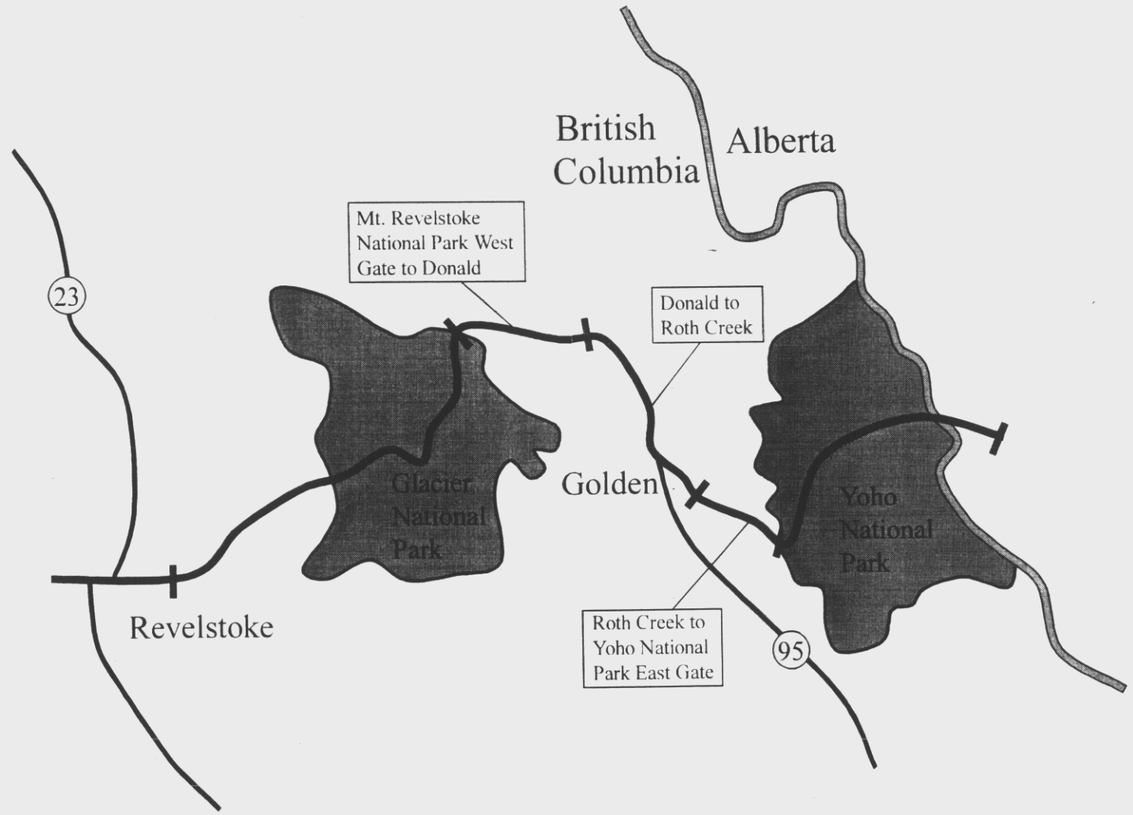
Trans Canada Highway
Cache Creek to the Rockies

Wildlife Habitat Mapping
Glacier National Park to Yoho National Park

Section 2: Donald to Roth Creek



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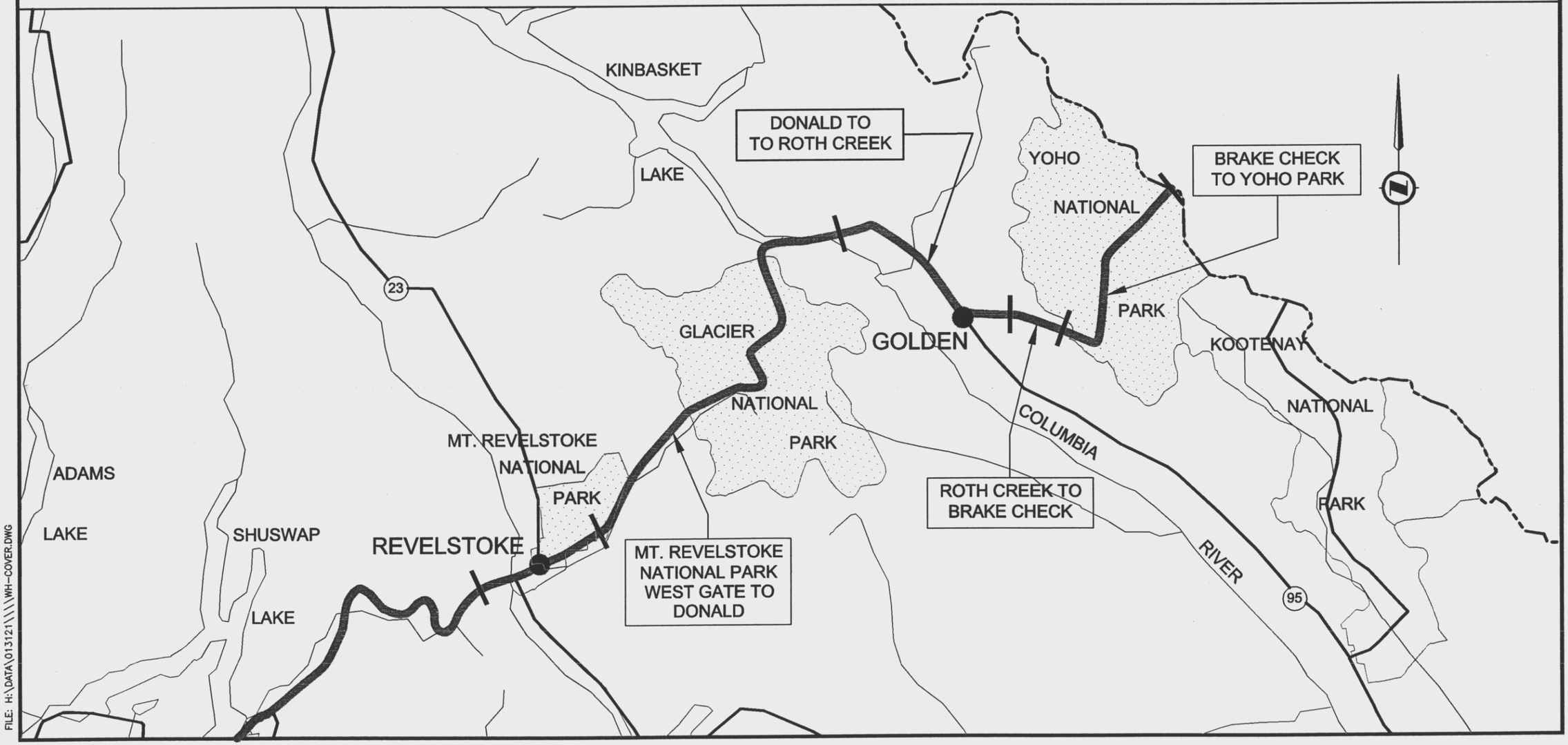

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TRANS CANADA HIGHWAY WILDLIFE HABITAT MAPPING GLACIER NATIONAL PARK TO YOHO NATIONAL PARK

Section 2: Donald to Roth Creek

By

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Executive Summary

Habitat models and maps were produced for deer, elk, moose, bighorn sheep and bear along a 1 kilometer wide strip centered on the Trans Canada Highway (TCH) between Glacier National Park and Yoho National Park. The study area corresponded to the area covered by 1:10,000 scale photomosaics developed by engineers for the BC Ministry of Transportation and Highways. Field data for the habitat maps were collected through wildlife habitat assessments, wildlife encounter transects and winter wildlife track surveys. The field data was compared to Forest Cover and Vegetation Resource Inventory (VRI) data to produce habitat models for each of the 5 species.

