD for anting	-create mosaic of Stages -retain as security/thermal and travel corridors	-create mosaic of Stages -retain as security/thermal and travel corridors -preserve CWD for anting	-create mosaic of Stages -retain as security/thermal and travel corridors	-create mosaic of Stages -retain as security/thermal and travel corridors -preserve CWD for anting
Grizzly Bear	-as above for black bear -monitor/control livestock grazing and human access	-as above for black bear -monitor/control livestock grazing and human access	-as above for black bear -monitor/control livestock grazing and human access	-as above for black bear -monitor/control livestock grazing and human access	-as above for black bear -monitor/control livestock grazing and human access	-as above for black bear -monitor/control livestock grazing and human access

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	Description		BEC
CD	Black cottonwood - Red-osier dogwood - Nootka rose		PPdh2/04
Map Symbol	CD1	CD2	CD3
Description	Grass-Forb/Shrub	Pole Sapling/Young forest	Mature/Old Forest
Present Limitations for Ungulates	-reduced habitat effectiveness due to human activities -potentially reduced forage/browse vigour and productivity due to fire suppression	-reduced habitat effectiveness due to human activities -potentially reduced forage/browse vigour and productivity due to fire suppression	-reduced habitat effectiveness due to human activities -potentially reduced forage/browse vigour and productivity due to fire suppression
Habitat Considerations	-subject to periodic flooding and erosion -important riparian habitat for biodiversity and linkage corridors	-subject to periodic flooding and erosion -important riparian habitat for biodiversity and linkage corridors	-subject to periodic flooding and erosion -good wildlife tree potential -important riparian habitat for biodiversity and linkage corridors
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-maintain as travel corridors -consider periodic prescribed burns every 15-20 years to improve habitat vigour -monitor and control livestock grazing and human access	-maintain as travel corridors -thin stands to promote forage and browse production, and to improve visibility -monitor and control livestock grazing and human access	-maintain as travel corridors -consider periodic light prescribed underburns burns every 15-20 years to improve habitat vigour -monitor and control livestock grazing and human access
Mule Deer	-maintain contiguous forest cover along travel corridors -consider periodic prescribed burns every 15-20 years to improve habitat vigour -monitor and control livestock grazing and human access	-thin and create openings to increase forage/browse production -maintain contiguous forest cover along travel corridors -consider periodic prescribed burns every 15-20 years to improve habitat vigour -retain adequate security/thermal cover -monitor and control livestock grazing and human access	-selectively log to create openings and increase forage/browse -maintain contiguous forest cover along travel corridors -consider periodic prescribed burns every 15-20 years to improve habitat vigour -retain adequate security/thermal cover -monitor and control livestock grazing and human access
White-tailed Deer	-as above for mule deer	-as above for mule deer -retain greater portion of closed canopy forest	-as above for mule deer -retain greater portion of closed canopy forest
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-as above for mule deer -allow to succeed to shrub	-as above for mule deer -create more openings and retain closed canopy forest for security/thermal cover	-as above for mule deer -create more openings through selective logging and retain closed canopy forest for security/thermal cover
Marten	-allow to succeed to Stage 3	-allow to succeed to Stage 3 -preserve CWD	-maintain as Stage 3 -preserve CWD and wildlife trees
Black Bear	-create a mosaic of Stages and consider periodic prescribed burns every 15-20 years -maintain contiguous forest cover along these natural linkage corridors -monitor and control livestock grazing and human access	-create a mosaic of Stages and consider periodic prescribed burns every 15-20 years -maintain contiguous forest cover along these natural linkage corridors -monitor and control livestock grazing and human access	-create a mosaic of Stages and consider periodic prescribed burns every 15-20 years -maintain contiguous forest cover along these natural linkage corridors -monitor and control livestock grazing and human access
Grizzly Bear	-as above for black bear	-as above for black bear	-as above for black bear

Appendix XXV. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC IDFdm2 Wildlife Habitat Treatment Units. Present habitat limitations and considerations are provided for ungulates, and recommendations are provided for ungulates, bears and marten, by dominant aspect. Structural stages have been grouped into Group 1 (stages 1,2 & 3), Group 2 (stages 4 & 5) and Group 3 (stages 6 & 7).

Map Unit	**Description**							**BEC**
DT	Douglas-fir/Lodgepole pine - Pinegrass - Twinflower							IDFdm2/01
Map Symbol	DT1	DTk1	DTw1	DT2	DTk2	DT3	DTk3	DTw3
Description	Grass-Forb/Shrub	Grass-Forb/Shrub cool aspect	Grass-Forb/Shrub warm aspect	Pole Sapling/Young Forest	Pole Sapling/Young Forest cool aspect	Mature/Old Forest	Mature/Old Forest	Mature/Old Forest cool aspect
Present Limitations for Ungulates	-ingrowth of Fd -human access -reduced productivity	-ingrowth of Fd -human access -reduced productivity	-ingrowth of Fd -human access -reduced productivity	-ingrowth of Fd -human access -reduced productivity	-ingrowth of Fd -human access -reduced productivity	-ingrowth of Fd -human access -reduced productivity	-ingrowth of Fd -human access -reduced productivity	-ingrowth of Fd -human access -reduced productivity
Habitat Considerations	-prolific growth post-fire -erosion and compaction hazard	-prolific growth post-fire -erosion and compaction hazard	-prolific growth post-fire -erosion and compaction hazard	-prolific growth post-fire -erosion and compaction hazard	-prolific growth post-fire -erosion and compaction hazard	-prolific growth post-fire -erosion and compaction hazard	-prolific growth post-fire -erosion and compaction hazard	-prolific growth post-fire -erosion and compaction hazard
HABITAT TREATMENT RECOMMENDATIONS								
Rocky Mountain Bighorn Sheep	-through harvest rotation maintain approximately 1/3 DT habitat in Stage 1 -early spring burn every 5-25 years (15 yr average) -thin surrounding areas extending to escape terrain for improved visibility -monitor and control access/grazing	-through harvest rotation maintain approximately 1/3 DT habitat in Stage 1 -early spring burn every 5-25 years (20 yr average) -thin surrounding areas extending to escape terrain for improved visibility -monitor and control access/grazing	-through harvest rotation maintain approximately 1/3 DT habitat in Stage 1 -early spring burn every 5-25 years (15 yr average) -thin surrounding areas extending to escape terrain for improved visibility -monitor and control access/grazing	-thin stands to improve visibility, productivity -light early spring burn every 5-25 years (15 yr average) once fuel loads reduced -monitor and control access/grazing	-thin stands to improve visibility, productivity -light early spring burn every 5-25 years (20 yr average) once fuel loads reduced -monitor and control access/grazing	-thin stands/ understory to improve visibility, productivity -early spring underburn every 5-25 years (15 yr average) once fuel loads reduced -monitor and control access/grazing	-thin stands/ understory to improve visibility, productivity -early spring underburn every 5-25 years (20 yr average) once fuel loads reduced -monitor and control access/grazing	-thin stands/ understory to improve visibility, productivity -early spring underburn every 5-25 years (15 yr average) once fuel loads reduced -monitor and control access/grazing
Mule Deer	-through harvest rotation maintain approximately 1/3 DT habitat in Stage 1 -early spring burn every 5-25 years (15 yr average) -maintain adjacent cover and travel corridors -monitor and control access/grazing	-through harvest rotation maintain approximately 1/3 DT habitat in Stage 1 -early spring burn every 5-25 years (20 yr average) -maintain adjacent cover and travel corridors -monitor and control access/grazing	-through harvest rotation maintain approximately 1/3 DT habitat in Stage1 -early spring burn every 5-25 years (15 yr average) -maintain adjacent cover and travel corridors -monitor and control access/grazing	-thin stands and create openings to improve visibility, productivity -early spring burn every 5-25 years (15 yr average) -maintain travel corridors -monitor and control access/grazing	-thin stands and create openings to improve visibility, productivity -early spring burn every 5-25 years (20 yr average) -maintain travel corridors -monitor and control access/grazing	-selectively log to thin stands and create openings to improve visibility/ productivity -early spring burn every 5-25 years (15 yr average) -maintain cover along travel corridors -monitor and control access/grazing	-selectively log to thin stands and create openings to improve visibility/ productivity -early spring burn every 5-25 years (20 yr average) -maintain cover along travel corridors -monitor and control access/grazing	-selectively log to thin stands and create openings to improve visibility/ productivity -early spring burn every 5-25 years (15 yr average) -maintain cover along travel corridors -monitor and control access/grazing
White-tailed Deer	-as above for mule deer -create mosaic of closed canopy forest and openings	-as above for mule deer -create mosaic of closed canopy forest and openings	-as above for mule deer -create mosaic of closed canopy forest and openings	-as above for mule deer -create mosaic of closed canopy forest and openings	-as above for mule deer -create mosaic of closed canopy forest and openings	-as above for mule deer -create mosaic of closed canopy forest and openings	-as above for mule deer -create mosaic of closed canopy forest and openings	-as above for mule deer -create mosaic of closed canopy forest and openings

Map Unit	**Description**							**BEC**
DT	Douglas-fir/Lodgepole pine - Pinegrass - Twinflower							IDFdm2/01
Map Symbol	DT1	DTk1	DTw1	DT2	DTk2	DT3	DTk3	DTw3
Description	Grass-Forb/Shrub	Grass-Forb/Shrub cool aspect	Grass-Forb/Shrub warm aspect	Pole Sapling/Young Forest	Pole Sapling/Young Forest cool aspect	Mature/Old Forest	Mature/Old Forest	Mature/Old Forest cool aspect
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-as above for mule deer -allow to succeed to shrub	-as above for mule deer -allow to succeed to shrub	-as above for mule deer -allow to succeed to shrub	-as above for white-tailed deer	-as above for white-tailed deer	-as above for white-tailed deer	-as above for white-tailed deer	-as above for white-tailed deer
Marten	-preserve any CWD -allow to succeed to Stage 3	-preserve any CWD -allow to succeed to Stage 3	-preserve any CWD -allow to succeed to Stage 3	-preserve any CWD -allow to succeed to Stage 3	-preserve any CWD -allow to succeed to Stage 3	-preserve understory, CWD and wildlife trees	-preserve understory, CWD and wildlife trees	-preserve understory, CWD and wildlife trees
Black Bear	-as above for white-tailed deer -preserve any CWD for anting	-as above for white-tailed deer -preserve any CWD for anting	-as above for white-tailed deer -preserve any CWD for anting	-as above for white-tailed deer -preserve any CWD for anting	-as above for white-tailed deer	-as above for white-tailed deer -preserve CWD for anting	-as above for white-tailed deer	-as above for white-tailed deer -preserve CWD for anting
Grizzly Bear	-as above for black bear	-as above for black bear	-as above for black bear	-as above for black bear	-as above for black bear	-as above for black bear	-as above for black bear	-as above for black bear

