Woodland Caribou

Scientific Name: *Rangifer tarandus caribou*
Woodland Caribou (mountain ecotype)

Species Code: M-RATA

Status: Blue-listed

Distribution

- **Provincial Range:** The woodland caribou in British Columbia are separated into three ecotypes based on biogeography differences rather than morphological differences (Nagorsen 1990). Mountain caribou can be found in southeastern British Columbia and in the east-central portions of the province. They inhabit areas of high snowfall where snow depths make cratering for winter forage difficult so they rely primarily on arboreal lichens for winter food. The northern caribou inhabits areas with low to moderate snow depths in the boreal forests in the north and west-central portions of BC. In these areas they forage primarily on terrestrial lichens but arboreal lichen use increases as winter progresses or during winters of deep snowpack. The boreal ecotype live in relatively flat terrain of the boreal forests in northeastern B.C.

- **Elevational Range:** Wide variety of elevations thoughout the year from valley bottoms to alpine meadows. Generally found most often in habitats from 1300m -1900m (Burke 1985).

- **Provincial Context:** Woodland caribou were abundant in southeastern British Columbia in the early 1900's but populations have since declined or disappeared (Stevenson 1985). The number of caribou in British Columbia is currently estimated to be about 18,000, of which 2500 fall into the mountain ecotype. Within the vicintiy of the study area there are approximately 250 animals (belonging to the Central Selkirk herd) (Hamilton *et al* 2000, Paquet 1999).

- **Range in Project Area:**
  Ecoprovince: Southern Interior Mountains
  Ecoregions: Columbia Mountains and Highlands and Selkirk Bitterroot Foothills
  Ecosections: Central Columbia Mountains and Selkirk Foothills
  Biogeoclimatic Zones: IDFun, ICHdw, ICHvk1, ICHwk1, ICHmw2, ICHmw3, ESSFwc1, ESSFwc4, ESSFvc, ESSFvcp, ESSFwcp, AT

Ecology and Key Habitat Requirements

- **General**

Caribou are primarily grazers, and display selective feeding habits, taking only the most palatable portions of selected forage. In the fall and early winter, mountain caribou feed on grasses, sedges, willow, dwarf birch tips and arboreal lichens. As the depth of the snow increases, their diet consists almost exclusively of arboreal lichens being that this is all that is available in the habitats they select. (Paquet 1997)

Mountain Caribou do not have a distinct home range, though a complex seasonal altitudinal migration up and down mountainous slopes makes use of seasonal habitats within the full range of elevations. Spring and early winter habitat can be found in low-elevation forests. Caribou exhibit the greatest variability in selection of these habitats. Generally these habitats are found in open canopied mature-old growth forests where succulent new vegetation is available (Burke 1985). Late winter and summer habitat is found in mid and high elevation Engelmann Spruce-Subalpine fir forests including parkland forests (ESSFp) and alpine tundra (AT). Late winter habitat is typically characterized as having moderate slopes on all aspects, and are large areas on ridge tops or upper slopes with open mature - old growth spruce - fir forests where lichen is abundant and easily available (Burke 1985).

In TFL23 the caribou population is very low. It is estimated that between 213 and 263 individuals reside year round in the study area (Hamilton *et al* 2000).

Unlike the tundra dwelling caribou, mountain caribou usually remain in small incohesive groups of less than 20 animals and usually in small groups of less that 5. The aggregation into small groups is likely a predator avoidance tactic.

Mountain caribou of the Selkirk Mountains occupy annual home ranges of up to 170 km^2 (Paquet 1997). Hamilton (2000) found that the female caribou in this area occupied 173 km^2 while males occupy home ranges of 254 $km^{2.}$

Breeding occurs in late autumn with males defending a small harem of 6-10 females. Gestation averages about 7 -8 months. Calves are born in late May or early June, at a time when food is more abundant and nutritious for both the mother and calf (Burke 1985). Calves are not camouflaged and must be able to travel with the cows almost immediately after birth.

Habitat Use and Life Requisites

- **Food**

Some researchers believe that caribou are severely restricted to the habitats that they use because of the morphology of the their front teeth. Mountain caribou have the smallest incisors of any ungulate in B.C. thereby limiting the type of food they can utilize; forage must be relatively soft (Paquet 1997).

Diet is seasonally variable. Caribou are principally grazers exhibiting selective foraging of grasses, flowering plants such as Sitka valerian, horsetails and scrub birch, black huckleberry and willow leaves and buds, falsebox, sedges and lichens in the spring and summer. These food sources are found in low elevation valley bottom forests in the spring and high elevation parkland forests and alpine meadows in the summer.

The fall and early winter diet consists of dried grasses and sedges, and twigs and buds of willow, huckleberry and scrub birch. Caribou find these food sources in low elevation ESSF forests in early winter and high ESSF forests in the fall.

In the late winter when the snow deepens and hardens the diet consists almost exclusively of arboreal lichens found growing in the subalpine and upper ESSF forests. Caribou have adapted to this kind of diet because these lichens are the only food source available at snow depths of up to 5m. This deep snow thereby elevates the caribou into the canopy where the lichen grows (Kinley 1999). Lichens are either pulled directly from the branches of conifers, picked from the snow having been blown from the tree or grazed from windthrown branches and trees. Two species of lichen are commonly eaten *Bryoria* spp, and *Alectoria sarmentosa*. These lichens grow very slowly and are only found in relatively stable mature subalpine fir - Engelman spruce forests aged 150 years or older (Paquet 1997) (Burke 1985).