For each species, a habitat model was produced for each of the 4 biogeoclimatic subzone variants that were found in the study area. The main forest attributes that habitat models were based on included: dominant tree species, total canopy closure, percent shrub cover, stand age, elevation and aspect. A six-class habitat rating scheme was used for the five species; actual ratings for each of the species ranged from 2-5. For each species' habitat map, a habitat rating was given to each Forest Cover or VRI polygon found in the study area. Mountain goat use areas and mineral licks were identified from previous studies.

Overall, the best winter habitats for deer and bighorn sheep were found in the Golden area; for moose and elk, between Donald and Golden; and for bear, good quality growing season habitat was found throughout the study area. For the section between Donald and Roth Creek, the best winter habitats for deer and bighorn sheep occurred from Golden to Roth Creek, for elk and moose best habitats were found between Donald and Golden, while good quality growing season habitats for bear were found throughout the section. Three mountain goat use areas were found east of Golden between 5.0-9.5 LKI.

Table of Contents

Acknowledgements

Special thanks to Chris Mulvihill, Inventory Forester, BC Ministry of Forests, Nelson Forest District, Nelson, BC and Frank Scheithauer, Arc Alpine Resource Consultants Ltd., Victoria, BC for providing Vegetation Resource Mapping data for the study area between Glacier National Park and Roth Creek. Thanks to the engineering firms of SNC-Lavalin, Vancouver, BC and UMA Engineering Ltd., Burnaby, BC for producing final hard copies of habitat maps. Many thanks to Heather Waye of Manning Cooper and Associates (MCA) and Virgil Hawkes and Jay Kerr of TerraMar Environmental Research, Sidney, BC for their valuable contribution conducting habitat assessments and Jennifer Grant and Amy Kerslake for conducting winter snow tracking. The project was directed and coordinated by John Cooper of MCA and Robin Taylor of Acres International Ltd, Vancouver, BC.

1.0 Introduction

The Trans Canada Highway (TCH) is part of a nationally important arterial highway. The TCH between Glacier National Park and Yoho National Park is currently a two-lane undivided highway. This section of the TCH corridor passes through four biogeoclimatic subzone variants and several important wildlife habitat types and areas.

The functional planning study for the Cache Creek to Rockies Program proposes the upgrading and widening of the current TCH alignment. These upgrades will impact the habitats that are adjacent to the TCH corridor and will affect the wildlife species that utilize them. In anticipation of these future upgrades, wildlife habitat mapping was initiated for the section of the TCH between Glacier National Park and Yoho National Park to catalogue wildlife habitat values that occur along the corridor.

Habitat maps were produced for five large mammal species that occur along this section of the TCH. The five wildlife species, deer (*Odocoileus virginianus* and *O. hemionus*), elk (*Cervus elaphus*), moose (*Alces alces*), bighorn sheep (*Ovis canadensis*) and bear (*Ursus americanus* and *U. arctos*), were selected for habitat mapping using forest cover and Vegetation Resource Inventory (VRI) data. As well, mountain goat (*Oreamnos americanus*) use areas and mineral licks were identified by previous wildlife inventories conducted in the study area.

The study area between Glacier National Park and Yoho National Park was divided into 3 sections: Glacier National Park to Donald, Donald to Roth Creek, and Roth Creek to Yoho National Park. The following report summarizes the wildlife habitat mapping produced for section 2: Donald to Roth Creek. These maps are designed to assist wildlife managers and others to identify important wildlife habitats that may be affected by upgrades to the TCH, as well as highlight any areas for potential mitigation measures.

2.0 Study Area

2.1 General

The study area follows the TCH corridor between Glacier National Park and Yoho National Park. The study area encompasses the area covered by 1:10,000 scale photomosaics developed by TCH design engineers (MOTH 1999). The study area is approximately 82 km long and spans, on average, 500 m on either side of the TCH right-of way.

2.2 Donald to Roth Creek

In this section of the study area the TCH runs from Donald to Golden then to Roth Creek. The TCH traverses two main rivers valleys in this section, the Columbia River and the Kicking Horse River. In the west, the TCH follows along the bottom of the north slope of the Columbia River Valley. Although the Columbia River floodplain is relatively broad, its sidewalls are moderately sloped. Several small creeks cross the TCH as well as

one majour tributary, the Blaeberry River. After the Blaeberry River, the Columbia River Valley becomes wider as it approaches the confluence of the Kicking Horse River at Golden. The lower portion of the Kicking Horse River is a narrow, steep walled canyon with exposed rocky outcrops. The canyon is narrow near Golden and gradually widens and gains elevation as it approaches Roth Creek.

This section of the TCH is found in the ICHmk1 and IDFdm2 subzone variants. The ICHmk1 is characterized by cool, wet winters and warm, moderately dry summers. Snowfall is moderate to high. Younger and mature stands of fir and pine are common along the side slopes of this section of the Columbia River Valley, while older climax stands are relatively absent. Spruce, fir, cottonwood and heavily shrubbed areas are common in riparian areas and river islands. The IDFdm2 is characterized by a cool winters with low to moderate snowfall, and warm, dry summers with a relatively long growing season. Open fir and pine stands are common throughout the priority area along the side slopes, with denser stands occurring near Edelweiss Creek in the west and Roth Creek in the east. The Columbia River floodplain has areas of spruce, cottonwood and fir stands as well as shrubby and aspen riparian areas and extensive cattail marshes. The north slope of the Kicking Horse Canyon is open stands of fir and pine with natural grassland openings, while the cooler south slopes contain dense stands of fir and spruce with some cedar and hemlock.

3.0 Methods

There were three main components that were used to develop habitat maps for each of the five wildlife species: 1) field data, 2) vegetation database, and 3) habitat models.