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	Description	BEC
AW	Antelope brush - Bluebunch wheatgrass	IDFdm2/02
Map Symbol	AW1	AW2/AW3
Description	Grass-Forb/Shrub	Open Forest
Present Limitations for Ungulates	-Fd encroachment -reduced forage/browse productivity -reduced visibility and predator detection -reduced habitat effectiveness due to human activities -competition with livestock	-Fd encroachment and ingrowth -reduced forage/browse productivity -reduced visibility and predator detection -reduced habitat effectiveness due to human activities -competition with livestock
Habitat Considerations	-xeric soils -shallow humus layers -none to negligible timber value	-xeric soils -shallow humus layers -none to negligible timber value -potential wildlife trees
HABITAT TREATMENT RECOMMENDATIONS		
Rocky Mountain Bighorn Sheep	-early spring light intensity burns every 5-20 years (10 yr average) -thin surrounding areas extening to escape terrain for improved visibility -monitor and control access/grazing	-early spring light intensity burns every 5-20 years (10 yr average) -thin surrounding areas extening to escape terrain for improved visibility -monitor and control access/grazing
Mule Deer	-early spring light intensity burns every 5-20 years (10 yr average) -thin surrounding areas for visibility and improved productivity -maintain adjacent cover and travel corridors -monitor and control access/grazing	-early spring light intensity burns every 5-20 years (10 yr average) -thin surrounding areas for visibility and improved productivity -maintain adjacent cover and travel corridors -monitor and control access/grazing
White-tailed Deer	-early spring light intensity burns every 5-20 years (10 yr average) -retain patches of adjacent closed canopy forest -maintain adjacent cover and travel corridors	-early spring light intensity burns every 5-20 years (10 yr average) -retain patches of adjacent closed canopy forest -maintain adjacent cover and travel corridors
Elk	-early spring light intensity burns every 5-20 years (10 yr average) -thin surrounding areas for visibility and improved productivity -maintain adjacent cover and travel corridors -monitor and control access/grazing	-early spring light intensity burns every 5-20 years (10 yr average) -thin surrounding areas for visibility and improved productivity -maintain adjacent cover and travel corridors -monitor and control access/grazing
Moose	-none practical	-none practical
Marten	-none practical	-none practical
Black Bear	-retain available security cover and travel corridors -preserve any CWD	-preserve available security cover and travel corridors -preserve CWD for anting
Grizzly Bear	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access

Map Unit	Description			BEC
DS	Douglas-fir - Snowberry - Balsamroot			IDFdm2/03
Map Symbol	DS1	DSk1	DS2	DS3
Description	Grass-Forb/Shrub	Grass-Forb/Shrub cool aspect	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-Fd encroachment -reduced forage/browse productivity -reduced visibility and predator detection -reduced habitat effectiveness due to human activities -competition with livestock	-Fd encroachment -reduced forage/browse productivity -reduced visibility and predator detection -reduced habitat effectiveness due to human activities -competition with livestock	-dense ingrowth of Fd -reduced forage/browse productivity -reduced visibility and predator detection -reduced habitat effectiveness due to human activities -competition with livestock	-dense ingrowth of Fd -reduced forage/browse productivity -reduced visibility and predator detection -reduced habitat effectiveness due to human activities -competition with livestock
Habitat Considerations	-soils sensitive to disturbance -conserve limited organic layers -dry and nutrient poor soils -seed banked species proliferate after fire	-soils sensitive to disturbance -conserve limited organic layers -dry and nutrient poor soils -seed banked species proliferate after fire	-soils sensitive to disturbance -conserve limited organic layers -dry and nutrient poor soils -seed banked species proliferate after fire	-soils sensitive to disturbance -conserve limited organic layers -dry and nutrient poor soils -seed banked species proliferate after fire
HABITAT TREATMENT RECOMMENDATIONS				
Rocky Mountain Bighorn Sheep	-thin surrounding areas extending to escape terrain for improved visibility -early spring light intensity burn every 5-25 years (10 yr average) -monitor and control access/grazing	-thin surrounding areas extending to escape terrain for improved visibility -early spring light intensity burn every 5-25 years (20 yr average) -monitor and control access/grazing	-thin stands to improve visibility and productivity -early spring underburn every 5-25 years (15 yr average) once thinned -monitor and control access/grazing	-early spring burn every 5-25 years (15 yr average) -thin stands/understory to improve visibility, productivity -monitor and control access/grazing
Mule Deer	-early spring light intensity burn every 5-25 years (10 yr average) -maintain adjacent cover and travel corridors -monitor and control access/grazing	-early spring light intensity burn every 5-25 years (20 yr average) -maintain adjacent cover and travel corridors -monitor and control access/grazing	-thin stands to improve visibility and productivity -early spring burn every 5-25 years (15 yr average) once thinned and fuel loads reduced -maintain travel corridors -monitor and control access/grazing	-thin stands to improve visibility and productivity -early spring burn every 5-25 years (15 yr average) once thinned and fuel loads reduced -maintain travel corridors -monitor and control access/grazing
White-tailed Deer	-as above for mule deer	-as above for mule deer -retain greater amount of closed canopy forest	-as above for mule deer -retain greater amount of closed canopy forest	-as above for mule deer -retain greater amount of closed canopy forest
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-infrequent use -preserve adjacent travel corridors	-infrequent use -preserve adjacent travel corridors	-infrequent use -preserve travel corridors	-infrequent use -preserve travel corridors
Marten	-poor habitat -allow to succeed to Stage 3	-poor habitat -allow to succeed to Stage 3	-preserve CWD -allow to succeed to Stage 3	-preserve understory, CWD and wildlife trees
Black Bear	-retain available security cover and travel corridors -preserve CWD	-retain available security cover and travel corridors -preserve CWD	-create a mosaic of Stages -preserve CWD for anting	-create a mosaic of Stages -preserve CWD for anting
Grizzly Bear	-retain available security cover and travel corridors -preserve CWD -control human access	-retain available security cover and travel corridors -preserve CWD -control human access	-create a mosaic of Stages -preserve CWD for anting -retain travel corridors -control human access	-create a mosaic of Stages -preserve CWD for anting -retain travel corridors -control human access

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	**Description**				**BEC**
SP	Douglas-fir/Western larch/Spruce - Pinegrass				IDFdm2/04
Map Symbol	SP1/SPk1	SP2	SPk2	SP3	SPk3
Description	Grass-Forb/Shrub gentle slope/cool aspect	Pole Sapling/Young Forest	Pole Sapling/Young Forest cool aspect	Mature/Old Forest	Mature/Old Forest cool aspect
Present Limitations for Ungulates	-ingrowth of Fd -human access -reduced productivity	-dense regeneration of Fd -human access -reduced forage and browse productivity -competition with livestock	-dense regeneration of Fd -human access -reduced forage and browse productivity -competition with livestock	-ingrowth of Fd -human access -reduced forage and browse productivity -competition with livestock	-ingrowth of Fd -human access -reduced forage and browse productivity -competition with livestock
Habitat Considerations	-soil compaction hazard on silty soils -prolific post-fire growth of seedbanked plant species	-soil compaction hazard on silty soils -prolific post-fire growth of seedbanked plant species	-soil compaction hazard on silty soils -prolific post-fire growth of seedbanked plant species	-soil compaction hazard on silty soils -prolific post-fire growth of seedbanked plant species	-soil compaction hazard on silty soils -prolific post-fire growth of seedbanked plant species
HABITAT TREATMENT RECOMMENDATIONS					
Rocky Mountain Bighorn Sheep	-early spring burn every 15-30 years (20 yr average) -thin surrounding areas extending to escape terrain for improved visibility -monitor and control access/grazing	-thin stands and create openings to improve visibility and productivity -if practical, early spring burn every 15-30 years (20 yr average) once thinned -monitor and control access/grazing	-thin stands and create openings to improve visibility and productivity -if practical, early spring burn every 15-30 years (25 yr average) once thinned -monitor and control access/grazing	-selectively log to thin stands\understory and create openings to improve visibility and productivity -if practical, early spring burn every 15-30 years (20 yr avg.) once fuel loads reduced -monitor and control access/grazing	-selectively log to thin stands\understory and create openings to improve visibility and productivity -if practical, early spring burn every 15-30 years (25 yr avg.) once fuel loads reduced -monitor and control access/grazing
Mule Deer	-thin surrounding areas for visibility and improved productivity -early spring burn every 15-30 years (20 yr average) -maintain adjacent cover and travel corridors -monitor and control access/grazing	-thin stands and create openings to improve visibility and productivity -if practical, early spring burn every 15-30 years (20 yr average) once thinned -maintain adjacent cover and travel corridors -monitor and control access/grazing	-thin stands and create openings to improve visibility and productivity -if practical, early spring burn every 15-30 years (25 yr average) once thinned -maintain adjacent cover and travel corridors -monitor and control access/grazing	-selectively log to thin stands\understory and create openings to improve visibility and productivity -if practical, early spring underburn every 15-30 years (20 yr avg.) once fuel loads reduced -maintain travel corridors -monitor and control access/grazing	-selectively log to thin stands\understory and create openings to improve visibility and productivity -if practical, early spring underburn every 15-30 years (25 yr avg.) once fuel loads reduced -maintain travel corridors -monitor and control access/grazing
White-tailed Deer	-as above for mule deer -retain greater cover of adjacent closed forest	-as above for mule deer -retain patches of dense forest cover	-as above for mule deer -retain patches of dense forest cover	-as above for mule deer -retain patches of dense forest cover	-as above for mule deer -retain patches of dense forest cover
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-as above for mule deer -retain greater levels of adjacent closed forest -allow to succeed to shrub and Stage 2/3	-as above for mule deer -thin less and retain greater levels of closed forest -create openings on moister sites supporting browse spp.	-as above for mule deer -thin less and retain greater levels of closed forest -create more openings on cool aspects for browse production	-as above for mule deer -thin less and retain greater levels of closed forest -create openings on moister sites supporting browse spp.	-as above for mule deer -thin less and retain greater levels of closed forest -create more openings on cool aspects for browse production
Marten	-preserve any CWD -allow to succeed to Stage 3	-preserve any CWD -allow to succeed to Stage 3	-preserve any CWD -allow to succeed to Stage 3	-preserve understory, CWD and wildlife trees	-preserve understory, CWD and wildlife trees

Map Unit	**Description**				**BEC**
SP	Douglas-fir/Western larch/Spruce - Pinegrass				IDFdm2/04
Map Symbol	SP1/SPk1	SP2	SPk2	SP3	SPk3
Description	Grass-Forb/Shrub gentle slope/cool aspect	Pole Sapling/Young Forest	Pole Sapling/Young Forest cool aspect	Mature/Old Forest	Mature/Old Forest cool aspect
Black Bear	-introduce prescribed burns as described above -create a mosaic of Stages -preserve CWD for anting -retain adjacent security/ thermal cover and travel corridors	-introduce prescribed burns as described above -create a mosaic of Stages -create openings on moist sites -preserve CWD for anting -retain adjacent security/ thermal cover and travel corridors	-introduce prescribed burns as described above -create a mosaic of Stages -create openings on moist sites -retain adjacent security/ thermal cover and travel corridors	-introduce prescribed burns as described above -create a mosaic of Stages -create openings on moist sites -preserve CWD for anting -retain adjacent security/ thermal cover and travel corridors	-introduce prescribed burns as described above -create a mosaic of Stages -create openings on moist sites -retain adjacent security/ thermal cover and travel corridors
Grizzly Bear	-as above for black bear -monitor/control human access	-as above for black bear -monitor/control human access	-as above for black bear -monitor/control human access	-as above for black bear -monitor/control human access	-as above for black bear -monitor/control human access