Table 1. Important forage species for Woodland caribou. The most important or preferred species are in bold type.

	Early Winter Forage Species	***Late Winter Forage Species***	***Growing Season Forage Species***
Terrestrial Lichens			***Cladina* spp.** ***Cladonia* spp.** ***Stereocaulon* spp.**
Arboreal Lichens	***Bryoria* spp.** ***Alectoria* spp.** ***Cetraria* spp.**	***Bryoria* spp.** ***Alectoria* spp.** ***Cetraria* spp.**	***Bryoria* spp.** ***Alectoria* spp.** ***Cetraria* spp.**
Shrubs	**falsebox** *Paxistima myrstinites* **buds of:** willow *Salix* spp. birch *Betula* spp. saskatoon *Amelanchier alnifolia* Alder *Alnus* spp.		**foliage of:** falsebox *Paxistima myrstinites* willow *Salix* spp. birch *Betula* spp. Labrador tea *Ledum* spp. *Vaccinium* spp. saskatoon *Amelanchier alnifolia* Alder *Alnus* spp. crowberry *Empetum nigrum* bog-laurel *Kalmia* spp.
Trees	subalpine fir *Abies lasiocarpa*	subalpine fir *Abies lasiocarpa*	subalpine fir *Abies lasiocarpa*
Graminoids			bluegrasses *Poa* spp. **altai fescue** *Festuca altaica* **fescues** *Festuca* spp. wheatgrasses *Elymus* spp. *Bromus* spp. sedges *Carex* spp. bulrush *Scirpus* spp. rushes *Juncus* spp.
Forbs			lupine *Lupinus* spp. Indian paintbrush *Castilleja* spp. pussytoes *Antennaria* spp. *Eriogonum* spp. cinquefoil *Potentilla* spp. **bracted lousewort** *Pedicullaris bracteosa* northern bedstraw *Galium boreale* fireweed *Epilobium* spp. *Anemone* spp. *Aster* spp. mountain arnica *Arnica latifolia* horsetail *Equisetum* spp. Sitka valerian *Valeriana sitchensis* Sitka burnet *Sanguisosrba canadensis*
Other Forage	**Mushrooms** Mosses wind thrown arboreal lichens	**Mushrooms** Mosses wind thrown arboreal lichens	**mushrooms** mosses wind thrown arboreal lichens (especially in spring and early winter)

- **Security Habitat**

In the Selkirk Mountains grizzly, cougar and to a minor degree lynx and wolverine are the main predators of Caribou. Caribou's anti-predator strategy is based on their ability to utilize subalpine and alpine forests

almost year-round. Caribou avoid predators because of their ability to travel in soft or deep snow while their predators such as cougar, grizzly bears and to a minor degree wolves can not (Paquet, 1997). Furthermore by selecting these mature high elevation forests they avoid contact with their predators, that are generally more concentrated in the more open younger structural stages at lower elevations (where the other ungulate such as elk, deer and moose are) (Kinley 1999).

Rugged, exposed alpine/subalpine terrain provides caribou with the best security habitat where they can distance themselves from other prey species and best detect and avoid predators. Caribou make use of forests during the winter season. Forested habitats with low shrub cover are good for maximum sightability (Hamilton *pers. comm.* 1997).

• **Thermal Habitat**

Caribou use thermal habitats to assist them in maintaining a constant body temperature. Thermal habitat is more important for caribou in the winter, as this is when they are nutritionally stressed and need to conserve energy. Caribou are highly adapted, both physiologically and behaviourally, to life in arctic and subarctic winters and in turn show no real thermal cover dependency (Himmer and Powers 1999). When winter conditions do become unfavorable, -35 degrees celcius or high wind speeds (30-40km/hr) caribou will retreat to the forest and bed down to conserve heat. Thermal habitat is provided by mature and old growth forests (structural stage 6-7) and closed crown closure (40%) (Apps and Kinley 1995), tree-islands in subalpine parkland, krummholtz, lee-slopes, and broken terrain that give shelter from chilling winds. Old growth forests where arboreal lichens are most abundant, also provide good snow interception.

In the early winter, fall and to some extent late winter mature to old-growth forests in the MSdk subzone are selected if they have dense canopy closure (40%) (Apps and Kinley 1995). This is to provide maximum snow interception and thermal cover, while providing 'green' forage later in the season. Ideal thermal habitat would also have abundant low shrub cover (limited tall shrub and low conifer cover) for maximum sightability.

Late winter and summer habitat has open mature-old growth forest with 11-40% crown closure (Apps and Kinley 1995). In the summer, most caribou are in subalpine and alpine habitats, where they can find relief from heat in forests, lingering snowfields, or cool windswept alpine slopes.

Seasons of Use

The exact times of seasonal migrations and habitat used by mountain caribou may vary between populations; four distinct seasonal habitat use patterns are generally recognized (Simpson and Woods 1987). The four distinct periods are early winter, late winter, spring and summer and fall (Simpson *et al*.1997).