3.1 Field Data

Three types of field surveys were conducted to gather data for the habitat maps: 1) wildlife habitat assessments, 2) wildlife encounter transects, and 3) winter wildlife track transects. Wildlife habitat assessments and wildlife encounter transects were completed between 2-9 and 16-22 June 1999. Winter wildlife track surveys were conducted on 8-10 November and 15-16 December in 1998; 1-2 April and 11-12 December in 1999; and 12-13 and 21-22 January and 7-8, 21 and 29 February in 2000

3.1a Wildlife Habitat Assessments

Wildlife habitat assessments were conducted at selected sample plots throughout the study area. Sample plot locations were determined by inspecting 1:10,000 scale photomosaics, 1:15,000 scale air photos and 1:50,000 scale VRI maps and selecting polygons that represented the greatest range of habitat types. Sample plots were generally distributed across the study area in an aggregated or clumped manor that coincided with access points located along road right-of-ways. One sample plot was completed in each polygon to maximize the habitats types sampled and to achieve the greatest geographical coverage of the study area.

To avoid biasing the locations of the sample plots centres, surveyors paced-off 50 m perpendicularly from the polygon boundary. Sample plots were paced further than 50 m if surveyors felt that forest edge effect was affecting stand characteristics at the sample plot centre.

For each sample plot a modified Wildlife Habitat Assessment (WHA) Form [FS882(5)] (MELP and MOF 1998) was completed with the following data: project name; plot number and location; surveyors' names; date; a broad habitat classification; structural stage; elevation; slope; aspect; ecological moisture regime. For the 4 ungulate species a 6 class rating scheme was used and the following data were gathered: the main season of use; the main use of the habitat; a rating of 1-6 for any landforms that may limit use; a rating of 1-6 for both security/thermal and food habitat; and an over rating (1-6) of the present habitat suitability. The same data were collected for bear, however, a 4 class rating scheme was used. Wildlife habitat assessments for each species was compared directly to its provincial benchmark, or the best habitat for that species found in British Columbia (RIC 1999).

At each sample plot a pellet count was completed that consisted of two 50 m segments that radiated from opposite directions from the plot centre. The initial 50 m segment was determined by using a random compass bearing. Along each segment all bear scat and ungulate pellets were counted and classified to species where possible and all browse sign or bear scratchings were noted. A brief description of the vegetation in the moss, herb, shrub and tree layers was noted.

If one of the 5 species were seen or their sign observed inside the sample plot or forest cover polygon the following data was collected on the WHA Form: the five letter code of the species; sex; life stage; activity or the behaviour of the species; a descriptor of whether the species was seen, heard, or evidenced by signs; the number of animals seen or heard, or the amount of signs found; and any comments. If the species of ungulate could not be determined by the sign, then a general comment would be recorded, i.e. ungulate species browse on shrubs.

3.1b Wildlife Encounter Transects

Wildlife encounter transects were used to identify important habitat types and use areas for each of the five wildlife species. Although there were no RIC approved standards for general wildlife encounter transects, surveys were modeled after protocol described in a draft RIC standards manual (RIC 1997) and inventory standards produced as part of the Canada-British Columbia Partnership Agreement on Forest Resource Development (Hatler 1991). Surveyors walked between 50-100 m on either side of the TCH centre line in adjacent habitat that paralleled the highway corridor. Surveyors recorded any sign or evidence of all wildlife species that were encountered while walking along the survey transect. Survey transects varied in length from 1.7 to 4.2 km in length and were marked on photomosaic maps.

A Wildlife Encounter Transect Form was developed that was modeled after templates in RIC (1997) and Hatler (1991). The form and data collection protocol that was produced

by Manning, Cooper and Associates were reviewed by James Quayle, Species Inventory Biologist, Resources Inventory Branch, BC Ministry of Environment, Lands and Parks.

The following data were collected on the Wildlife Encounter Transect Form: project name; transect label and location; surveyors' names; date; start and end time and weather conditions. For each species or its sign that were encountered the following data were collected: the five letter code of the species; the approximate LKI the observation was made; the type of observation – visual, call or sign; the sex and age class if possible; the activity of the animal or a description of the sign found.

3.1c Winter Wildlife Track Transects

Winter wildlife track transects were used to identify areas along the TCH corridor that were important winter habitat and crossing areas for the five wildlife species. There were no specific RIC approved standards for ungulate snow-tracking transects in the RIC manual *Ground-based Inventory Methods for Selected Ungulates*, RIC (1998). Consequently, snow-tracking surveys were modeled after similar work that occurred during the construction of the Okanagan Connector Highway (Gyug and Simpson 1989).

Surveyors conducted track transects in high value habitat areas, potential wildlife crossing structure areas, and in areas where there were little data of wildlife use. These areas were marked on photomosaics and visited, weather permitting, during each of the site visits. Track transects were either driven by 4x4 truck or walked on foot depending on snow level conditions.

The following data were collected on the Winter Wildlife Track Transect Form: project name; transect name and location; surveyors' names; date; weather conditions; number of days since the last snowfall; and any comments. For all tracks that were encountered, the following data were collected: description of the track location; the nearest LKI; the species of the animal where possible; number of tracks; snow depth in cm; sinking depth of the track in cm; direction of travel; and an approximation of the age of the track in days.

3.2 Vegetation Database

Ministry of Forests 1:50,000 scale VRI maps for the Nelson Forest District and an accompanying database were used as an overlay for the habitat models between Glacier National Park and Donald. Of the 48 habitat variables listed in the VRI database, 21 were used to develop the habitat models. The majority of habitat variables were either not conducive for differentiating wildlife habitat or they were not always provided or entered into the database to be used consistently throughout the habitat models.

The following VRI habitat variables were used to develop the habitat model: soil nutrient regime, land cover component 1 and 2 with corresponding percent covers, tree crown closure, vertical complexity, dominant tree species 1-5 and percent cover, leading species age, leading species height, basal area, density, and scrub crown closure.

3.3 Habitat Models

For each of the subzone variants found in the study area a separate habitat model was developed for each of the five wildlife species. The models were developed with close attention to existing habitat classification and mapping that was done immediately south of the study area (Demarchi et al. 1983; Lea 1984, Lea 1989). This comparison between studies ensured that the habitat classification and mapping for the TCH was consistent in terms of over-all ranges of ratings as well as the relative value of different habitat types. Each model was based on information collected in the field, including the wildlife habitat assessment plots, wildlife encounter transects, and winter wildlife track surveys.

The data that were collected specifically for the development of the models (the wildlife habitat assessment plots) were combined with other local field studies (e.g. Demarchi and Searing 1997), and existing mapping south of the study area. This combined data were used to determine the way in which the model would interpret how polygon attributes (e.g. soil nutrient regime, land cover component 1 and 2, tree crown closure, vertical complexity, dominant tree species, leading species age, leading species height, density, scrub crown closure, slope, aspect and elevation) would be rated as habitat for the five species.