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	**Description**		**BEC**
SS	Douglas-fir/Western larch/Spruce - Pinegrass		IDFdm2/05
Map Symbol	SS1	SS2	SS3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-higher predation rates associated with carnivore travel corridors -human access -potential competition with livestock	-dense tree regeneration may limit forage/browse production -higher predation rates associated with carnivore travel corridors -human access	-ingrowth of Fd and dense understory may limit forage/browse production -higher predation rates associated with carnivore travel corridors -human access
Habitat Considerations	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard on clayey soils -potential fluvial erosion hazard present -important as riparian habitat and high biodiversity -narrow elongated habitat units	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard on clayey soils -potential fluvial erosion hazard present -important as riparian habitat and high biodiversity -windthrow hazard -narrow elongated habitat units	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard on clayey soils -potential fluvial erosion hazard present -important as riparian habitat and high biodiversity -windthrow hazard -good wildlife tree potential -narrow elongated habitat units
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-none required	-thin stands through known sheep travel corridors and where adjacent to escape terrain for improved predator detection	-thin stands by selective logging and brush understory through known sheep travel corridors and where adjacent to escape terrain for improved predator detection
Mule Deer	-treat in same manner and at same time as treat for adjacent SP1 habitat units -preserve contiguous forest cover to maintain existing travel corridors -monitor and control access/grazing	-treat in same manner and at same time as treat for adjacent SP2 habitat units -preserve contiguous forest cover to maintain existing travel corridors -monitor and control access/grazing	-treat in same manner and at same time as treat for adjacent SP habitat units -preserve contiguous forest cover to maintain existing travel corridors -monitor and control access/grazing
White-tailed Deer	-as above for SP1 habitat treatments	-as above for SP1 habitat treatments	-as above for SP1 habitat treatments
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-as above for SP1 habitat treatments	-as above for SP1 habitat treatments	-as above for SP1 habitat treatments
Marten	-preserve CWD -retain adjacent cover	-preserve CWD -allow to succeed to Stage 3	-maintain as Stage 3 -preserve understory, CWD and wildlife trees
Black Bear	-as above for SP1 habitat treatments	-as above for SP1 habitat treatments	-as above for SP1 habitat treatments
Grizzly Bear	-as above for black bear	-as above for black bear	-as above for black bear
Comments: The SS habitat type is of limited areal extent in the Galton study area and was not a dominant component of any of the mapped Wildlife Treatment polygons			

Map Unit	**Description**		**BEC**
SH	Hybrid white spruce - Horsetail		IDFdm2/07
Map Symbol	SH1	SH2	SH3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-poor forage ratings -higher predation rates associated with carnivore travel corridors -human access	-poor forage ratings -higher predation rates associated with carnivore travel corridors -human access	-poor forage ratings -higher predation rates associated with carnivore travel corridors -human access
Habitat Considerations	-organic layer displacement hazard -potential fluvial erosion hazard present -important as riparian habitat and high biodiversity -windthrow hazard -good wildlife tree potential -limited areal extent	-organic layer displacement hazard -potential fluvial erosion hazard present -important as riparian habitat and high biodiversity -windthrow hazard -good wildlife tree potential -limited areal extent	-organic layer displacement hazard -potential fluvial erosion hazard present -important as riparian habitat and high biodiversity -windthrow hazard -good wildlife tree potential -limited areal extent
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-none practical	-thin stands through known travel corridors	-selectively log and thin stands through known travel corridors
Mule Deer	-none	-thin stands and create openings when treating adjacent SS habitat	-selectively log to create openings to promote forage/browse production
White-tailed Deer	-none	-as above for mule deer	-as above for mule deer
Elk	-none	-as above for mule deer	-as above for mule deer
Moose	-allow to succeed to shrub stage	-as above for mule deer	-as above for mule deer
Marten	-allow to succeed to Stage 3	-allow to succeed to Stage 3	-maintain as Stage 3 -preserve understory, CWD and wildlife trees
Black Bear	-preserve sites for foraging on spring horsetail and other succulents	-thin stands and create openings when treating adjacent SS habitat -preserve sites for foraging on spring horsetail and other succulents	-thin stands and create openings when treating adjacent SS habitat -preserve sites for foraging on spring horsetail and other succulents
Grizzly Bear	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access
Comments: The SS habitat type is of very limited areal extent in the Galton study area and was not a dominant component of any of the mapped Wildlife Treatment polygons.			

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Appendix XXVI. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC MSdk Wildlife Habitat Treatment Units. Present habitat limitations and considerations are provided for ungulates, and habitat treatment recommendations are included for ungulates, bears and marten, by dominant aspect class. Structural stages have been grouped into Group 1 (stages 1,2 & 3), Group 2 (stages 4 & 5) and Group 3 (stages 6 & 7).

Map Unit	**Description**			**BEC**
SG	Hybrid white spruce - Soopolallie - Grouseberry			MSdk/01
Map Symbol	SG1	SG2	SGk2	SG3
Description	Grass-Forb/ Shrub	Pole Sapling/ Young Forest	Pole Sapling/ Young Forest on cool aspect	Mature /Old Forest
Present Limitations for Ungulates	-rapid regeneration by Pl and Fd	-rapid regeneration by Pl and Fd -high tree densities negatively affect forage/browse production, locomotion and predation rates	-rapid regeneration by Pl, Fd and Bl -high tree densities negatively affect forage/browse production, locomotion and predation rates -high moss cover	-high canopy closures tend to reduce forage/browse production -thick understory reduces browse/forage production and predator detection rates
Habitat Considerations	-rapid vegetation succession -moderate to high forage production -compaction hazard on silty soils	-rapid vegetation succession -often dense post fire stands of Pl -compaction hazard on silty soils	-rapid vegetation succession -often dense post fire stands of Pl -compaction hazard on silty soils	-compaction hazard on silty soils -high fuel loads consisting of CWD
HABITAT TREATMENT RECOMMENDATIONS				
Rocky Mountain Bighorn Sheep	-maintain historical range and areas adjacent escape terrain in Stage 1 through mechanical slashing and early spring burns every 20 to 40 years -thin surrounding stands extending to escape terrain to ensure good visibility	-in areas with escape terrain create large clearings of Stage 1 leaving retention patches for thermal cover -introduce periodic low intensity burns to maintain ecosystem vigour -thin surrounding stands extending to escape terrain to ensure good visibility	-on sites adjacent to escape terrain capable of supporting graminoid cover create large openings of Stage 1 by slashing and/or burning -on more cool mossy sites adjacent escape terrain thin stands to allow good visibility for predator evasion	-where adjacent escape terrain create large openings by logging while leaving retention patches for thermal cover -where practical introduce periodic burns every 20 years to maintain ecosystem vigour -selectively log and thin stands along travel corridors
Mule Deer	-maintain approximately one third of the SG habitat in Stage 1 through logging and/or slashing and burning -where practical introduce periodic fire every 40 years on average to maintain ecosystem vigour -retain patches of security/ thermal cover and riparian travel corridors	-maintain approximately one third of the SG habitat in Stage 2 through logging and/or slashing and burning -thin other stands to improve forage/browse production -where practical introduce periodic fire every 40 years on average to maintain ecosystem vigour -retain patches of security/ thermal cover and riparian travel corridors	-on slopes capable of supporting good graminoid cover create large openings by thinning and slashing/burning -retain gully and other natural travel corridors and security/thermal cover -as in other ecosystems preserve salt lick sites	-create large openings by logging and thin stands on sites with good forage production capabilities -maintain approximately one third of the SG habitat in Stage 3 through logging and/or slashing and burning -where practical introduce periodic fire every 40 years on average to maintain ecosystem vigour -preserve riparian travel corridors
White-tailed Deer	-as above for mule deer but retain greater interspersions of forest cover -create a mosaic of openings and various Structural Stages	-as above for mule deer -create a mosaic of openings and various Structural Stages	-retain a proportion of Stage 2 but thin to improve forage and browse production	-thin stands and understory to promote good forage production and to improve predator detection
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-allow to succeed to shrub stage -retain adjacent security/ thermal cover and travel corridors	-create a mosaic of Stages with a large proportion of the land base maintained as Stage 1 -retain security/thermal cover and travel corridors		-maintain a representation of Stage 3 habitat interspersed with earlier structural stages
Marten	-allow sites to succeed to old growth	-allow sites to succeed to old growth	-allow sites to succeed to old growth	-retain large contiguous areas of Stage 3 -maintain dense understory conditions -retain CWD and wildlife trees
Black Bear	-as above for mule deer -maintain a mosaic of Structural Stages for	-same as above for mule deer -create a diversity of Stages	-create openings and thin other stands on sites capable of supporting forb/graminoids	-create openings to promote forb and soft mass production

	forb and berry diversity -on warm sites retain any CWD for anting	-thin dense stands to increase forb and berry productivity	and berry crops -create a mosaic of Stages and retain patches of cover along with travel corridors	-retain a mosaic of stands for security/thermal cover
Map Unit	**Description**			**BEC**
SG	Hybrid white spruce - Soopolallie - Grouseberry			MSdk/01
Map Symbol	SG1	SG2	SGk2	SG3
Description	Grass-Forb/ Shrub	Pole Sapling/ Young Forest	Pole Sapling/ Young Forest on cool aspect	Mature /Old Forest
Grizzly Bear	-as above for black bear -monitor and control human access	-maintain a mosaic of Stage 2 and other Structural Stages -thin dense stands to increase forb and berry productivity -preserve available CWD for anting -restrict access and human disturbance	-maintain a mosaic of Stage 2 and other Structural Stages -thin dense stands to increase forb and berry productivity -preserve available CWD for anting -restrict access and human disturbance	-create openings to promote forb and berry production -retain a mosaic of stands for foraging and security/thermal cover -restrict access and human disturbance

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	Description	BEC
SW	Saskatoon - Bluebunch wheatgrass	MSdk/02

Map Symbol	SW1
Description	Grass-Forb
Present Limitations for Ungulates	-limited security/thermal cover -limited browse and forage potential on more dry site with exposed soil
Habitat Considerations	-xeric to subxeric moisture regime -limited soil nutrient levels -high mineral soil displacement and erosion hazard on moderate slopes -no timber value

HABITAT TREATMENT RECOMMENDATIONS

Rocky Mountain Bighorn Sheep	-introduce periodic low intensity burns approximately every 15 years (10 to 30 year range) to maintain ecosystem vigour -thin surrounding stands extending to adjacent escape terrain or along travel corridors -monitor and control human access
Mule Deer	-introduce periodic low intensity burns approximately every 15 years (10 to 30 year range) to maintain ecosystem vigour -retain adjacent travel corridors and thermal/security cover
White-tailed Deer	-infrequent use little benefit expected through treatments -same treatment as for mule deer is all that is required
Elk	-introduce periodic low intensity burns approximately every 15 years (10 to 30 year range) to maintain ecosystem vigour -retain adjacent travel corridors and thermal/security cover
Moose	-none practical -infrequent use will benefit from the treatment described for mule deer above
Marten	-none practical
Black Bear	-as above for mule deer -preserve areas supporting soopolallie and saskatoon but rejuvenate with periodic burns as prescribed above -preserve any existing CWD for anting
Grizzly Bear	-as above for black bear -in addition preserve areas supporting root crops