In **early winter (late October-January)** the caribou migrate to lower elevation ESSF forests and upper MSdk and ICH forests and the transition zone between the two. Here the forest canopies intercept snow thereby decreasing snow depth, and providing thermal cover and green forage later in the season than the more exposed forest communities at higher elevations (U.S. Fish and Wildlife Service 1992). In order for these habitats to be suitable for caribou in this season they must have gentle to moderate slopes, be of older age class and closed canopy (structural stage 6-7 with >50% crown closure) and have low shrubs thereby facilitating siteability and forage species.

By **late winter (mid January-May)** the snow hardens and facilitates migration to higher elevation ESSFdk, moderate-gentle slope ESSFdku and ESSFdkp (parkland) forests. The heavy snow accumulation lifts the caribou up into the forest canopy where it can feed upon the arboreal lichen that is required for survival. Gentle sloping areas are preferred due to their lower avalanche hazards. These

preferred late winter forests have a crown closure of 30-50% and high concentrations of the arboreal lichen species *Alectoria sarmentosa* and *Bryoria spp.*

When the warmth of the **Spring (May – late June)** begins to melt the winter's snow the caribou move to areas of early green up such as valley bottom MSdk and ICH forests and, lower elevation ESSF forest and openings adjacent to forests. It is at the lower elevation that winter weakened caribou feed on succulent new vegetation. Lichen litterfall or blowdown is also an important component of the spring diet of caribou. Some animals may remain at higher elevations utilizing this resource. Again closed canopy forests with low shrubs in the understory are preferred, as long as their visibility is unobstructed.

Pregnant females will leave the spring feeding grounds earlier than other caribou. The females will move away from other caribou to remote, rugged and/or snow covered ESSFdku and ESSFdkp areas at higher elevations. Calving grounds need to be close to forests with high concentrations of arboreal lichen, as they are required to sustain the new mothers. It is thought that this is a predator avoidance behavior to increase calf survival.

Summer and Fall (**late June- late October)** sees the caribou in the alpine and subalpine open forests, meadows, seeps, bogs and riparian like habitat in the ESSFdku, ESSFdkp and AT where vegetation is succulent and in abundance (U.S. Fish and Wildlife Service 1992) (Simpson and Woods 1987) (Banfield 1981).

Table 2. General seasonal habitat use by mountain caribou (Stevenson *et al*. 1994)

	SPRING **May – late June**	**SUMMER-FALL** **late June – late Oct**	**EARLY WINTER** **late Oct – mid-Jan**	**LATE WINTER** **mid-Jan – May**
HABITAT	Two distinct patterns: -snow-covered habitats in ESSF -snow-free habitats in lower ESSF or ICH	Upper ESSF and AT zones.	Lower ESSF zone, ESSF/ICH ecotone, ICH zone.	Primarily subalpine parkland in upper ESSF zone; occasionally AT zone.
FORAGE	Arboreal lichens (snow-covered habitats). New green vegetation (snow-free habitats).	Herbaceous green vegetation.	Arboreal lichen, especially as litterfall and on wind-thrown trees. Low evergreen shrubs (especially *paxistima*) when available. Some conifer foliage. Occasional browsing on shrubs.	Arboreal lichens available on standing trees. Some conifer foliage.
MORTALITY FACTORS	Bear and wolf predation; early calf mortality is high, but mechanisms are not well understood.	Wolf, bear, and cougar predation.	Wolf predation, poaching.	Accidents, especially avalanches.
KEY HABITAT ATTRIBUTES	Use of snow-covered habitats is likely a predator-avoidance mechanism. In snow-free habitats, non-calving mountain caribou select sites where obstructions to visibility and movement are low	Availability of rugged, mountainous summer ranges a key factor in separating mountain caribou from wolves.	Arboreal lichen, especially as litterfall and on windthrown trees. Understory dominated by low evergreen shrubs, not tall shrubs or conifers. Snow interception by conifers.	Arboreal lichens available on standing trees.
COMMENTS	Calving occurs in ESSF or AT, usually near snowline. Some			

	cows move downslope, then re-ascend to calve; others remain at higher elevations. Most bulls use snow-free habitats.			

Table 3 summarizes the life requisites required for each month of the year for mountain caribou.

Life Requisite	Month	Season
Food, Security and Thermal habitat	January	Early Winter
Food, Security and Thermal habitat	February	Late Winter
Food, Security and Thermal habitat	March	Late Winter
Food, Security and Thermal habitat	April	Spring
Food, Security and Thermal habitat	May	Spring
Food, Security and Thermal habitat	June	Spring/Summer
Food, Security and Thermal habitat	July	Growing (Summer)
Food, Security and Thermal habitat	August	Growing (Summer)
Food, Security and Thermal habitat	September	Growing (Fall)
Food, Security and Thermal habitat	October	Growing (Fall)
Food, Security and Thermal habitat	November	Early Winter
Food, Security and Thermal habitat	December	Early Winter

Habitat Use and Ecosystem Attributes

Table 4 outlines the specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics) that are considered when rating each life requisite.