Current literature was reviewed and, in some cases, provincial species experts were consulted to determine the habitat needs for each species and how it related to the habitat types found in each subzone variant. Subzone variants were ranked from highest to lowest for their habitat suitability for each of the five wildlife species. Maximum and minimum habitat rating ranges were then defined for each of the ranked subzone variants in reference to potential carrying capacity estimates found in Demarchi et al. (1983).

The primary vegetation variable in the VRI database that was used in the habitat models was dominant tree species. For each subzone variant a list of dominant tree species was produced from the VRI data set. It was assumed that the dominant tree species would provide a general indication of the forest stand type and its potential as suitable habitat for each of the five wildlife species. A list of potential browse species that may be present in each forest stand type was then produced in reference to its corresponding site series (Braumandl and Curran 1992) and similar studies that occurred in the same subzones in the east Kootenays (Lea 1984, 1989). The abundance of potential browse species found in each forest stand type then determined the range of habitat ratings ascribed to the dominant tree species VRI variable.

For deer, moose and bear the secondary VRI vegetation variable used in the habitat models was percent shrub cover. This variable was used as an indicator of the abundance of potential browse species that were present or available in each polygon. It was assumed that in the VRI data set, if a polygon had a high percent cover of shrubs, then a portion of that total shrub cover would be of the potential browse species listed for its corresponding forest stand type. Consequently, if a polygon had good shrub cover, it would have a higher habitat rating for the particular species. Where no shrub data was available in the VRI data set, it was assumed that shrub cover was good.

For elk and bighorn sheep, total canopy closure or stand age were used as the secondary VRI vegetation variable that weighted habitat ratings. These variables were used as a surrogate for

identifying thermal habitat attributes for polygons. Aspect and slope were also used to weight habitat ratings for deer and bighorn sheep, species that were particularly dependent on steep slopes with little snow cover for their winter forage.

Habitat ratings were not dependent on human disturbance factors. Instead, all habitat ratings were ascribed on habitat quality only. Human disturbance factors such as habitation, agriculture, roads or railways that do affect certain wildlife use were considered as non-habitat effects and were not reflected in the habitat maps. For example, polygons that contained the TCH and CPR corridors were given a 5 habitat rating for all species. These polygons generally included habitat fringes in their right-of-ways that could act as movement corridors.

A mountain goat habitat model was not developed for the study area. Significant mountain goat habitats were very limited within the narrow study area adjacent to the highway due to the species requirements for steep rocky terrain. As well, mountain goat use areas along the TCH between Glacier National Park and Yoho National Park were already well documented (Acres 1998; Demarchi and Searing 1997). Since the VRI and forest cover polygons used to stratify the study area did not differentiate steep rocky habitats preferred by mountain goats, a habitat model was not produced for the species. Instead, mapsheets were generated that highlighted known mountain goat use areas and mineral licks within the study area after Demarchi and Searing (1997).

3.4 Habitat Maps

Habitat maps were produced from a MS Access database that was created for the study area. The database contained all polygons that were found in the study area and their 21 corresponding VRI variables that was used in the habitat models. For each of the polygons, a habitat rating was ascribed for each of the five wildlife species as they related to each of the species' corresponding habitat models. This database was then used by GIS technicians to generate habitat maps.

Habitat maps consisted of VRI map polygons overlaid on 1:10,000 scale photomosiacs. Each of the polygons were numbered with their corresponding identification number from the VRI database. Polygons were themed with a fill pattern that corresponded with each of the four habitat ratings (classes 2-5). Rivers, lakes and small bodies of water were not rated on the habitat maps and their corresponding polygons did not receive any fill patterns.

Subzone variant boundaries were approximated on the 1:10,000 scale habitat maps based on 1:250,000 scale Broad Ecosystem Maps (MOF 1999). Variant lines were drawn to follow VRI map polygon. NTS 1:50,000 scale mapsheet boundaries were also drawn on the habitat maps as each mapsheet had the same series of polygon numbers as its neighbouring mapsheets.

The 1000 m elevation contour was transferred from 1:50,000 scale NTS maps onto the habitat maps. Track surveys east of Columbia River suggested that 1000 m as a reasonable break for differentiating between early winter and late winter limiting snow depths for deer and elk. Surveys during the winters of 1998-2000 showed little use east of Wiseman Creek which corresponds to the 1000 m level. Although there was a lack of data for along the Kicking Horse River, the 1000 m level was also used to differentiate between early and late winter use for deer and elk.

4.0 Results

4.1 Deer Habitat Model

White-tailed and Mule Deer Winter Season Habitat Ratings
Winter Season - November to April for the Southern Interior Mountains Ecoprovince

Mule deer winter range generally consists of pioneer-seral shrublands in drier south-facing slopes (Demarchi 1986). This species tends to prefer broken or steep terrain with windswept slopes that provide exposed forage. White-tailed deer are generally restricted to valley bottoms, low elevation terraces, or moderate south-facing slopes. White-tailed deer also prefer pioneer seral shrublands, however, they can adapt to cultivated areas, particularly when they are adjacent to forest stands.

There are few data for deer winter range for the section of the TCH between Glacier National Park and Donald (Acres 1998). This section does not contain as significant deer winter range as the section between Donald and Roth Creek. Above 1000 m, areas west of Wiseman Creek, snow levels in late winter may limit deer use during heavy snowfall years.

Between Golden and Yoho National Park, Demarchi and Searing (1997) found deer most abundant west of 10.0 LKI. Generally, deer numbers were the greatest near the confluence of the Kicking Horse and Columbia Rivers, particularly west of 4.0 LKI. The study found that white-tailed deer used gentle south- and west-facing slopes around the Golden town site, while mule deer were found along the north side of the Kicking Horse Canyon on steeper south-facing slopes. Generally, there was considerable overlap in the winter ranges used by the two species in the Golden area. However, mule deer were more likely found at higher elevations, steeper terrain and deeper snow, while white-tailed deer tended to be most abundant in the valley bottom.

Deer Ratings for East Kootenay Ecosection
The Kootenay Interior Cedar-Hemlock moist cool (ICHmk1)
Donald to Edelweiss Creek

Assumptions:
Habitat ratings are based on the direction of aspect, canopy closure and steepness of slopes. Polygons on southern facing aspects with relatively open canopies on moderate to steep slopes are rated higher as winter habitat than polygons with close canopied forests on flatter, northern facing slopes. Snow levels are generally heavier in this variant compared to the IDFdm2 and are consequently less productive in winter for deer. Maximum and minimum habitat ratings were 3 and 5 for deer in the ICHmk1 during the winter season.

1. **Floodplain Islands and Floodplain Riparian** – polygons are flat and provide browse habitat in early winter, however, snow accumulations during high snowfall years may limit use.