Map Unit	Description		BEC
LJ	Lodgepole pine - Juniper - Pinegrass		MSdk/03
Map Symbol	LJ1	LJ2	LJ3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-limited palatable graminoid and browse production -restricted security/thermal cover	-limited palatable graminoid and browse production -restricted security/thermal cover	-limited palatable graminoid and browse production -restricted security/thermal cover
Habitat Considerations	-xeric to submesic soils and limited nutrients -steep slopes prone to organic layer and mineral soil displacement and erosion hazard -mass wasting hazard on steep slopes -compaction hazard on silty soils	-xeric to submesic soils and limited nutrients -steep slopes prone to organic layer and mineral soil displacement and erosion hazard -mass wasting hazard on steep slopes -compaction hazard on silty soils	-xeric to submesic soils and limited nutrients -steep slopes prone to organic layer and mineral soil displacement and erosion hazard -mass wasting hazard on steep slopes -compaction hazard on silty soils
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-maintain approximately one third of LJ habitat type as Stage 1 targeted at historical range and areas adjacent escape terrain -in these areas use slashing and low intensity burns approximately every 25 years (15 to 35 year average) to maintain unit vigour and control forest ingrowth -thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control human access	-revert approximately one third of LJ habitat type to Stage 1 targeted at historical range and areas adjacent escape terrain -thin stands and use low intensity burns approximately every 25 years (15 to 35 year average) to maintain as vigorous Stage 1 units -thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control ingrowth of Fd and Pl as required through mechanical slashing and more frequent prescribed burns	-using partial cutting maintain approximately one third of LJ habitat type as Stage 1 targeted at historical range and areas adjacent escape terrain -use low intensity burns approximately every 25 years (15 to 35 year average) to maintain as vigorous Stage 1 units -thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control ingrowth of Fd and Pl as required through mechanical slashing and more frequent prescribed burns
Mule Deer	-maintain approximately one third of LJ type as Stage 1 where located on or adjacent steep broken slopes -where practical introduce low intensity burns approximately every 25 years (15 to 35 year average) to maintain unit vigour and control forest ingrowth -maintain travel corridors and patches of security/thermal cover -monitor and control human access	-thin stands and create openings of Stage 1 habitat especially where located on or adjacent steep broken slopes -on productive units introduce low intensity burns approximately every 25 years (15 to 35 year average) to maintain openness and improve ecosystem vigour -maintain travel corridors and patches of security/thermal cover -monitor and control human access	-use partial cutting to thin stands and create openings of Stage 1 habitat especially where located on or adjacent steep broken slopes -on productive open canopy units introduce low intensity ground fire approximately every 25 years (15 to 35 year average) to maintain openness and improve ecosystem vigour -maintain travel corridors and security/thermal cover -monitor and control human access
White-tailed Deer	-retain up to one third of the LJ habitat as Stage 1 in the form of small clearings (e.g. 2 ha) or larger openings with irregular edges -maintain travel corridors and patches of security/thermal cover	-create small openings of Stage 1 and larger openings with irregular edges -maintain travel corridors	-create small openings of Stage 1 and larger openings with irregular edges -maintain travel corridors
Elk	-as for mule deer above	-as for mule deer above	-as for mule deer above
Moose	-allow to succeed to shrub -maintain adjacent security/thermal cover and travel corridors -monitor and control human access	-create small openings of Stage 1 and larger openings with irregular edges -maintain adjacent travel corridors -monitor and control human access	-create small openings of Stage 1 and larger openings with irregular edges -maintain travel corridors -monitor and control human access
Marten	-allow to succeed to Stage 3 -preserve any existing CWD	-allow to succeed to Stage 3- -preserve CWD	-maintain as closed canopy Stage 3 and preserve understory -retain CWD
Black Bear	-retain Stage 1 habitat in a mosaic of structural stages -where practical introduce low intensity burns approximately every 25 years (15 to 35 year average) to maintain unit vigour and control forest ingrowth -maintain Stage 1 for anting, forb and soft mast crops -maintain travel corridors and security/thermal cover -retain any existing CWD for anting	-retain Stage 2 habitat in a mosaic of structural stages -where practical introduce low intensity burns approximately every 25 years (15 to 35 year average) to maintain unit vigour and control forest ingrowth -maintain Stage 1 for anting, forb and soft mast crops -maintain travel corridors	-create openings and irregular Stage 3/Stage 1 edge -where practical introduce low intensity burns approximately every 25 years (15 to 35 year average) to maintain unit vigour and control forest ingrowth -maintain Stage 1 for anting, forb and soft mast crops
Grizzly Bear	-as above for black bear	-as above for black bear	-as above for black bear

	-monitor and control human access	-monitor and control human access	-monitor and control human access

Map Unit	Description								BEC
LP	Lodgepole pine - Oregon grape - Pinegrass								MSdk/04
Map Symbol	LP1	LPk1	LPw1	LP2	LPk2	LPw2	LP3	LPk3	LPw3
Description	Grass-Forb/Shrub	Grass-Forb/Shrub on cool aspects	Grass-Forb/Shrub on warm aspects	Pole Sapling/Young Forest	Pole Sapling/Young Forest	Pole Sapling/Young Forest	Mature/ Old Forest	Mature/ Old Forest on cool slope	Mature/ Old Forest on warm slope
Present Limitations for Ungulates	-dominated by less palatable pinegrass	-dominated by less palatable pinegrass	-dominated by less palatable pinegrass	-dense Pl, poor palatable forage production	-dense Pl with low forage rates -mosses common	-dense Pl, poor palatable forage production	-poor palatable forage production -mainly pinegrass	-poor palatable forage production -mosses common	-poor palatable forage production -mainly pinegrass
Habitat Considerations	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients -high fuel loads	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients -high fuel loads	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients -high fuel loads	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients -high fuel loads	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients -high fuel loads	-organic/mineral layer displacement, mass wasting, erosion and compaction hazards -limited organic layer, dry cold soils and low nutrients -high fuel loads
HABITAT TREATMENT RECOMMENDATIONS									
Rocky Mountain Bighorn Sheep	-retain 1/3 of LP as Stage 1 in areas adjacent escape terrain -burn every 30 years on average -thin adjacent stands and travel corridors	-retain 1/3 of LP as Stage 1 in areas adjacent escape terrain -burn every 30 years on average -thin adjacent stands and travel corridors	-retain 1/3 of LP as Stage 1 in areas adjacent escape terrain -burn every 30 years on average -thin adjacent stands and travel corridors	-thin stands and create large openings where adjacent escape terrain -burn every 40 years on average -monitor/control human access	-thin stands and create large openings where adjacent escape terrain -burn every 40 years on average -monitor/control human access	-thin stands and create large openings where adjacent escape terrain -burn every 40 years on average -monitor/control human access	-thin stands to open canopy and create large openings where adjacent escape terrain -burn every 40 years on average -monitor/control human access	-thin stands to open canopy and create large openings where adjacent escape terrain -burn every 40 years on average -monitor/control human access	-thin stands to open canopy and create large openings where adjacent escape terrain -burn every 40 years on average -monitor/control human access
Mule Deer	-retain 1/3 of LP as Stage 1 on productive sites with adjacent steep broken terrain -burn every 30 years on average -retain security/ thermal cover and travel corridors -control access	-retain 1/3 of LP as Stage 1 on productive sites with adjacent steep broken terrain -burn every 30 years on average -retain security/ thermal cover and travel corridors -control access	-retain 1/3 of LP as Stage 1 on productive sites with adjacent steep broken terrain -burn every 30 years on average -retain security/ thermal cover and travel corridors -control access	-thin stands and create openings on productive sites with adjacent steep broken terrain -burn every 40 years on average -retain travel corridors -monitor/control human access	-lower priority -thin stands and create openings on productive sites -log and low intensity burn every 60 years on average -retain travel corridors -monitor/control human access	-thin stands and create openings on productive sites with adjacent steep broken terrain -burn every 40 years on average -retain travel corridors -monitor/control human access	-thin stands on productive sites with adjacent steep broken terrain -burn every 40 years on average -retain travel corridors -monitor/control human access	-lower priority -thin stands and create openings on productive sites -burn every 60 years on average -retain travel corridors -monitor/control human access	-thin stands on productive sites with adjacent steep broken terrain -burn every 40 years on average -retain travel corridors -monitor/control human access
White-tailed Deer	-retain 1/3 of LP as Stage 1 -use prescribed burns every 30 years on average -retain security/ thermal cover and travel corridors	-retain 1/3 of LP as Stage 1 -use prescribed burns every 30 years on average -retain security/ thermal cover and travel corridors	-retain 1/3 of LP as Stage 1 -use prescribed burns every 30 years on average -retain security/ thermal cover and travel corridors	-thin stands and create openings -burn sites every 40 years on average -retain travel corridors	-thin stands and create openings -burn sites every 60 years on average -retain travel corridors	-thin stands and create openings -burn sites every 40 years on average -retain travel corridors	-thin stands and create openings -burn sites every 40 years on average -retain travel corridors	-thin stands and create openings -burn sites every 60 years on average -retain travel corridors	-thin stands and create openings -burn sites every 40 years on average -retain travel corridors
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-allow to succeed to shrub -maintain adjacent forest cover and	-allow to succeed to shrub -maintain adjacent forest cover and	-allow to succeed to shrub -maintain adjacent forest cover and	-thin stands and create openings to promote browse production	-thin stands and create openings to promote browse production	-on productive sites thin stands and create openings to promote browse	-thin stands and create openings to promote browse production	-thin stands and create openings to promote browse production	-on productive sites thin stands and create openings to promote browse

	travel corridors	travel corridors	travel corridors			production			production

Map Unit	**Description**								**BEC**
LP	Lodgepole pine - Oregon grape - Pinegrass								MSdk/04
Map Symbol	LP1	LPk1	LPw1	LP2	LPk2	LPw2	LP3	LPk3	LPw3
Description	Grass-Forb/Shrub	Grass-Forb/Shrub on cool aspects	Grass-Forb/Shrub on warm aspects	Pole Sapling/Young Forest	Pole Sapling/Young Forest	Pole Sapling/Young Forest	Mature/ Old Forest	Mature/ Old Forest on cool slope	Mature/ Old Forest on warm slope
Marten	-allow to succeed to Stage 3 -retain all CWD	-allow to succeed to Stage 3 -retain all CWD	-allow to succeed to Stage 3 -retain all CWD	-allow to succeed to Stage 3 -retain all CWD	-allow to succeed to Stage 3 -retain all CWD	-allow to succeed to Stage 3 -retain all CWD	-retain as Stage 3 -retain dense understory/CWD	-retain as Stage 3 -retain dense understory/CWD	-retain as Stage 3 -retain dense understory/CWD
Black Bear	-create a mosaic of Stages -retain any CWD -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain any CWD -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain any CWD -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain any CWD -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain any CWD -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain any CWD -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain security/ thermal cover and travel corridors	-create a mosaic of Stages -retain any CWD -retain security/ thermal cover and travel corridors
Grizzly Bear	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	Description		BEC
SS	Hybrid white spruce - Soopolallie - Snowberry		MSdk/05
Map Symbol	SS1	SS2	SS3
Ecosystem Description	Grass-Forb/Shrub	Pole Sapling/Young	Mature/Old Forest
Present Limitations for Ungulates	-predator travel corridors	-stand density may impede locomotion and reduce forage/browse productivity -predator travel corridors	-high canopy closure may reduce forage/browse productivity -predator travel corridors
Habitat Considerations	-cold/air and soil temperatures -poor nutrient content on clay soils -organic layer displacement hazard on clay soils -compaction hazard on silty and clayey soils	-cold/air and soil temperatures -poor nutrient content on clay soils -organic layer displacement hazard on clay soils -compaction hazard on silty and clayey soils	-cold/air and soil temperatures -poor nutrient content on clay soils -organic layer displacement hazard on clay soils -compaction hazard on silty and clayey soils -wildlife trees potentially present
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-maintain in Stage 1 in areas adjacent escape terrain	-maintain open canopy where adjacent foraging and travel corridors	-maintain open understory where adjacent foraging and travel corridors
Mule Deer	-maintain a portion of the SS habitat type as Stage 1 -monitor and control human access	-thin and create openings to promote forage and browse production -preserve travel corridors -monitor and control human access	-create openings to promote forage and browse production -preserve travel corridors -monitor and control human access
White-tailed Deer	-thin to promote forage and browse production, and aid in predator detection	-thin to promote forage and browse production, and aid in predator detection	-as above for mule deer
Elk	-as above for mule deer	-thin to promote forage and browse production, and aid in predator detection	-as above for mule deer
Moose	-maintain a portion of the SS habitat type as Stage 1 -preserve travel corridors	-thin stands and create openings to promote browse production -preserve contiguous forest along travel corridors	-thin stands and create openings to promote browse production -preserve contiguous forest along travel corridors
Marten	-allow to succeed to Stage 3 -retain existing CWD	-allow to succeed to Stage 3 -retain existing CWD	-maintain as Stage 3 -preserve dense understory and CWD
Black Bear	-maintain a portion of SS habitat as Stage 1 creating edge with forest types -preserve travel corridors and adequate security cover	-create openings and a mosaic of cover types -preserve travel corridors	-create openings and a mosaic of cover types -preserve travel corridors
Grizzly Bear	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access