Table 4. Predictive ecosystem mapping (PEM) attributes considered for each life requisite for mountain caribou

Life Requisite	PEM Attribute
Food Habitat	- site: site disturbance, elevation, slope, aspect, structural stage - soil/terrain: bedrock, terrain texture, flooding regime - vegetation: % cover by layer, species list by layer, cover for each species for each layer
Security/Thermal Habitat	- site: elevation, slope, aspect, structural stage - soil/terrain: terrain texture - vegetation: % cover by layer - mensuration: tree species, dbh, height

Table 5 Life requisites required and Habitat use rated for mountain caribou.

Life Requisite	Habitat-Use	Month	Rating column title
Food	General Living-Early Winter	Nov,Dec,Jan	MRATA_FDEW
	General Living-Late Winter	Feb,Mar	MRATA_FDLW
	General Living-Spring	Apr,May,Jun	MRATA_FDP
	General Living-Summer & Fall	Jul,Aug,Sept,Oct	MRATA_FDS&F
Security and Thermal habitat	General Living-Early Winter	Nov,Dec,Jan	MRATA_STEW
	General Living-Late Winter	Feb,Mar	MRATA_STLW

	General Living-Spring	Apr,May,Jun	MRATA_STP
	General Living-Summer & Fall	Jul,Aug,Sept,Oct	MRATA_STS&F

Ratings

Based on habitat studies of comparable populations in the Kootenay region a 6 class / 5 season rating scheme will be employed.

- **Provincial Benchmark**

Ecosection: Cariboo Mountains (CAM)

	Winter	Growing
Biogeoclimatic Zone:	ESSFwk	ESSFwk
Broad Ecosystem Unit	SF6 White spruce - Subalpine fir forest	SM Subalpine-meadow

- **Ratings Assumptions**

Assumptions for MRATA_STEW & MRATA_STLW	
TEM attribute	**Assumptions**
Slope	-moderate slopes (16-35%) rated up to class 1 -Increasing slopes (>60%) as with gentle slopes (0-15%) decrease the rating down a class (Apps and Kinley 1995)
Crown Closure	-Crown closure class of 11-40% combined with low shrub cover were found to be preferred by Apps and Kinley (1995) and therefore can be rated up to class 1 -Crown closure <11% rated up to class 3 at best while those > 40% rated up to 2 at best
Plants	-Ecosystems that fall into the mesic to xeric regime (dry) of the ESSF subzones with abundance of Se and Bl rate up to 1, whereas those found in the moist and very dry end of the moisture regime (mesic-subhydric and xeric to very xeric) rate slighly lower, up to class 3 -those units dominated by Pl and Lw rate up to 4-5 due to the open nature of these stands.
Structural Stage **(no structural model for TFL 23 PEM-ratings for capability only)**	-Stages 1, 2 and 3 rated up to class 2 if at high elevations -Stages 4 and 5 rated up to class 2 or 3 -Stages 6 and 7 rated up to class 1
Assumptions for MRATA_STP & MRATA_STS&F	
Crown Closure	-Crown closure class of 11-40% combined with low shrub cover were found to be preferred by Apps and Kinley (1995) and therefore can be rated up to class 1 -Crown closure <11% rated up to class 3 at best while those > 40% rated up to 2 at best
Plants	-Ecosystems that fall into the submesic to subhygric regime (moist) of the ESSF subzones with abundance of Se and Bl rate up to 1 , whereas those found in the dry end of the regime (xeric) rate slighly lower, up to class 3
Structural Stage **(no structural model for TFL 23 PEM-ratings for capability only)**	-Stages 1, 2 and 3 rated up to class 2 if at high elevations -Stages 4 and 5 rated up to class 2 or 3 -Stages 6 and 7 rated up to class 1
Assumptions for MRATA_FDEW & MRATA_FDLW	
Plants	-EUs with lichen-bearing trees (classes 3-5 *Bryoria, Alectoria*) and snow accumulations rated up to class 1, usually structural stage 6 and 7 in upper ESSF and parkland habitat -EU's with mature – oldgrowth Pw in ESSF and parkland habitats rate class 1 due to abundant lichen loading often associated with these trees. -EUs that contain the plants listed in Table 1 rated up to class 1 depending on the density

	of forage species
Snow depth	-Snow depths > 200 cm throughout the winter assist caribou in reaching arboreal lichens and are rated up to class 1 (ESSFdku and ESSFdkp subzones)
Assumptions for MRATA_FDP & MRATA_FDS&F	
Plants	-Moist/Seepage Forests and Wetland/Wetland Forest units rated up to class 2 Fescue-Lichen meadows rated up to class 2 -EUs that contain the plants listed in Table 1 rated up to class 1 depending on the density of forage species

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Mountain Goat

Scientific Name: *Oreamnos americanus*
Species Code: M-ORAM

Status: Yellow listed

Distribution

- **Provincial Range**

The present distribution of mountain goats in the province has changed little from that of historical times. However, some populations have been exterminated and in many parts of its range numbers have decreased due to habitat loss, disease or starvation and over-hunting. Mountain goats are found throughout suitable habitats in a variety of biogeoclimatic zones on the mainland of British Columbia. In British Columbia mountain goats are most abundant in the Rocky Mountains, scattered populations exist in the coastal mountain and in northern mountains and plateaus (Stevens and Lofts 1988).