4w – regardless of shrub or canopy closure, used as early winter range

Southern Aspect Polygons

2. **Recent Clearcut**
   4w – if good shrub cover
   5w – if poor shrub cover
3. **Older Clearcut**
   5w – regardless of shrub cover
4. **Pastureland** – habitat used in early winter, but generally not in mid to late winter
   4w – if good shrub cover
   5w – if poor shrub cover
5. **Douglas-fir Dominated Forest**
   3w – if open canopy cover (≤50%); open canopies for thermal insolation as these polygons tend to be steep, south facing aspects.
   4w – if closed canopy cover (>50%)
6. **Lodgepole Pine Dominated Forest**
   4w – if open canopy cover (≤50%); open canopies will have more browse/grazing species
   5w – if closed canopy cover (>50%); closed canopies will have less browse/grazing species, i.e. more moss and lichen on forest floor
7. **Spruce Dominated Forest** – less steep slopes and heavier snow cover provide fewer grass and other grazing species
   4w – if open canopy cover (≤50%)
   5w – if closed canopy cover (>50%)
8. **Aspen Dominated Forest** – relatively moister, flatter slope and heavier snow cover
   4w – regardless of canopy cover

Deer Ratings for East Kootenay Ecosection
The Kootenay Interior Douglas-fir dry mild (IDFdm2)
Edelweiss Creek to Roth Creek

Assumptions:
Habitat ratings are based on the direction of aspect, canopy closure and steepness of slopes. Polygons on southern facing aspects with relatively open canopies on moderate to steep slopes are rated higher as winter habitat than polygons with close canopied forests on flatter, northern facing slopes. Generally, polygons in this subzone variant are somewhat drier and more open canopied than other subzone variants and are more productive in winter for deer. Maximum and minimum habitat ratings were 2 and 5 for deer in the IDFdm2 during the winter season.

1. **Floodplain Islands and Floodplain Riparian** – polygons are flat and provide browse habitat in early winter, however, snow accumulations during high snowfall years may limit use.
   4w – regardless of shrub or canopy closure, used as early winter range

Southern Aspect Polygons

2. **Recent Clearcut**
   4w – if good shrub cover

5w – if poor shrub cover

3. **Older Clearcut**
   5w – regardless of shrub cover
4. **Open Grassland**
   3w – if naturally occurring grassland
5. **Pastureland**
   4w – regardless of shrub cover
6. **Cliffs**
   4w - occasionally used for thermal regulation
7. **Douglas-fir Dominated Forest**
   2w – if open canopy cover (≤50%)
   3w – if closed canopy cover (>50%)
8. **Lodgepole Pine Dominated Forest**
   3w – if open canopy cover (≤50%)
   4w – if closed canopy cover (>50%)
9. **Spruce Dominated Forest** – relatively moister, flatter slope and heavier snow cover
   4w – if open canopy cover (≤50%)
   5w – if closed canopy cover (>50%)
10. **Aspen Dominated Forest** – relatively moister, flatter slope and heavier snow cover
    4w – regardless of canopy cover
11. **Urban Areas** – Golden town site
    3w – habitat patches within city limits
    5w – residential and commercial areas

Northern Aspect Polygons

12. **Recent Clearcut**
    5w – regardless of shrub cover
13. **Older Clearcut**
    5w – regardless of shrub cover
14. **Cliffs**
    5w - not used for thermal regulation
15. **Douglas-fir Dominated Forest**
    4w – if open canopy cover (≤50%)
    5w – if closed canopy cover (>50%)
16. **Lodgepole Pine Dominated Forest**
    5w – regardless of canopy cover
17. **Spruce Dominated Forest** – relatively moister, flatter slope and heavier snow cover
    5w – regardless of canopy cover
18. **Aspen Dominated Forest** – relatively moister, flatter slope and heavier snow cover
    5w – regardless of canopy cover

4.2 Elk Habitat Model

Elk Winter Season Habitat Ratings
Winter Season - November to April for the Southern Interior Mountains Ecoprovince

Elk are capable of using a wide variety of habitats in winter. Generally, low elevation grasslands and pioneer seral shrubs on rolling to moderate slopes adjacent to medium to dense forest cover or riparian areas are preferred (Demarchi 1986). Steep terrain is typically avoided by elk. In higher snow fall areas, mature coniferous forest cover becomes important for thermal cover.

There is few data available for elk winter range for the section of the TCH between Glacier National Park and Donald (Acres 1998). Elk use the riparian habitats along the Beaver River that are found directly east of Glacier National Park. This section does not contain as significant elk winter range as the section between Donald and Roth Creek. Above 1000 m, areas west of Wiseman Creek, snow levels in late winter may limit elk use during heavy snowfall years.

Demarchi and Searing (1997) found elk east of Golden from 19.0 LKI east to Yoho National Park boundary. This area supports extensive stands of trembling aspen and an abundance of shrubs and includes two patches that were thinned and burned by BC Ministry of Environment, Lands and Parks to enhance its habitat for elk. Elk were also found wintering in riparian habitats southeast of Golden along the Columbia River and lower benches of the Beaverfoot Range (Demarchi and Searing 1997). Along the Kicking Horse River, the gentle terrain of the floodplains and river benches near Yoho National Park provide the greatest suitability for elk, while the steep slopes of the canyon provide little elk habitat.

Elk Ratings for East Kootenay Ecosection
The Kootenay Interior Cedar-Hemlock moist cool (ICHmk1)
Donald to Edelweiss Creek

Assumptions:
Habitat ratings are based on canopy closure and steepness of slopes. Polygons with relatively closed canopies on flatter slopes are rated higher as winter habitat than polygons with open canopied forests on moderate to steep slopes. Due to greater precipitation levels, browse species are generally more abundant in this subzone variant compared to the IDFdm2 and are consequently more productive for elk in winter. Maximum winter rating of 2 in ICHmk1 due to winters of heavy snow that produce snow levels which may inhibit use. Elk prefer mature to old forest stands; younger seral, coniferous forest polygons of <80 years old (MELP and MOF 1998) were rated one level lower then stated below. Maximum and minimum habitat ratings were 2 and 5 for elk in the ICHmk1 during the winter season.