Map Unit	Description		BEC
SH	Hybrid white spruce - Dogwood - Horsetail		MSdk/06
Map Symbol	SH1	SH2	SH3
Description	Grass-Forb/Shrub	Pole Sapling/Young	Mature/Old Forest
Present Limitations for Ungulates	-dense tall shrub cover may negatively affect forage/browse production and predator detection -carnivore travel corridor	-dense tree/shrub regeneration may negatively affect forage production and predator detection -carnivore travel corridor	-dense understory may negatively affect forage/browse production and predator detection -carnivore travel corridor
Habitat Considerations	-riparian habitat -compaction hazard on silty soils -windthrow hazard	-riparian habitat -compaction hazard on silty soils -windthrow hazard	-riparian habitat -compaction hazard on silty soils -windthrow hazard -wildlife trees potentially present
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-monitor and control human access	-thin stands in areas used as travel routes or where adjacent foraging habitat -monitor and control human access	-maintain open understory and selectively log stands in areas used as travel routes or where adjacent foraging habitat -monitor and control human access
Mule Deer	-monitor and control human access	-thin and create openings to promote forage and browse production -preserve travel corridors -monitor and control human access	-selectively log to create small openings and promote forage and browse production -preserve travel corridors -monitor and control human access
White-tailed Deer	-monitor and control human access	-as above for mule deer	-as above for mule deer
Elk	-monitor and control human access	-as above for mule deer	-as above for mule deer
Moose	-maintain a portion of the SH habitat type as Stage 1 -preserve travel corridors	-thin stands and create openings to promote browse production -preserve contiguous forest along travel corridors	-selectively log to create openings and promote forage/browse production -preserve contiguous forest along travel corridors
Marten	-allow to succeed to Stage 3 -retain existing CWD	-allow to succeed to Stage 3 -retain existing CWD	-maintain as stage 3 -preserve CWD
Black Bear	-maintain a portion of SH habitat as Stage 1 creating edge with forest types -preserve travel corridors and adequate security cover	-create openings and a mosaic of cover types -preserve travel corridors	-maintain a mosaic of Stages -create openings to promote forb and berry productivity
Grizzly Bear	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access

Appendix XXVII. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC ESSFdk Wildlife Habitat Treatment Units. Present habitat limitations and considerations are provided for ungulates, and habitat treatment recommendations are included for ungulates, bears and marten, by dominant aspect class. Structural stages have been grouped into Group 1 (stages 1,2 & 3), Group 2 (stages 4 & 5) and Group 3 (stages 6 & 7).

Map Unit	**Description**					**BEC**
FA	Subalpine fir - Azalea - Foamflower					ESSFdk/01
Map Symbol	FA1, FAw1	FAk1	FA2, FAw2	FAk2	FA3, FAw3	FAk3
Description	Grass-Forb/Shrub gentle and warm slopes	Grass-Forb/Shrub cool aspect	Pole Sapling/Young Forest gentle and warm slopes	Pole Sapling/Young Forest cool aspect	Mature/Old Forest gentle and warm slopes	Mature/Old Forest warm aspect
Present Limitations for Ungulates	-rapid succession	-rapid succession -high moss cover potentially	-dense tree regen. negatively affects forage/browse production and predator detection	-dense tree regen. negatively affects forage/browse production and predator detection -high moss cover	-closed canopy and dense understory reduces forage/browse production	-closed canopy and dense understory reduces forage/browse production -high moss cover
Habitat Considerations	-soil compaction hazard on silty soils -mass wasting hazard on steep slopes -cool air/soil temperatures	-soil compaction hazard on silty soils -mass wasting hazard on steep slopes -cold air/soil temperatures	-soil compaction hazard on silty soils -mass wasting hazard on steep slopes -cool air/soil temperatures	-soil compaction hazard on silty soils -mass wasting hazard on steep slopes -cold air/soil temperatures	-soil compaction hazard on silty soils -mass wasting hazard on steep slopes -cool air/soil temperatures	-soil compaction hazard on silty soils -mass wasting hazard on steep slopes -cold air/soil temperatures
HABITAT TREATMENT RECOMMENDATIONS						
Rocky Mountain Bighorn Sheep	-in areas adjacent to escape terrain maintain large portions of FA habitat as Stage 1 meadows and thin surrounding stands -monitor/control human access	-typically poor forage -in areas adjacent to escape terrain maintain as Stage 1 and thin surrounding stands	-in areas adjacent to escape terrain create large openings through slashing -thin surrounding stands -monitor/control human access	-thin stands and reduce underbrush when adjacent to escape terrain	-in areas adjacent to escape terrain log to create Stage 1 habitat -reduce understory by slashing to improve visibility and promote forage production -monitor/control access	-log and thin stands in areas adjacent to escape terrain -may require removal of understory by slashing to improve visibility
Mule Deer	-when adjacent steep open broken terrain maintain large portions of FA habitat in Stage 1 -monitor/control human access	-generally high moss cover and little forage/browse -in less steep areas create openings to promoite forage/browse production	-create large openings to promote forage production -retain security/thermal cover -monitor/control human access	-on less steep slopes create openings to promote forage/browse production	-log to create large openings to promote forage/browse production -retain security/thermal cover -monitor/control human access	-on less steep slopes create openings to promote forage/browse production
White-tailed Deer	-retain large portions of the FA habitat in Stage 1 -create a mosaic of slaller openings and closed canopy forest -preserve adjacent riparian corridors	-generally high moss cover and little forage/browse -in less steep areas create openings to promoite forage/browse production	-create a mosaic of smaller openings and closed canopy forest -preserve adjacent riparian corridors	-on less steep slopes create openings to promote forage/browse production	-log to create a mosaic of small openings for forage/browse and closed canopy forest for cover -preserve adjacent riparian corridors	-on less steep slopes create openings to promote forage/browse production
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-maintain a large portion of FA habitat in Stage 1 and retain adjacent secuirty/thermal cover -preserve travel corridors -monitor/control human	-on less steep andmore productive sites create openings to increase browse availability	-create a mosaic of openings and closed forest -preserve travel corridors -monitor/control human access	-on less steep and more productive sites create openings to increase browse availability	-log to create a mosaic of openings and closed forest -preserve travel corridors -monitor/control human access	-on less steep and more productive sites log to create openings and increase browse availability

	access					

Map Unit	Description					BEC
FA	Subalpine fir - Azalea - Foamflower					ESSFdk/01
Map Symbol	FA1, FAw1	FAk1	FA2, FAw2	FAk2	FA3, FAw3	FAk3
Description	Grass-Forb/Shrub gentle and warm slopes	Grass-Forb/Shrub cool aspect	Pole Sapling/Young Forest gentle and warm slopes	Pole Sapling/Young Forest cool aspect	Mature/Old Forest gentle and warm slopes	Mature/Old Forest warm aspect
Marten	-allow to succeed to Stage 3	-allow to succeed to Stage 3	-allow to succeed to Stage 3 -retain CWD	-allow to succeed to Stage 3 -retain CWD	-preserve as Stage 3 -retain dense understory and CWD	-preserve as Stage 3 -retain dense understory and CWD
Black Bear	-maintain a portion of mesic sites as Stage 1 for succulents and forage diversity	-on less steep and more productive sites create openings to increase forb/berry availability	-create openings to promote vegetation diversity and berry and forb production	-on less steep and more productive sites create openings to increase forb/berry availability	-create openings to promote vegetation diversity and berry and forb production	-on less steep and more productive sites create openings to increase forb/berry availability
Grizzly Bear	-as above for black bear -preserve site supporting glacier lily -retain contiguous cover along riparian corridors -monitor/control human access	-as above for black bear -preserve site supporting glacier lily -retain contiguous cover along riparian corridors -monitor/control human access	-as above for black bear -preserve site supporting glacier lily -retain contiguous cover along riparian corridors -monitor/control human access	-as above for black bear -preserve site supporting glacier lily -retain contiguous cover along riparian corridors -monitor/control human access	-as above for black bear -preserve site supporting glacier lily -retain contiguous cover along riparian corridors -monitor/control human access	-as above for black bear -preserve site supporting glacier lily -retain contiguous cover along riparian corridors -monitor/control human access

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	Description		BEC
DM	Douglas-fir - Douglas maple -Soopolallie		ESSFdk/02
Map Symbol	DM1	DM2	DM3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-lack of forage and browse -limited security/thermal cover -habitat exclusion on steep inaccessible slopes	-lack of forage and browse -limited security/thermal cover -habitat exclusion on steep inaccessible slopes	-lack of forage and browse -limited security/thermal cover -habitat exclusion on steep inaccessible slopes
Habitat Considerations	-xeric to subxeric shallow soils -organic and mineral layer displacement hazard -erosion and mass wasting hazard on steep slopes -conserve thin organic layers	-xeric to subxeric shallow soils -organic and mineral layer displacement hazard -erosion and mass wasting hazard on steep slopes -conserve thin organic layers	-xeric to subxeric shallow soils -organic and mineral layer displacement hazard -erosion and mass wasting hazard on steep slopes -conserve thin organic layers
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-control ingrowth of Fd and maintain ecosytem vigour by introducing low intensity early spring burns every 20-25 years	-control ingrowth of Fd and maintain ecosytem vigour by introducing low intensity early spring burns every 20-25 years	-maintain open staucture and control ingrowth of Fd and maintain ecosytem vigour by introducing low intensity early spring burns every 20-25 years
Mule Deer	-as above for bighorn sheep	-as above for bighorn sheep	-as above for bighorn sheep
White-tailed Deer	-none practical	-none practical	-none practical
Elk	-as above for bighorn sheep	-as above for bighorn sheep	-as above for bighorn sheep
Moose	-none practical	-none practical	-none practical
Marten	-none practical	-none practical	-none practical
Black Bear	-control ingrowth of Fd and maintain ecosytem vigour by introducing low intensity early spring burns every 20-25 years -preserve available security/thermal cover and travel corridors along gullies -preserve areas of bearberry, saskatoon and soopallalie production	-control ingrowth of Fd and maintain ecosytem vigour by introducing low intensity early spring burns every 20-25 years -preserve available security/thermal cover and travel corridors along gullies -preserve areas of bearberry, saskatoon and soopallalie production and stands of whitebark pine	-control ingrowth of Fd and maintain ecosytem vigour by introducing low intensity early spring burns every 20-25 years -preserve available security/thermal cover and travel corridors along gullies -preserve areas of bearberry, saskatoon and soopallalie production and stands of whitebark pine
Grizzly Bear	-as above for black bear -preserve any areas supporting good production of root crops	-as above for black bear -preserve any areas supporting good production of root crops	-as above for black bear -preserve any areas supporting good production of root crops