- **Elevational Range:** Poole and Mowat (1997) found that the elevation range of selected habitats in the West Kootenays varied between seasons. In the Growing season Goats were found at an average elevation of 1978 m with a min elevation of 1303 and max elevation of 2341 m, while in the winter season the mean elevation was 1712 while the maximum elvevation was 2327 m and the minimum elevaiton was 1059 m.

- **Provincial Context**

Mountain goats are restricted to the northwest portion of North America, including British Columbia. British Columbia has more native goat range than any other province. The 1997 provincial population estimate for mountain goats was estimated at 50,000 (Hatter 1997).

- **Range in Project Area:**

Ecoprovince: Southern Interior Mountains
Ecoregions: Columbia Mountains and Highlands and Selkirk Bitterroot Foothills
Ecosections: Central Columbia Mountains and Selkirk Foothills
Biogeoclimatic Zones: IDFun, ICHdw, ICHvk1, ICHwk1, ICHmw2, ICHmw3, ESSFwc1, ESSFwc4, ESSFvc, ESSFvcp, ESSFwcp, AT

Ecology and Key Habitat Requirements

The mountain goat is a generalist herbivore. Habitat selection is determined more by topographical features rather than by the presence of specific forage species. Mountain goats inhabit rugged terrain comprised of cliffs, ledges, projecting pinnacles and talus slopes in subalpine and alpine habitats. Forage sites for mountain goats must be adjacent to suitable landforms to which they can retreat in times of danger. Studies have shown that the distance to cliffs was the most important factor determining goat distribution and that summering goats made little use of foraging areas over 400 m from cliffs (Poole and Heard 2001, Smith 1986, USDA Forest service 1997).

The diet of mountain goats in the interior of British Columbia is primarily graminoids. The winter diet includes mainly shrubs, trees, litterfall and both arboreal and terrestrial lichens. Summer diets are more varied with a higher proportion of forbs, grasses and sedges and less browse (Fox and Smith 1988). Grasses and forbs are highly palatable and nutritious in spring and early summer, and they become less nutritious in fall and winter. During the fall and winter seasons, the higher protein content of woody forage encourages greater browsing.

Winters are spent on well ledged or fractured cliffs, and very steep terrain with interspersed vegetation with low snow accumulation. These habitats are usually, on steep south to southwest aspects with access to forage. Mountain goats use those portions of winter ranges on slopes exceeding 40 degrees. (Poole and Mowat 1997, Hebert and Turnbull 1977, McCrory 1977). In interior wet belt forests such as

those found in TFL 23 suitable winter ranges may also be at lower elevations where snow is less abundant and persistent, such as steep sloping forests (Poole and Mowat 1997, Demarchi 2000 *et al*, Herbert and Turnbull 1977, McCrory *et al 1977).*

In spring, mountain goats feed in snow-free habitats on warm aspects. As the summer progresses, they will follow the melting snow line up slope and feed on emerging young, succulent vegetation on other aspects. During the summer months, goats often use areas of lush herbaceous forage in alpine grasslands, meadows, and grassy slide-rock slopes of the AT and ESSF parklands. Timbered areas and avalanche tracks in the ESSF subzones may also be used during migration or movement between cliff bands and feeding areas. When crossing areas that are without escape terrain goats repeatedly use the same trails (Poole and Mowat 1997, McCrory *et al* 1977, Hebert and Turnbull 1977, USDA Forest service 1997).

In general mountain goats will make use of higher elevation habitats in the summer and lower ones during the winter (USDA Forest service 1997).

Kids are born between May-June on the steepest most rugged areas of the goat's range.

Habitat Use and Life Requisites
The life requisites that will be rated for Mountain Goat are: food and security habitat which are described in detail below.

• **Feeding Habitat**
Mountain goats select habitat more for its topographical features than for the availability of specific forage species. Mountain goats will feed in a variety of habitats adjacent to escape terrain such as alpine tundra, alpine/subalpine wet meadow, subalpine parkland, talus shrublands and subalpine forest burns. Goats may feed in lower coniferous forests during winter in wet snow areas (Demarchi *et al* 2000, Poole and Mowat 1997) or may use windswept ridges in dry interior locations (Stevens and Lofts 1988).

Mountain goats feed on a variety of plant foods. Grasses, sedges, rushes, ferns, forbs, lichens, shrubs and conifers are important in different seasons. Winter diet preferences in the West Kootenays are no known but likely they will feed upon whatever plants are available or emerging from the snow, from dried grasses to conifer needles, shrubs, litterfall lichen and even mosses and ground lichens (Poole and Mowat 1997). Their summer diet is more varied with a higher proportion of forbs, grasses and sedges. Grasses have been found to make up the bulk of their summer diet.

Table 1. Important forage species for mountain goats.