1. **Floodplain Islands and Floodplain Riparian** – polygons are flat and provide browse habitat in early winter, however, snow accumulations during high snowfall years may

limit use. Younger riparian successional stages are natural fluctuations caused by occasional flooding; <80 year old forest polygons are not down rated.
3w – if good shrub cover and some coniferous canopy cover (≥20%)
4w – if poor shrub cover or little or no coniferous canopy cover (<20%)

2. **Recent Clearcut**
   4w – if good shrub cover
   5w – if poor shrub cover
3. **Older Clearcut**
   5w – regardless of shrub cover
4. **Pastureland** – habitat used in early winter, but generally not in mid to late winter
   4w – if good shrub cover
   5w – if poor shrub cover or adjacent to human habitation
5. **Douglas-fir Dominated Forest**
   3w – if open canopy cover (≤50%)
   2w – if closed canopy cover (>50%)
6. **Lodgepole Pine Dominated Forest**
   4w – if open canopy cover (≤50%); open canopies will have more browse/grazing species
   5w – if closed canopy cover (>50%); closed canopies will have less browse/grazing species, i.e. more moss and lichen on forest floor
7. **Spruce Dominated Forest** – less steep slopes and heavier snow cover provide fewer grass and other grazing species
   4w – if open canopy cover (≤50%)
   3w – if closed canopy cover (>50%)
8. **Aspen Dominated Forest** – relatively moister, flatter slope and heavier snow cover
   4w – regardless of canopy cover

Elk Ratings for East Kootenay Ecosection
The Kootenay Interior Douglas-fir dry mild (IDFdm2)
Edelweiss Creek to Roth Creek

Assumptions:
Habitat ratings are based on canopy closure and steepness of slopes. Polygons with relatively closed canopies on flatter slopes are rated higher as winter habitat than polygons with open canopied forests on moderate to steep slopes. Generally, polygons in this subzone variant are somewhat drier and more open canopied than other subzone variants and are less productive in winter for elk than moister subzone variants. Elk prefer mature to old forest stands; younger seral, coniferous forest polygons of <80 years old (MELP and MOF 1998) were rated one level lower then stated below. Maximum and minimum habitat ratings were 3 and 5 for elk in the IDFdm2 during the winter season.

1. **Floodplain Islands and Floodplain Riparian** – polygons are flat and provide browse habitat in early winter, however, snow accumulations during high snowfall years may limit use. Younger riparian successional stages are natural fluctuations caused by occasional flooding; <80 year old forest polygons are not down rated.

3w – if good shrub cover and some coniferous canopy cover (≥20%)
4w – if poor shrub cover or little or no coniferous canopy cover (<20%)

2. **Recent Clearcut**
   4w – if good shrub cover
   5w – if poor shrub cover
3. **Older Clearcut**
   5w – regardless of shrub cover
4. **Open Grassland**
   4w – if naturally occurring grassland, generally steep slopes
5. **Pastureland**
   4w – if good shrub cover
   5w – if poor shrub cover
6. **Cliffs**
   5w – generally too steep for use
7. **Douglas-fir Dominated Forest** – generally steep slopes
   4w – if open canopy cover (≤50%)
   3w – if closed canopy cover (>50%)
8. **Lodgepole Pine Dominated Forest**
   4w – if open canopy cover (≤50%)
   5w – if closed canopy cover (>50%)
9. **Spruce Dominated Forest** – relatively moister, flatter slope and heavier snow cover
   5w – if open canopy cover (≤50%)
   4w – if closed canopy cover (>50%)
10. **Aspen Dominated Forest** – relatively moister, flatter slope and heavier snow cover
    4w – regardless of canopy cover
11. **Urban Areas** – Golden town site
    4w – habitat patches within city limits
    5w – residential and commercial areas

4.3 Moose Habitat Model

Moose Winter Season Habitat Ratings
Winter Season - November to April for the Southern Interior Mountains Ecoprovince

Moose generally winter in valley bottoms, floodplains and riparian habitat. Areas where the topography is gentle, forested terraces or aspen dominated forested slopes are also used (Demarchi 1986).

The section of the TCH between Glacier National Park and Donald is a movement corridor for moose, particularly near Donald (Acres 1998). There is also important moose habitat in the Beaver River floodplain that is down slope of the TCH just east of Glacier National Park. Significant moose movement and consequent road kills occur between Glacier National Park and 11.0 LKI.

Along the Kicking Horse River Demarchi and Searing (1997) only found moose sign in the MSdk, east of 11.0 LKI. However, the study found little suitable moose winter habitat found along the Kicking Horse River and suggested that only a few animals winter in the valley.

Moose Ratings for East Kootenay Ecosection
The Kootenay Interior Cedar-Hemlock moist cool (ICHmk1)
Donald to Edelweiss Creek

Assumptions:
Habitat ratings are based on productive shrub browse, with polygons with higher shrub cover rated higher as winter habitat than polygons with lower shrub cover. Snow interception by trees is a consideration for moose winter habitat so ratings are adjusted down one rating for polygons with little or no tree cover. Maximum and minimum habitat ratings were 2 and 5 for moose in the ICHmk1 during the winter season.

1. **Floodplain Islands and Floodplain Riparian** – areas that are flooded regularly will generally have fewer shrubs than areas that are on intermittently flooded, consequently, regularly flooded areas will be rated lower than intermittently flooded areas.
   2w – if good shrub cover and some coniferous canopy cover (≥20%)
   3w – if poor shrub cover or little or no coniferous canopy cover (<20%)
2. **Recent Clearcut**
   3w – if good shrub cover
   4w – if poor shrub cover
3. **Older Clearcut**
   4w – if good shrub cover
   5w – if poor shrub cover
4. **Pastureland**
   5w - occasional local and migratory movements only

5. **Douglas-fir and Lodgepole Pine Dominated Forest** – relatively drier and lower production of browse shrubs
   4w – if good shrub cover
   5w – if poor shrub cover
6. **Spruce Dominated Forest** – relatively moister and higher production of browse shrubs
   3w – if good shrub cover
   4w – if poor shrub cover
7. **Aspen Dominated Forest (Bench)** – relatively moister, however, the shrubs that are found in these areas are generally not preferred browse species for moose (e.g. thimbleberry, rose)
   3w – if good shrub cover
   4w – if poor shrub cover
8. **Aspen Dominated Forest (Riparian)** – relatively moister, and the shrubs that are found in these areas are generally preferred browse species (e.g. willow, dogwood)
   2w – if good shrub cover
   3w – if poor shrub cover

Moose Ratings for East Kootenay Ecosection
The Kootenay Interior Douglas-fir dry mild (IDFdm2)
Edelweiss Creek to Roth Creek

Assumptions:
Habitat ratings are based on productive shrub browse, with polygons with higher shrub cover rated higher as winter habitat than polygons with lower shrub cover. Snow interception by trees is a consideration for moose winter habitat so ratings are adjusted down one rating for polygons with little or nil tree cover. Generally, polygons in the IDFdm2 are somewhat drier and less productive for moose than similar areas in other subzone variants within the study area. Maximum and minimum habitat ratings were 2 and 5 for moose in the IDFdm2 during the winter season.