Map Unit	**Description**					**BEC**
FG	Subalpine fir - Azalea - Grouseberry					ESSFdk/03
Map Symbol	FG1	FGw1	FG2	FGw2	FG3	FGw3
Description	Grass-Forb/Shrub	Grass-Forb/Shrub warm aspect	Pole Sapling/Young Forest	Pole Sapling/Young Forest warm aspect	Mature/Old Forest	Mature/Old Forest warm aspect
Present Limitations for Ungulates	-none	-sparse vegetation -large areas which lack security/thermal cover -high moss cover	-dense Bl regeneration limits availability of palatable browse/forage -poor visibility -high moss cover	-potentially dense Bl regeneration -poor visibility -high moss cover	-high canopy closure and dense Bl in understory limits availability of palatable browse/forage -poor visibility -high moss cover	-potentially high canopy closure and dense Bl in understory may reduce cover of palatable browse/forage -poor visibility -high moss cover
Habitat Considerations	-thin organic layers with displacement hazard -cold soil/air temperatures, and low nutrient levels retard plant growth	-thin organic layers with displacement hazard -cool soil/air temperatures, and low nutrient levels retard plant growth	-thin organic layers with displacement hazard -cold soil/air temperatures, and low nutrient levels retard plant growth	-thin organic layers with displacement hazard -cool soil/air temperatures, and low nutrient levels retard plant growth	-thin organic layers with displacement hazard -cold soil/air temperatures, and low nutrient levels retard plant growth	-thin organic layers with displacement hazard -cool soil/air temperatures, and low nutrient levels retard plant growth
HABITAT TREATMENT RECOMMENDATIONS						
Rocky Mountain Bighorn Sheep	-none	-create large openings of Stage1 adjacent to escape terrain -thin surrounding stands extending to escape terrain to ensure good visibility -introduce prescribed burns every 20 years to maintain forage production -monitor and control access	-none	-create large openings of Stage 1 adjacent to escape terrain -introduce prescribed burns every 20 years to maintain forage production -thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control human access	-none	-log to create large openings of Stage 1 adjacent to escape terrain -introduce prescribed burns every 20 years to maintain forage production -thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control access
Mule Deer	-on less steep and more productive sites maintain areas of Stage 1 -retain adjacent security/ thermal cover and corridors	-retain approximately 1/3 of FG habitat on warm slopes as Stage 1 -introduce prescribed burns for newly harvested areas -reintroduce burns into Stage 1 areas on historical winter range every 20 years -retain patches of security/ thermal cover and travel corridors	-on productive sites create openings to increase forage/browse production -preserve security/thermal cover and travel corridors	-on productive sites create openings to increase forage/browse production -preserve security/thermal cover and travel corridors	-log to create openings to increase forage/browse production -preserve security/thermal cover and travel corridors	-log to create openings to increase forage/browse production -preserve security/thermal cover and travel corridors
White-tailed Deer	-maintain a mosaic of Stage 1 through harvesting and possibly periodic burns of logged areas -retain adjacent security/thermal cover and corridors	-maintain a mosaic of Stage 1 through harvesting and possibly periodic burns of logged areas -retain adjacent security/thermal cover and corridors	-on productive sites create openings to increase forage/browse production -preserve security/thermal cover and travel corridors	-on productive sites create openings to increase forage/browse production -preserve security/thermal cover and travel corridors	-log to create openings to increase forage/browse production -preserve security/thermal cover and travel corridors	-maintain stands of Stage 3 for forage diversity and for security/thermal cover
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-allow to succeed to shrub stage -retain adjacent security/	-allow to succeed to shrub stage -retain adjacent security/	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer

	thermal cover and travel corridors	thermal cover and travel corridors				
Map Unit	**Description**					**BEC**
FG	Subalpine fir - Azalea - Grouseberry					ESSFdk/03
Map Symbol	FG1	FGw1	FG2	FGw2	FG3	FGw3
Description	Grass-Forb/Shrub	Grass-Forb/Shrub warm aspect	Pole Sapling/Young Forest	Pole Sapling/Young Forest warm aspect	Mature/Old Forest	Mature/Old Forest warm aspect
Marten	-allow to succeed to Stage 3 -retain existing CWD	-allow to succeed to Stage 3 -retain existing CWD	-allow to succeed to Stage 3 -retain existing CWD	-allow to succeed to Stage 3 -retain existing CWD	-maintain as Stage 3 -retain existing CWD	-maintain as Stage 3 -retain existing
Black Bear	-create a mosaic of Stages -preserve security/thermal cover and travel corridors	-create a mosaic of Stages and maintain a higher proportion of Stage 1 on warm slopes -retain CWD for anting -preserve security/thermal cover and travel corridors	-none	-create openings of Stage 1 and maintain a higher proportion of Stage 1 on warm slopes -retain CWD for anting -preserve security/thermal cover and travel corridors	-create openings of Stage 1 through logging -preserve security/thermal cover and travel corridors	-log to create openings of Stage 1 and maintain a higher proportion of Stage 1 on warm slopes -retain CWD for anting -preserve security/thermal cover and travel corridors
Grizzly Bear	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access	-as above for black bear -monitor and control human access

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	**Description**		**BEC**
FM	Subalpine fir - Azalea - Stepmoss		ESSFdk/05
Map Symbol	FM1	FM2	FM3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-carnivore travel corridor -high moss cover	-dense tree regen. negatively affects forage/browse production and predator detection -high moss cover -carnivore travel corridor	-closed canopy and dense understory reduces forage/browse production -high moss cover -carnivore travel corridor
Habitat Considerations	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard -cold air/soil temperatures	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard -cold air/soil temperatures	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard -cold air/soil temperatures -riparian habitat
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control human access	-create openings of Stage1 adjacent to escape terrain -thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control human access	-selectively log and thin stands in areas adjacent to escape terrain -monitor and control human access
Mule Deer	-maintain a portion of the FM habitat in Stage 1 focussed on those units adjacent to steep open slopes -monitor and control human access	-create openings in those units adjacent to steep open slopes to promote forage production -monitor and control human access	-selectively log to create openings in those units adjacent to steep open slopes to promote forage production -monitor and control human access
White-tailed Deer	-maintain a portion of the FM habitat in Stage 1 -preserve adjacent riparian corridors	-create openings of Stage 1 habitat to promote forage/browse production -preserve adjacent riparian corridors	-selectively log to create openings of Stage 1 habitat to promote forag/browse production -preserve adjacent riparian corridors
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-maintain as Stage 1 -preserve adjacent cover and travel corridors	-create openings of Stage 1 habitat to promote forage/browse production	-selectively log to create openings of Stage 1 habitat to promote forage/browse production
Marten	-allow to succeed to Stage 3	-allow to succeed to Stage 3	-preserve as Stage 3
Black Bear	-maintain a portion of the FM habitat in Stage 1 -preserve adjacent riparian corridors	-create openings of Stage 1 habitat to promote forage/browse production -preserve adjacent riparian corridors	-selectively log to create openings of Stage 1 habitat to promote forag/browse production -preserve adjacent riparian corridors
Grizzly Bear	-as above for black bear	-as above for black bear	-as above for black bear

Map Unit	Description		BEC
FH	Subalpine fir - Azalea - Horsetail		ESSFdk/06
Map Symbol	FH1	FH2	FH3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-carnivore travel corridor	-dense tree regen. negatively affects forage/browse production and predator detection -high moss cover -carnivore travel corridor	-closed canopy and dense understory reduces forage/browse production -high moss cover -carnivore travel corridor
Habitat Considerations	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard -cold air/soil temperatures -riparian habitat	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard -cold air/soil temperatures -riparian habitat	-soil compaction hazard on silty and clayey soils -organic layer displacement hazard -cold air/soil temperatures -windthrow hazard -riparian habitat
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control human access	-create openings of Stage1 adjacent to escape terrain -thin surrounding stands extending to escape terrain to ensure good visibility -monitor and control human access	-selectively log and thin stands in areas adjacent to escape terrain -monitor and control human access
Mule Deer	-maintain a portion of the FH habitat in Stage 1 focussed on those units adjacent to steep open slopes -monitor and control human access	-create openings in those units adjacent to steep open slopes to promote forage production -monitor and control human access	-selectively log to create openings in those units adjacent to steep open slopes to promote forage production -monitor and control human access
White-tailed Deer	-maintain a portion of the FH habitat in Stage 1 -preserve adjacent riparian corridors	-create openings of Stage 1 habitat to promote forage/browse production -preserve adjacent riparian corridors	-selectively log to create openings of Stage 1 habitat to promote forag/browse production -preserve adjacent riparian corridors
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-maintain as Stage 1 -preserve adjacent cover and travel corridors	-create openings of Stage 1 habitat to promote forage/browse production	-selectively log to create openings of Stage 1 habitat to promote forage/browse production
Marten	-allow to succeed to Stage 3	-allow to succeed to Stage 3	-preserve as Stage 3
Black Bear	-maintain a portion of the FH habitat in Stage 1 -preserve areas supporting dense cover of horsetail for early spring foraging -preserve adjacent riparian corridors	-create openings of Stage 1 habitat to promote forage/browse production -preserve areas supporting dense cover of horsetail for early spring foraging -preserve adjacent riparian corridors	-selectively log to create openings of Stage 1 habitat to promote forag/browse production -preserve areas supporting dense cover of horsetail for early spring foraging -preserve adjacent riparian corridors
Grizzly Bear	-as above for black bear	-as above for black bear	-as above for black bear

Appendix XXVIII. Galton Range bioterrain and ecosystem mapping project expanded legend to the BEC ESSFdku Wildlife Habitat Treatment Units. Present habitat limitations and considerations are provided for ungulates, and habitat treatment recommendations are included for ungulates, bears and marten, by dominant aspect class. Structural stages have been grouped into Group 1 (stages 1,2 & 3), Group 2 (stages 4 & 5) and Group 3 (stages 6 & 7).