Graminoids	bluegrasses *Poa* spp. fescues *Festuca* spp. wheatgrasses *Elymus* spp. *Calamagrostis* spp. *Trisetum* spp.	*Bromus* spp. sedges *carex* spp. rushes *juncus* spp. woodrush *Luzula* spp. *Agrostis* spp.
Forbs	moss campion *Silene acaulis* *Penstemon* spp. *Aster* spp. cinquefoil *Potentilla* spp. yarrow *Achillea millefolium* stonecrop *Sedum* spp. *Arnica* spp.	pussytoes *Antennaria* spp. mountain sagewort *Artemisia norvegica* field chickweed *Cerastium arvense* edible thistle *Cirsium edule* Jacob's ladder *Polimonium* spp. smooth alumroot *Heuchera glabra*
Shrubs	yellow mountain-heather *Phyllodoce glanduliflora* white moss heather *Cassiope mertensiana* trailing bramble *Rubus pedatus* willow *Salix* spp. *Vaccinium* spp. black twinberry *Lonicera involucrata* kinnikinick *Arctostaphylos uva-ursi* saskatoon *Amelanchier alnifolia* crowberry *Empetrum nigrum*	
Trees	subalpine fir *Abies lasiocarpa* Douglas-fir *Pseudotsuga menziesii* common juniper *Juniperus communis*	
Ferns	lady fern *Athyrium filix-femina* deer fern *Blechnum spicant* spiny wood fern *Dryopteris* spp. bracken *Pteridium aquilinum*	
Mosses	*Hylocomium splendens* *Rhytidiadelphus spp.* *Sphagnum cuspidatum*	
Lichens	*Bryoria* spp. *Alectoria* spp. *Usnea* spp. *Lobaria* spp.	

• **Security Habitat**

Security habitat is used by mountain goats to escape predators. Mountain goats need steep, preferably greater than 100% slope, rugged terrain with cliffs, rock ledges and talus slopes (Smith 1994). Escape terrain should optimally be within 400 m of forage sites. Visibility is another important factor in security habitat selection. Lack of visibility may limit their use of dense stands of conifers far from escape terrain.

Seasons of Use

Table 2 summarizes the life requisites required for each month of the year.

Table 2. Monthly life requisites required for mountain goat.

Life Requisite	Month	Season
Food, Security habitat	January	Winter
Food, Security habitat	February	Winter
Food, Security habitat	March	Winter
Food, Security habitat	April	Growing (Spring)
Food, Security habitat	May	Growing (Spring)
Food, Security habitat	June	Growing (Summer)
Food, Security habitat	July	Growing (Summer)
Food, Security habitat	August	Growing (Summer)
Food, Security habitat	September	Growing (Fall)
Food, Security habitat	October	Growing (Fall)
Food, Security habitat	November	Winter
Food, Security habitat	December	Winter

Habitat Use and Ecosystem Attributes

Table 3 outlines the specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics) that are considered when rating each life requisite

Table 3. Mapping attributes considered for each life requisite for mountain goat.

Life Requisite	PEM Attribute
Feeding Habitat	- site: site disturbance, elevation, slope, aspect, structural stage - soil/terrain: bedrock, terrain texture, flooding regime - vegetation: % cover by layer, species list by layer, cover for each species for each layer
Security Habitat	- site: elevation, slope, aspect, structural stage - soil/terrain: bedrock, terrain texture - vegetation: % cover by layer - mensuration: tree species, dbh, height
Thermal Habitat	- site: site disturbance, elevation, slope, aspect, structural stage - soil/terrain: bedrock, terrain texture, flooding regime - vegetation: % cover by layer, crown closure - mensuration: tree species, dbh, height

Table 4 Life requisites and Habitat use rated for mountain goat.

Life Requisite	Habitat-Use	Month	Rating column title
Food	General Living-Winter	Nov,Dec,Jan,Feb,Mar	MORAM_FDW
	General Living-Spring	Apr,May,Jun	MORAM_FDP
	General Living-Summer	Jul,Aug	MORAM_FDS
	General Living-Fall	Sept,Oct	MORAM_FDF
Security and Thermal habitat	General Living-Winter	Nov,Dec,Jan,Feb,Mar	MORAM_STW
	General Living-Spring	Apr,May,Jun	MORAM_STP
	General Living-Summer	Jul,Aug	MORAM_STS
	General Living-Fall	Sept,Oct	MORAM_STF

Ratings
There is a detailed level of knowledge of the habitat requirements of mountain goats in British Columbia to warrant a 6-class rating scheme

- **Provincial Benchmark**

	Winter	**Growing**
Ecoprovince:	Southern Interior Mountains	Southern Interior Mountains
Ecosection:	Southern Park Ranges (SPK)	Southern Park Ranges (SPK)
Biogeoclimatic Zone:	ESSFdk	AT
Broad Ecosystem Unit:	White Spruce-subalpine fir/RO –Rock	Alpine meadow

Habitats: Mature – oldgrowth forests, subalpine parkland and seepage areas complexed with cliffs, rock bluffs, talus slopes, and avalanche tracks, on steep (greater than 80% slope), south to southwest aspects. Mountain goats may at times use habitats on gentle to moderate slopes but usually within close proximity to steep escape terrain. Northerly aspects may be used in winter if windswept of snow accumulations.