1. **Floodplain Islands and Floodplain Riparian** – areas that are flooded regularly will generally have fewer shrubs than areas that are on intermittently flooded, consequently, regularly flooded areas will be rated lower than intermittently flooded areas.
   2w – if good shrub cover and some coniferous canopy cover (≥20%)
   3w – if poor shrub cover or little or no coniferous canopy cover (<20%)
2. **Recent Clearcut**
   3w – if good shrub cover
   4w – if poor shrub cover
3. **Older Clearcut**
   4w – if good shrub cover
   5w – if poor shrub cover
4. **Open Grassland**
   5w – generally steep slopes

5. **Pastureland**
   5w - occasional local and migratory movements only
6. **Douglas-fir and Lodgepole Pine Dominated Forest** – relatively drier and lower production of browse shrubs
   5w – regardless of shrub cover
7. **Spruce Dominated Forest** – relatively moister and higher production of browse shrubs
   3w – if good shrub cover
   4w – if poor shrub cover
8. **Aspen Dominated Forest (Bench)** – relatively moister, however, the shrubs that are found in these areas are generally not preferred browse species for moose (e.g. thimbleberry, rose)
   4w – regardless of shrub cover
9. **Aspen Dominated Forest (Riparian)** – relatively moister, and the shrubs that are found in these areas are generally preferred browse species (e.g. willow, dogwood)
   3w – regardless of shrub cover
10. **Urban Areas** – Golden town site
    4w – habitat patches within city limits
    5w – residential and commercial areas

4.4 Bighorn Sheep Habitat Model

Bighorn Sheep Winter Season Habitat Ratings
Winter Season - November to April for the Southern Interior Mountains Ecoprovince

Bighorn sheep generally winter in low elevation, southerly exposed slopes that are adjacent to rocky outcroppings, escarpments or talus slopes that are used as escape terrain (Demarchi 1986). In winter, bighorn sheep are mostly limited by forage, snow depth and escape terrain.

Only the IDFdm2 was rated for bighorn sheep. The transition from the IDFdm2 to the MSdk corresponded with a majour decrease in available escape terrain as did the transition between the IDFdm2 and ICHmk1. The subzone variant boundaries acted as convenient lines to use for differentiating bighorn sheep winter range as there was little effective escape terrain west of Edelweiss Creek and east of Roth Creek. Consequently, neither the ICHmk1 nor the MSdk were rated for bighorn sheep.

There were no records or data of bighorn sheep occurring in the section of the TCH between Glacier National Park and Donald (Acres 1998).

The Kicking Horse Valley is the northern most limit of bighorn sheep along the western side of the Rocky Mountains. Winter range in the Kicking Horse Valley is extremely limited and the local population is susceptible to large winter die-off. Supplemental feeding during the winter is provided by Golden residents, without which, it is unlikely that the local herd could survive consecutive harsh winters (Demarchi and Searing 1997). Demarchi and Searing (1997) only found bighorn sheep sign on the north side of the Kicking Horse Valley in the IDFdm2, Golden east to 10.0 LKI.

Bighorn Sheep Ratings for East Kootenay Ecosection
The Kootenay Interior Cedar-Hemlock moist cool (ICHmk1)
Donald to Edelweiss Creek

Assumptions:
Bighorn sheep were not rated in the ICHmk1 as this species generally does not occur in this section of the study area.

Bighorn Sheep Ratings for East Kootenay Ecosection
The Kootenay Interior Douglas-fir dry mild (IDFdm2)
Edelweiss Creek to Roth Creek

Assumptions:
Habitat ratings are based on the direction of aspect, canopy closure and steepness of slopes. Polygons on southern facing aspects with open grasslands and open canopy forests on moderate to steep slopes are rated the highest as winter habitat. Polygons with close canopied forests on flatter, northern facing slopes are rated low. Maximum winter rating of 2 in IDFdm2 due to winters of heavy snow that cause snow levels that may

inhibit use and reduces densities. Maximum and minimum habitat ratings were 2 and 5 for bighorn sheep in the IDFdm2 during the winter season.

1. **Floodplain Islands and Floodplain Riparian** – polygons are too flat for bighorn sheep
   5w – regardless of shrub or canopy closure, used as early winter range

Southern Aspect Polygons

2. **Recent Clearcut**
   5w – regardless of shrub cover
3. **Older Clearcut**
   5w – regardless of shrub cover
4. **Open Grassland**
   2w – if naturally occurring grassland
5. **Pastureland**
   4w – if upland pastureland
   5w – if lowland pastureland
6. **Cliffs**
   2w – escape terrain and lambing
7. **Douglas-fir Dominated Forest**
   3w – if open canopy cover (≤50%)
   4w – if closed canopy cover (>50%)
8. **Lodgepole Pine Dominated Forest**
   5w – regardless of canopy cover
9. **Spruce Dominated Forest** – relatively moister, flatter slope and heavier snow cover
   5w – regardless of canopy cover
10. **Aspen Dominated Forest** – relatively moister, flatter slope and heavier snow cover
    5w – regardless of canopy cover
11. **Urban Areas** – Golden town site
    3w – habitat patches within city limits
    5w – residential and commercial areas

Northern Aspect Polygons

5w – regardless of polygon cover

4.5 Bear Habitat Model

Bear Growing Season Habitat Ratings

Growing Season – May to October for the Southern Interior Mountains Ecoprovince

Grizzly and black bear are opportunistic omnivores and utilize a large variety of habitat types, and particularly with grizzlies, across large areas. Avalanche paths, valley bottom forests, riparian habitats were selected in spring by grizzlies near Mount Revelstoke National Park (Simpson et al. 1985); while burned areas and spruce-balsam forests were used later in the summer due to the presence of berry crops.

Both species of bear occur in the section of the TCH between Glacier National Park and Donald (Acres 1998). The riparian habitat adjacent to the Beaver River east of the eastern gate of Glacier National Park provide suitable bear habitat as do wetland areas between Wiseman Creek and Oldman Creek.

The Kicking Horse Valley has the highest suitability density for grizzly bears in the Central Rockies Ecosystem (Komex International Ltd. 1995). The high suitability of the area is mostly attributable to its undeveloped state, however, human activity is continually increasing in the area (Demarchi and Searing 1997). Black bears were found throughout the Kicking Horse Valley by Demarchi and Searing (1997), particularly in areas of berry-producing shrubs, deciduous trees and forb growth.

Bear Ratings for East Kootenay Ecosection
The Kootenay Interior Cedar-Hemlock moist cool (ICHmk1)
Donald to Edelweiss Creek

Assumptions:
Habitat ratings are based on forest stand type and shrub productivity. Moister forest stands generally provide better forage for bear than drier stands. Good shrub cover suggests productive sites that may have succulent herbaceous forage and berry producing shrubs. Maximum and minimum habitat ratings were 2 and 5 for bear in the ICHmk1 during the growing season.