Map Unit	Description	BEC
FG	Subalpine fir - Grouseberry	ESSFdku/(01[a])

Map Symbol	FG1	FG2	FGw2	FG3	FGw3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Pole Sapling/Young Forest warm aspect	Mature/Old Forest	Mature/Old Forest
Present Limitations for Ungulates	-generally limited forage and browse available -habitat exclusion through winter period due to significant snow packs -lacks security/thermal cover	-generally limited forage and browse available -habitat exclusion through winter period due to significant snow packs	-frequently limited forage and browse available -may have limited security/thermal cover	-generally limited forage and palatable browse available -habitat exclusion through winter period due to significant snow packs	-frequently limited forage and browse available -may have limited security/thermal cover
Habitat Considerations	-shallow soils sensitive to disturbance -wide moisture range extending to subxeric conditions in summer -late spring melt and cool soils retard plant growth	-shallow soils sensitive to disturbance -wide moisture range extending to subxeric conditions in summer -late spring melt and cool soils retard plant growth	-exposed shallow soils sensitive to disturbance -wide moisture range extending to subxeric conditions in summer -soil conditions and climatic extremes result in slow plant recolonization and stunted growth -may provide snow free habitat in winter	-shallow soils sensitive to disturbance -wide moisture range with subxeric conditions in summer - late spring melt and cool soils retard plant growth	-exposed shallow soils sensitive to disturbance -wide moisture range extending to subxeric conditions in summer -soil conditions and climatic extremes result in slow plant recolonization and stunted growth -may provide snow free habitat in winter
HABITAT TREATMENT RECOMMENDATIONS					
Rocky Mountain Bighorn Sheep	-preserve organic materials and limit fire to light burns on the deeper soils and mesic slopes	-thin dense stands adjacent to escape terrain and along travel corridors -preserve organic materials and limit fire to light burns on the deeper soils and mesic slopes	-thin dense stands adjacent to escape terrain and along travel corridors -preserve organic materials and limit fire to light burns on the deeper soils	-thin dense stands adjacent to escape terrain and along travel corridors -preserve organic materials and limit fire to light burns on the deeper soils and mesic slopes	-thin dense stands adjacent to escape terrain and along travel corridors -preserve organic materials and limit fire to light burns
Mule Deer	-preserve organic materials and limit fire to light burns on the deeper soils and mesic slopes	-preserve organic materials and limit fire to light burns on the deeper soils and mesic slopes	-preserve organic materials and limit fire to light burns on the deeper soils	-preserve organic materials and limit fire to light burns on the deeper soils and mesic slopes	-preserve organic materials and limit fire to light burns
White-tailed Deer	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Marten	-allow to succeed to old growth -preserve CWD	-allow to succeed to old growth -preserve CWD	-allow to succeed to old growth -preserve CWD	-retain dense understory -preserve CWD/wildlife trees	-retain dense understory -preserve CWD/wildlife trees
Black Bear	-as above for mule deer -maintain a mosaic of Stage 1 for forbs and berries	-as above for mule deer -create a mosaic of Stages for forb and berry production -preserve whitebark pine	-as above for mule deer -create a mosaic of Stages for forb and berry production -preserve whitebark pine	-as above for mule deer -create a mosaic of Stages for forb and berry production -preserve whitebark pine	-as above for mule deer -create a mosaic of Stages for forb and berry production -preserve whitebark pine
Grizzly Bear	-as above for black bear -preserve sites supporting glacier lily	-as above for black bear -preserve sites supporting glacier lily	-as above for black bear -preserve sites supporting glacier lily	-as above for black bear -preserve sites supporting glacier lily	-as above for black bear -preserve sites supporting glacier lily

[a] Proposed un-correlated site series designation.

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	Description	BEC
PJ	Open whitebark pine/Subalpine fir - Common juniper - Grouseberry	ESSFdku/(02) [a]

Map Symbol	PJ1	PJ2	PJ3
Description	Sparsely vegetated/Grass-forb/Shrub	Open Pole Sapling/Young Forest	Open Mature/Old Forest
Present Limitations for Ungulates	-very steep and rugged terrain -very limited forage and browse -lack of security cover	-very steep and rugged terrain -very limited forage and browse -lack of security cover	-very steep and rugged terrain -very limited forage and browse -lack of security cover
Habitat Considerations	-thin soils and inoperable slopes -sparsely vegetated -extreme environmental conditions restrict plant growth -no/negligible timber values	-thin soils and inoperable slopes -sparsely vegetated -extreme environmental conditions restrict plant growth -no/negligible timber values	-thin soils and inoperable slopes -sparsely vegetated -extreme environmental conditions restrict plant growth -no/negligible timber values
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-generally no treatments required -preserve as escape terrain -thin adjacent stands and enhance forage production -introduce controlled low intensity burns as required to control Fd growth	-generally no treatments required -preserve as escape terrain -thin adjacent stands and enhance forage production -introduce controlled low intensity burns as required to control Fd growth	-generally no treatments required -preserve as escape terrain -thin adjacent stands and enhance forage production -introduce controlled low intensity burns as required to control Fd growth
Mule Deer	-generally no treatments required -introduce controlled low intensity burns as required to control Fd growth	-generally no treatments required -introduce controlled low intensity burns as required to control Fd growth	-generally no treatments required -introduce controlled low intensity burns as required to control Fd growth
White-tailed Deer	-none practical	-none practical	-none practical
Elk	-as above for mule deer -infrequent use	-as above for mule deer -infrequent use	-as above for mule deer -infrequent use
Moose	-none practical	-none practical	-none practical
Marten	-none practical	-none practical	-none practical
Black Bear	-none practical	-none practical	-none practical
Grizzly Bear	-generally no treatments required -introduce controlled low intensity burns as required to control Fd growth	-generally no treatments required -introduce controlled low intensity burns as required to control Fd growth	-generally no treatments required -introduce controlled low intensity burns as required to control Fd growth

[a] Proposed un-correlated site series designation.

Map Unit	Description	BEC
PB	Subalpine fir/Whitebark pine - Beargrass - Grouseberry	ESSFdku/(03) [a]

Map Symbol	PB1	PB2	PB3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-limited palatable forage and browse available -habitat exclusion through winter period due to snow packs	-limited palatable forage and browse available -habitat exclusion through winter period due to snow packs	-limited palatable forage and browse available -habitat exclusion through winter period due to snow packs
Habitat Considerations	-shallow soils sensitive to disturbance -large seasonal range in moisture conditions extending to xeric in summer -late spring melt and cool spring soils may retard plant growth -no/negligible timber values	-shallow soils sensitive to disturbance -large seasonal range in moisture conditions extending to xeric in summer -late spring melt and cool spring soils may retard plant growth -no/negligible timber values	-shallow soils sensitive to disturbance -large seasonal range in moisture conditions extending to xeric in summer -late spring melt and cool spring soils may retard plant growth -no/negligible timber values
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites	-thin dense stands adjacent to escape terrain and along travel corridors -preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -maintain areas of traditional winter range in Stage 1 through slashing and controlled burns	-thin Bl in understory to open stands for visibility where adjacent to escape terrain and along travel corridors -preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -maintain areas of traditional winter range in Stage 1 through slashing and controlled burns
Mule Deer	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -maintain areas of traditional winter range in Stage 1 through slashing and controlled burns	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -maintain areas of traditional winter range in Stage 1 through slashing and controlled burns
White-tailed Deer	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-as above for mule deer	-as above for mule deer	-as above for mule deer
Marten	-allow to succeed to old growth -preserve CWD	-allow to succeed to old growth -preserve CWD	-retain dense understory -preserve CWD/wildlife trees
Black Bear	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -maintain a mosaic of Stage 1 for forbs and berries -retain CWD for anting	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -create a mosaic of Stages for forb and berry production -preserve whitebark pine and CWD	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -create a mosaic of Stages for forb and berry production -preserve whitebark pine and CWD
Grizzly Bear	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops

[a] Proposed un-correlated site series designation.

Map Unit	Description	BEC
WG	Whitebark pine - Grouseberry	ESSFdku/(04) [a]

Map Symbol	WG1	WG2	WGk2	WG3	WGk3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Pole Sapling/Young Forest on cool aspect	Mature/Old Forest	Mature/Old Forest on cool aspect
Present Limitations for Ungulates	-limited forage and browse available -may be habitat exclusion in winter period due to snow packs	-limited palatable forage and browse available -may be habitat exclusion in winter period due to snow packs	-limited palatable forage and browse available -habitat exclusion through winter period due to snow packs	-limited palatable forage and browse available -may be habitat exclusion in winter period due to snow packs	-limited palatable forage and browse available -habitat exclusion through winter period due to snow packs
Habitat Considerations	-shallow soils sensitive to disturbance -submesic to subxeric soils -vegetation stressed by wind and insolation exposure -no/negligible timber values	-shallow soils sensitive to disturbance -submesic to subxeric soils -vegetation stressed by wind and insolation exposure -no/negligible timber values	-shallow soils sensitive to disturbance -submesic soils -vegetation stressed by wind and insolation exposure -no/negligible timber values	-shallow soils sensitive to disturbance -submesic to subxeric soils -vegetation stressed by wind and insolation exposure -no/negligible timber values	-shallow soils sensitive to disturbance -submesic soils -vegetation stressed by wind and insolation exposure -no/negligible timber values
HABITAT TREATMENT RECOMMENDATIONS					
Rocky Mountain Bighorn Sheep	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider light prescribed burns on historical winter range (i.e site devoid of snow in late winter)	-thin dense stands adjacent to escape terrain and along travel corridors -preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider light prescribed burns on historical winter range	-thin dense stands adjacent to escape terrain and along travel corridors -preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites	-thin understory to open stands for visibility where adjacent to escape terrain and along travel corridors -preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider light prescribed burns on historical winter range	-thin Bl in understory to open stands for visibility where adjacent to escape terrain and along travel corridors -preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites
Mule Deer	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider light prescribed burns on historical winter range	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider light prescribed burns on historical winter range	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider light prescribed burns on historical winter range	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider light prescribed burns on historical winter range
White-tailed Deer	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider benefit of slashing/controlled burns on productive sites	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -consider benefit of slashing/controlled burns on productive sites
Marten	-allow to succeed to old growth -preserve CWD	-allow to succeed to old growth -preserve CWD	-allow to succeed to old growth -preserve CWD	-retain dense understory -preserve CWD/wildlife trees	-retain dense understory -preserve CWD/wildlife trees
Black Bear	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -create a mosaic of Stages for forb and berry production	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -create a mosaic of Stages for forb and berry production	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -create a mosaic of Stages for forb and berry production	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -create a mosaic of Stages for forb and berry production	-preserve organic materials and limit natural ignition fire to low intensity burns on the more deeper soils and mesic sites -create a mosaic of Stages for forb and berry production

	-preserve whitebark pine and CWD	-preserve whitebark pine and CWD	-preserve whitebark pine and CWD	-preserve whitebark pine and CWD	-preserve whitebark pine and CWD

Map Unit	**Description**	**BEC**
WG	Whitebark pine - Grouseberry	ESSFdku/(04) [a]

Map Symbol	WG1	WG2	WGk2	WG3	WGk3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Pole Sapling/Young Forest on cool aspect	Mature/Old Forest	Mature/Old Forest on cool aspect
Grizzly Bear	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops	-as above for black bear -preserve sites supporting yellow glacier lily and other root/corm crops

[a] Proposed un-correlated site series designation.

Modifiers: w = warm aspect (135 - 285 , slope >25%); k = cool aspect (285 - 135 , slope >25%)

Map Unit	Description	BEC
HG	Subalpine fir - Pink mountain-heather	ESSFdku/(05[a])

Map Symbol	FG1	FG2	FG3
Description	Grass-Forb/Shrub	Pole Sapling/Young Forest	Mature/Old Forest
Present Limitations for Ungulates	-habitat exclusion through winter period due to significant snow packs	-habitat exclusion through winter period due to significant snow packs	-habitat exclusion through winter period due to significant snow packs
Habitat Considerations	-localized with limited areal extent -steep slope hazards for road construction -prone to avalanching and largely maintained as krummholz -late spring melt and cool soils retard plant growth	-localized with limited areal extent -steep slope hazards for road construction -prone to avalanching and largely maintained as krummholz -late spring melt and cool soils retard plant growth	-localized with limited areal extent -steep slope hazards for road construction -prone to avalanching and seldom succeeding to Stage 3 -late spring melt and cool soils retard plant growth
HABITAT TREATMENT RECOMMENDATIONS			
Rocky Mountain Bighorn Sheep	-generally not practical due to limited extent -maintain organic material	-generally not practical due to limited extent -maintain organic material	-generally not practical due to limited extent -maintain organic material
Mule Deer	-generally not practical due to limited extent -maintain organic material	-generally not practical due to limited extent -maintain organic material	-generally not practical due to limited extent -maintain organic material
White-tailed Deer	-infrequent use; no treatment required	-infrequent use; no treatment required	-infrequent use; no treatment required
Elk	-as above for mule deer	-as above for mule deer	-as above for mule deer
Moose	-as above for mule deer -avalanching maintains sites naturally	-as above for mule deer -avalanching maintains sites naturally	-as above for mule deer -avalanching maintains sites naturally
Marten	-allow to succeed to old growth -preserve CWD	-allow to succeed to old growth -preserve CWD	-retain dense understory -preserve CWD/wildlife trees
Black Bear	-generally not practical due to limited extent -maintain organic material -avalanching maintains sites naturally	-generally not practical due to limited extent -maintain organic material -avalanching maintains sites naturally	-generally not practical due to limited extent -maintain organic material -avalanching maintains sites naturally
Grizzly Bear	-as above for black bear -preserve sites supporting glacier lily	-as above for black bear -preserve sites supporting glacier lily	-as above for black bear -preserve sites supporting glacier lily
Comments: The HG habitat type made up only a minor component of polygons(ie. < 10%) and none was actually mapped.			