- **Ratings Assumptions**

Assumptions for MORAM_STW	
TEM attribute	**Assumptions**
Aspect	-Cool aspects are rated lower than warm aspects due to deeper snow
Slope	-Forested and non-forested slopes > 100% slope rated up to class 1 -Slopes 26-99% rated up to class 2 -Level and gently sloping EU's rated up to class 4
Structural Stage **(no structural model for TFL 23 PEM-ratings for capability only)**	-Stages greater than 3 on steep slopes will decrease ratings slightly because of reduced sightability -Stages greater than 3 on level or gentle slopes will increase ratings slightly because of reduced sightability permitting mountain goats to be less visible
Site Series	-Talus slopes rated up to class 2 -Cliffs rated up to class 1 -Rock outcrops on slopes > 100% rated up to class 1
Assumptions for MORAM_STP, MORAM_STS & MORAM_STF	
Aspect	-Cool aspects may be rated lower than warm aspects due to deeper snow
Slope	-Forested and non-forested slopes > 100% slope rated up to class 1 -Slopes 26-99% rated up to class 2 -Level and gently sloping EU's rated up to class 4
Structural Stage **(no structural model for TFL 23 PEM-ratings for capability only)**	-Stages greater than 3 on steep slopes will decrease ratings slightly because of reduced sightability -Stages greater than 3 on level or gentle slopes will increase ratings slightly because of reduced sightability permitting mountain goats to be less visible
Site Series	-Talus slopes rated up to class 2 -Cliffs rated up to class 1 -Rock outcrops on slopes > 100% rated up to class 1
Assumptions for MORAM_FDW	
Plants	-EUs that contain the plants listed in Table 1 rated up to class 1 depending on density of forage species
Aspect	-Cool aspects may be rated lower than warm aspects due to deeper snow
Slope	-Forested and non-forested slopes > 100% slope rated up to class 1 -Slopes 26-99% rated up to class 2 -Level and gently sloping EU's rated up to class 4

Assumptions for MORAM_FDP, MORAM_FDS & MORAM_FDF	
Plants	-EUs that contain the plants listed in Table 1 rated up to class 1 depending on density of forage species
Aspect	-Cool aspects may be rated lower than warm aspects due to deeper snow
Slope	-Forested and non-forested slopes > 100% slope rated up to class 1 -Slopes 26-99% rated up to class 2 -Level and gently sloping EU's rated up to class 4

- **Ratings Adjustment Considerations**

Final capability and suitability map products may incorporate 1) landscape heterogeneity and connectivity; 2) habitats adjacent to significant anthropogenic disturbance regimes (e.g. settlements); 3) adjacency to escape terrain.
One study showed that the distance to cliffs was the most important factor determining goat distribution and that summering goats made little use of foraging areas over 400m from cliffs (USDA Forest service 1997).

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Grizzly Bear

Scientific Name: *Ursus arctos*
Species Code: M-URAR

Status: Blue-listed

Distribution

- **Provincial Range**

Grizzly bears are distributed throughout most of the mainland of the province. They are absent from Vancouver Island, the Queen Charlotte Islands and outer coastal islands. They occur in all biogeoclimatic zones in the province, except the Coastal Douglas Fir zone (CDF). They utilize a wide variety of habitats ranging from coastal estuaries to alpine meadows.

- **Elevational Range:** Sea-Level to Alpine

- **Provincial Context**

Grizzly bears are most abundant in the coastal ecosystems and in areas in the southern Rocky Mountains (Flathead area and Glacier National Park). The current population estimate for grizzly bears in British Columbia is approximately 13,000 (Fuhr and Demarchi 1990).

- **Range in Project Area:**

Ecoprovince: Southern Interior Mountains
Ecoregions: Columbia Mountains and Highlands and Selkirk Bitterroot Foothills
Ecosections: Central Columbia Mountains and Selkirk Foothills
Biogeoclimatic Zones: IDFun, ICHdw, ICHvk1, ICHwk1, ICHmw2, ICHmw3, ESSFwc1, ESSFwc4, ESSFvc, ESSFvcp, ESSFwcp, AT

Ecology and Key Habitat Requirements

Habitat use by grizzly bears is influenced primarily by food availability, the presence of suitable resting, denning and mating sites, the presence of other bears and by human development. They are very adaptable and inhabit a wide variety of habitat types from coastal coniferous forests through boreal forests to alpine/subalpine meadows and alpine tundra. Grizzly bears are omnivorous and opportunistic in their feeding habits. In late spring and early summer, the bulk of their diet is green leafy material. They will also feed on insects, fruits, berries, fish, carrion and small and large mammals.

Grizzly Bears inhabit a broad range of habitat types throughout the course of a year, with optimum habitat being composed of a structurally diverse combination of forested land and open habitats in all subzones in the study area. In the spring grizzly bears in the Kootenay region frequent areas of quick green up, with rapid vegetation growth, and high concentrations of ungulate carrion. These areas are found in low elevation valley bottoms, wetlands, wet meadows and south facing avalanche chutes. Later in the season and into the summer the bears will graze on grasses, horsetails, rushes and sedges. During berry season they will feed on blueberries, buffalo berries and huckleberries. They will also prey on small mammals, especially ground squirrels, throughout the growing season (Lofroth).

During periods of inactivity, Grizzly bears will occasionally utilize bed sites in forest habitats with thick understory vegetation. These sites are often a simple shallow depression in the forest leaf litter, but may become deeper with use. The location of these bedding sites is often dependent on the weather conditions. On warm summer days they will dig deep beds in pockets of snow or in cool sand, under a dense cover of shrubs. In wet weather, beds will often be located in dry areas such as at the base of a tree (Lofroth). Bedding requirements are generally site-specific and cannot be mapped based on TEM

attributes and so were not rated. If located, these features were identified in the "Evidence of Use" section in the Wildlife Habitat Assessment form.