1. **Floodplain Islands and Floodplain Riparian** – areas that are flooded regularly will generally have fewer shrubs than areas that are on intermittently flooded. Consequently, regularly flooded areas will be rated lower than intermittently flooded areas due to their lower overall forage production.
   2g – if good shrub cover and some coniferous canopy cover (≥20%)
   3g – if poor shrub cover or little or no coniferous canopy cover (<20%)
2. **Recent Clearcut**
   3g – if good shrub cover
   4g – if poor shrub cover
3. **Older Clearcut**
   4g – if good shrub cover
   5g – if poor shrub cover

4. **Pastureland**
   3g – important grazing in early spring
5. **Douglas-fir and Lodgepole Pine Dominated Forest** – relatively drier and lower production of succulent herbaceous forage. but can produce berries in fall
   3g – if good shrub cover
   4g – if poor shrub cover
6. **Spruce Dominated Forest** – relatively moister and higher production of succulent herbaceous forage and berry producing shrubs
   2g – if good shrub cover
   3g – if poor shrub cover
7. **Aspen Dominated Forest** – relatively moister and higher production of succulent herbaceous forage and berry producing shrubs
   2g – if good shrub cover
   3g – if poor shrub cover

Bear Ratings for East Kootenay Ecosection
The Kootenay Interior Douglas-fir dry mild (IDFdm2)
Edelweiss Creek to Roth Creek

Assumptions:
Habitat ratings are based on forest stand type and shrub productivity. Moister forest stands generally provide better forage for bear than drier stands. Good shrub cover suggests productive sites that may have succulent herbaceous forage and berry producing shrubs. Generally, polygons in the IDFdm2 are somewhat drier and less productive for bear than similar areas in other subzone variants within the study area. Maximum and minimum habitat ratings were 2 and 5 for bear in the IDFdm2 during the growing season.

1. **Floodplain Islands and Floodplain Riparian** – areas that are flooded regularly will generally have fewer shrubs than areas that are on intermittently flooded. Consequently, regularly flooded areas will be rated lower than intermittently flooded areas due to their lower overall forage production.
   2g – if good shrub cover and some coniferous canopy cover (≥20%)
   3g – if poor shrub cover or little or no coniferous canopy cover (<20%)
2. **Recent Clearcut**
   3g – if good shrub cover
   4g – if poor shrub cover
3. **Older Clearcut**
   4g – if good shrub cover
   5g – if poor shrub cover
4. **Open Grassland**
   3g – important grazing in early spring
5. **Pastureland**
   3g - important grazing in early spring
6. **Douglas-fir and Lodgepole Pine Dominated Forest** – relatively drier and lower production of succulent herbaceous forage. but can produce berries in fall

   3g – if good shrub cover
   4g – if poor shrub cover
7. **Spruce Dominated Forest** – relatively moister and higher production of succulent herbaceous forage and berry producing shrubs
   3g – if good shrub cover
   4g – if poor shrub cover
8. **Aspen Dominated Forest** – relatively moister and higher production of succulent herbaceous forage and berry producing shrubs
   2g – if good shrub cover
   3g – if poor shrub cover
9. **Urban Areas** – Golden town site
   4g – habitat patches within city limits
   5g – residential and commercial areas

4.6 Mountain Goat Use Areas

Mountain goats prefer high elevation areas that are rugged and generally treeless (Demarchi 1986). During late spring and early summer, mountain goats may be found at lower elevations, however, they are generally confined to rugged areas that have rock escarpments that act as important escape terrain.

Demarchi and Searing (1997) found evidence of mountain goats on both sides of the Kicking Horse River between 5-mile Bridge and Park Bridge, 9.0 to 15.0 LKI. In this area, goats were generally only found in steep, open subalpine and alpine habitats on both the north and south sides of the TCH. Mineral licks were located at 5.0 LKI on the south side of the Kicking Horse River and at 5-Mile Bridge. Goats generally only came down near the TCH where mineral licks, or occasionally, where spring forage were found.

5.0 Discussion

See Appendix A for habitat maps.

5.1 Deer Habitat Maps

Habitat maps showed a general trend of deer winter habitat values that gradually improved from the west near Donald towards the east near Golden and the Kicking Horse Canyon. From Donald to Blaeberry River (30-41 LKI), habitat ratings of 4 dominated the landscape followed by ratings of 5 and occasional ratings of 3 in open fir stands. From Blaeberry River to Edelweiss Creek (41-53 LKI), ratings of 3 were more frequently encountered and ratings of 5 became more uncommon. From Edelweiss Creek to Golden up through the Kicking Horse Canyon deer winter habitat improved due to lower snowfall levels and steeper terrain. Ratings of 2, 3 and 4 were equally represented on south-facing slopes through the Kicking Horse Canyon, while ratings of 5 dominated north-facing slopes.

5.2 Elk Habitat Maps

Habitat maps showed a general trend of higher elk winter habitat values between Donald and Golden that gradually became relatively lower from Golden through the Kicking Horse Canyon. From Donald to Neale Creek (30-37 LKI), habitat ratings of 3 dominated the landscape and ratings of 4 and 5 were equally represented. From Neale Creek to Edelweiss Creek (37-53 LKI), habitat improved and ratings of 2, 3 and 4 were equally encountered and ratings of 5 were nearly absent. From Edelweiss Creek through Golden and into the Kicking Horse Canyon habitat quality became lower due to the steeper terrain. Ratings of 3, 4 and 5 were equally represented on both south- and north-facing slopes in the Kicking Horse Canyon.

5.3 Moose Habitat Maps

Habitat maps showed good moose winter habitat values between Donald and Golden; while poor habitat values were found between Golden and the Kicking Horse Canyon. From Donald to Edelweiss Creek (30-53 LKI), riparian habitat and river islands were equally given ratings of 2 and 3, while polygons on the valley side slopes were predominately ratings of 4 with ratings of 3 and 5 equally represented. From Edelweiss Creek through Golden and into the Kicking Horse Canyon habitat quality became quite low, with ratings of 4 and 5 found equally on both south- and north-facing slopes.

5.4 Bighorn Sheep Habitat Maps

Polygons were not rated in the ICHmk1 between Donald and Edelweiss Creek as bighorn sheep do not regularly occur in this section of the study area. In the IDFdm2, between Edelweiss Creek and Roth Creek, there were equal amounts of ratings of 3 and 4 on south-facing slopes in the Kicking Horse Canyon. In this same area, ratings of 2 were common and generally were clumped in open and rocky areas. North-facing slopes along the Kicking Horse Canyon had only ratings of 5.

5.5 Bear Habitat Maps

Habitat maps showed that there was good growing season habitat values for bear between Donald and Edelweiss Creek, while habitat quality was generally lower from Edelweiss Creek to Golden through the Kicking Horse Canyon. From Donald to Edelweiss Creek (30-53 LKI), there were equal amounts of ratings of 2 and 3, while ratings of 4 and 5 were almost absent. From Edelweiss Creek through Golden and into the Kicking Horse Canyon habitat quality became lower due to steeper and drier terrain. Ratings of 3 and 4 were equally represented and few ratings of 5 were found on both south- and north-facing slopes along the Kicking Horse Canyon.

5.6 Mountain Goat Use Areas

Three mountain goat use areas were identified by Demarchi and Searing (1997), all were found between Donald and Roth Creek. A small use area and mineral lick was located at 5.0 LKI on the south side of the Kicking Horse River. Two use areas and mineral licks were found on the north and south side of the TCH at 5 Mile Bridge at 9.5 LKI.

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