[a] Proposed un-correlated site series designation.

Appendix XXIX. Summary database of Visual Inspection Plots completed for the Galton Range study area.

Appendix XXX. Summary database of Detailed Plots completed for the Galton Range study area.

Appendix XXXI. Abbreviated version of the Bioterrain and Ecosystem Map polgon database for the Galton Range study area.

Appendix XXXII. Map legend for bioterrain mapping completed for the Galton Range study area.

Map Symbol	**Terrain Unit**	**Principal Texture (After B.C. Terrain Classification System)**	**Terrain Unit Thickness**	Topography	**Soil Drainage**	**Slope Class (After Howes and Kenk,1988)***
Ov	Organic Veneer	Peat and Fen	<1 m	Takes Form of Underlying Surface	Poorly Drained	1
Ev	Eolian Veneer	Very Fine Sand and Silt	<1 m	Takes Form of Underlying Surface	Well to Moderately Well Drained	1
Cv	Colluvial Veneer	Matrix is Silty Sand or Sandy Silt; Also has Rock Fragments (Rubble)	20 cm to 1 m	Takes Form of Underlying Surface	Well Drained Over Rock and Gravel; Moderately Well Drained to Imperfectly Drained When Overlying Fine Grained Material	2 to 5
Cx	Thin Colluvial Veneer	Matrix is Silty Sand or Sandy Silt; Also has Rock Fragments (Rubble)	2 - 20 cm	Takes Form of Underlying Surface	Well Drained	2 to 4
Cb	Colluvial Blanket	Matrix is Silty Sand or Sandy Silt; Also has Rock Fragments (Rubble).	>1 m (usually <3 m)	Takes Form of Underlying Surface	Well Drained Over Rock and Gravel; Moderately Well Drained to Imperfectly Drained When Overlying Fine Grained Material	2 to 4
Cf	Colluvial Fan	Rock Rubble (Angular Fragments); Some Fine Matrix	>5 m	Fan; Moderately Steep Slope	Well Drained	3 to 4
Ca	Colluvial Apron (Coales-cing Colluvial Fans)	Rock Rubble (Angular Fragments); Some Fine Matrix	>5 m	Apron	Well Drained	3 to 4
Ck	Thick Colluvium on Moderately Steep Slope	Rock Rubble (Angular Fragments); Some Fine Matrix	>5 m	Variable Moderately Steep Slopes	Well Drained	4
Us	Undiffer-entiated Slope	Layered Sequence of Several Types of Unconsolidated Material	>5 m (up to 100 m)	Steep Erosional Slopes Along Terraces and Riverbanks	Usually Well Drained at Surface, but can have Saturated Subsurface Horizons	5
RS	Debris Slide	Highly Variable (Dependant on Source Material); Ranges from Fine Grained to Coarse Rock Rubble	>5 m	Uneven Slide Surface	Well to Imperfectly Drained	3 to 4
LS	Landslide	Angular Rock Rubble	1 to 5 m	Uneven Slide Surface	Well drained	4
Rt	Debris Torrent Gully	Variable amounts of Coarse Debris	Variable	Gully	Well Drained	3 to 5
Lv	Lacustrine Veneer	Silt, Sand and Clay	<1 m	Takes Form of Underlying Surface	Moderately Well to Poorly Drained	1
Lb	Lacustrine Blanket (Recent)	Silt, Clay & Sand	>1 m (usually <3 m)	Takes Form of Underlying Surface	Moderately Well to Poorly Drained	1 to 3
Lp	Lacustrine Plain (Recent)	Silt, Clay & Sand	>5 m	Flat to Gently Undulating	Moderately Well to Poorly Drained	1 to 2
Fb	Fluvial Blanket (Recent)	Gravel (Rounded to Subrounded), Sand & Fines	>1 m (usually <3 m)	Takes Form of Underlying Surface	Well Drained	1 to 2
Fp	Fluvial Plain (Recent)	Gravel (Rounded to Subrounded), Sand & Fines	>1 m (usually >5 m)	Flat to Gently Undulating	Well to Poorly Drained	1

Ft	Fluvial Terrace (Recent)	Gravel (Rounded to Subrounded), Sand & Fines	>1 m (usually >5 m)	Flat to Gently Undulating	Well Drained	1
Ff	Fluvial Fan (Recent)	Gravel (Rounded to Subrounded), Sand & Fines, Some Boulders and Cobbles	>1 m (usually <3 m)	Gently Sloping	Well Drained but some Water-Saturated Zones	1 to 2
$F^{G}b$	Glacio-fluvial blanket	Gravel (Rounded to Subrounded); Some Sand (possible Morainal Deposits at Depth)	>1 m (usually <3 m)	Takes Form of Underlying Surface	Well Drained	1 to 2
$F^{G}t$	Glacio-fluvial Terrace	Gravel (Rounded to Subrounded); Some Sand (possible Morainal Deposits at Depth)	>1 m (usually >5 m)	Flat to Gently Undulating	Well Drained	1 to 2
$F^{G}p$	Glacio-fluvial Plain	Gravel (Rounded to Subrounded); Some Sand (possible Morainal Deposits at Depth)	>1 m (usually >5 m)	Flat to Gently Undulating	Well to Moderately Well Drained	1 to 2
$F^{G}s$	Thick Glacio-fluvial Sloping	Gravel (Rounded to Subrounded); Some Sand (possible Morainal Deposits at Depth)	>5 m	Steeply Sloping	Moderately Well Drained	5
$F^{G}u$	Glacio-fluvial Undulating	Gravel (Rounded to Subrounded); Some Sand (possible Morainal Deposits at Depth)	>1 m	Undulating	Well to Moderately Well Drained	1 to 2
$F^{G}h$	Glacio-fluvial Hummocky	Gravel (Rounded to Subrounded); Some Sand (possible Morainal Deposits at Depth)	>1 m (usually >5 m)	Hummocky	Well to Moderately Well Drained	1 to 4
$F^{G}f$	Glacio-fluvial Fan	Gravel (Rounded to Subrounded), Sand & Fines, Some Boulders and Cobbles	>5 m	Gently Sloping	Well Drained	1 to 2
$L^{G}p$	Glacio-lacustrine Plain	Silt, Clay & Sand	>1 m (usually >5 m)	Flat to Gently Undulating	Moderately Well to Poorly Drained	1 to 2
$L^{G}t$	Glacio-lacustrine Terrace	Silt, Clay & Sand (possible Morainal Deposits at Depth)	>1 m (usually <5 m)	Flat to Gently Undulating	Well to Moderately Well Drained	1 to 2
Mv	Moraine Veneer	Till Matrix is Primarily Silt, Sand and Clay; Coarse Fragments are >2mm; Subangular to Subrounded and Comprise 30% or more of the Till	<1 m	Takes Form of Underlying Surface	Moderately Well to Well Drained	2 to 3
Mb	Moraine Blanket	Till Matrix is Primarily Silt, Sand and Clay; Coarse Fragments are >2mm; Subangular to Subrounded and Comprise 30% or more of the Till	>1 m (usually <3 m)	Takes Form of Underlying Surface	Moderately Well to Well Drained	1 to 4
Mm	Rolling Moraine (Drumlin-oid)	Till Matrix is Silt, Fine Sand and Clay (Till in areas between Ridges has Higher Clay Content); Coarse Fragments >2 mm are mostly Pebble-sized, Subrounded to Rounded and form <25% of Till	>5 m	Rolling; Linear Hills	Well Drained on Upper Slopes of Ridges; Some Poorly Drained Areas Between Ridges	1 to 2
Mr	Moraine Ridge	Till Matrix is Silt, Fine Sand and Clay; Coarse Fragments >2 mm are mostly Pebble-sized, Subrounded to Rounded and form <25% of Till	>5 m	Moderately to Steeply Sloping; Ridged	Well Drained	3 to 4
Mp	Moraine Plain	Till Matrix is Silt, Fine Sand and Clay; Coarse Fragments >2 mm are mostly Pebble-sized, Subrounded to Rounded and form <25% of Till	>5 m	Flat to Gently Undulating	Moderately Well to Imperfectly Drained	1 to 4
R	Rock	E. of Grasmere PreCambrian; Argillite, Siltstone, Quartzite, Dolomite (Siyeh and Dutch Creek formations); W. of Grasmere covered by Quaternary	----	Rolling, Sloping, Hummocky and Ridged	Rapidly Drained Where At Surface	1 to 5

		Sediments				

Based on terrain survey intensity level D maps of Grasmere/Phillips Creek - Cranbrook Forest District.

Surface Expression

j = gentle slope; unidirectional (>5% to <27%)
a = moderate slope; unidirectional (>27% to <49%)
k = moderately steep; unidirectional (>49% to <70%)
s = steep slope (>70%)
v = veneer; 10 cm to <1m thick
b = blanket; >1m thick
t = terrace; step like
p = unidirectional surface (<5%)
f = segment of cone (<27%)
u = hillocks & hollows; up to 27%; irregular in plan
m = elongate hillocks; 5% to 27%
r = parallel ridges (Unconsolidated Material); 27% to 70%
h = hummocks (Steep-sided Hillocks and Hollows); 27% to 70%

Slope Class (after Howes & Kenk, 1988)*

Class	%	Degrees
1	0-5	0-3
2	6-27	4-15
3	28-49	16-26
4	50-70	27-35
5	>70	>35

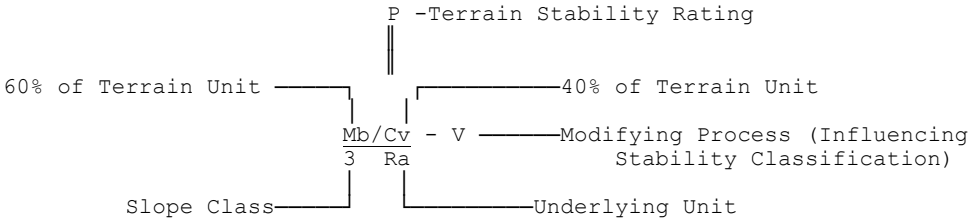
Geologic Processes

A = Avalanches
V = Gully Erosion
AV = Avalanches & Gully Erosion
Rr = Rapid Mass Movement (Rock Slide)
Rt = Debris Torrent
VRt = Debris Torrent Gullies
E = Eroded & Chanelled by Glacial Meltwater
H = Kettled by Melting of Glacial Ice

On Site Symbols

= Escarpment
= Ridge (Large Escarpment)
= Gully
= Individual Avalanche
= Cirque
= Drumlin
= Landslide Scar
= Gravel Pit
= Helicopter Traverse
= Field Investigation Site
= Moraine Ridge

Example of Terrain Stability Map Unit



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