Home ranges may change seasonally or annually depending on the differences in weather and food availability. Seasonal movements of grizzly bears are influenced by the availability of seasonally important food resources or habitat components, breeding activity, reproductive status of individuals and availability of denning habitat. Grizzly bears may move extensively between seasonal food sources and denning sites. They may concentrate seasonally at high-energy food sources such as salmon spawning grounds and productive berry patches.

Home ranges vary in size depending on the individual and the location. Males may have home ranges up to 3000 km^2. Females have well-defined ranges of between 25 and 600 km^2. Home ranges often overlap although adult females may maintain ranges exclusive of other adult females.

Winter dens are excavated in late autumn and the bears enter them with the onset of snowfall and colder temperatures. Dens are usually at high elevations on aspects where snow accumulates. It is here that the grizzly remains dormant for the majority of the winter.

Breeding occurs in late May until mid-July (Stevens and Lofts 1988). On average one to three cubs are born in January or February after a gestation period of 229 to 266 days. Birth and early maternal care occurs in winter dens. The cubs remain with their mother for the first two or three years.

Habitat Use and Life Requisites
The life requisites that will be rated for Grizzly Bear are living (food and security/thermal) in spring, summer and fall, and hibernating which are described in detail below.

- **Living**

Food
Habitat use is influenced by food availability, the presence of suitable denning and mating sites and the presence of other bears. Grizzly bears are opportunistic omnivores and feed on vegetation, berries, insects, small and large mammals, carrion and fish. They will also feed on insects such as carpenter ants, yellow jackets and bees. Their diet varies throughout the seasons depending on the availability and abundance of food items. Grizzlies tend to follow the retreating snow to higher elevations feeding on new vegetation, roots and berries. In the spring season, they will feed on grasses, sedges, forbs, roots and ungulates. Summers are spent in the AT or upper ESSF subzones and the ESSF parkland subzones. Here they feed on berries, primarily soapberry and huckleberry. They will also feed on forbs, roots, insects and small mammals favoring large open areas of structural stage 2 & 3. A minor down slope migration may occur in late summer and fall. Their diet during the fall season will include a smaller, though substantial proportion of berries as they are depleted, and an increasing component of other food species such as forbs, bulbs, insects and ungulates (Mowat and Ramcharita 1999). They will search out these food items in avalanche chutes and forest openings, such as minor clearcuts, of the ESSF and ICH subzones. They may even wander into clearings and openings in the IDF subzones.

Table 1. Known and potential forage species for grizzly bears (items in bold are known to be important or preferred).

Common Name	Latin name	Parts consumed
western yarrow	*Achillea millefolium*	leaves
wild onion	*Allium* spp.	entire plant
saskatoon	*Amelanchier alnifolia*	berries
kneeling angelica	*Angelica genuflexa*	leaves, stems, roots
wild sarsaparilla	*Aralia nudicaulis*	berries

kinnikinnick	*Arctostaphylos uva-ursi*	berries
aster	*Aster* spp.	leaves
milk-vetch	*Astragalus* spp.	leaves
lady fern	*Athyrium filix-femina*	fronds
scrub birch	*Betula glandulosa*	leaves
bluejoint reedgrass	*Calamagrosits canadensis*	leaves
Sitka sedge	*Carex sitchensis*	leaves
sedge	*Carex* spp.	leaves
edible thistle	*Cirsium edule*	flowers
red-osier dogwood	*Cornus stolonifera*	berries
tufted hairgrass	*Deschampsia cespitosa*	leaves
crowberry	*Empetrum nigrum*	berries
fireweed	*Epilobium angustifolium*	leaves, flowers
purple-leaved willowherb	*Epilobium ciliatum*	leaves, flowers
common horsetail	*Equisetum arvense*	foliage
wood horsetail	*Equisetum sylvaticum*	foliage
wild strawberrry	*Fragaria virginiana*	berries
cow parsnip	*Heracleum lanatum*	leaves, stems, flowers, roots
arctic lupine	*Lupinus arcticus*	roots
black twinberry	*Lonicera involucrata*	berries
Utah honeysuckle	*Lonicera utahensis*	berries
woodrush	*Luzula* spp.	entire plant
Oregon-grape	*Mahonia* spp.	leaves, berries
bog cranberry	*Oxycoccus oxycoccos*	berries
whitebark pine	*Pinus albicaulis*	cone seeds
stink currant	*Ribes bracteosum*	berries
northern blackcurrant	*Ribes hudsonianum*	berries
black gooseberry	*Ribes lacustre*	berries
northern gooseberry	*Ribes oxyacanthoides*	berries
prickly rose	*Rosa acicularis*	hips
Nootka rose	*Rosa nutkana*	hips
nagoonberry	*Rubus arcticus*	berries
dwarf nagoonberry	*Rubus arcticus* spp. *acaulis*	berries
five-leaved bramble	*Rubus pedatus*	berries
trailing raspberry	*Rubus pubescens*	berries
willow	*Salix* spp.	catkins
elderberry	*Sambucus* spp.	berries
mountain ash	*Sorbus* spp.	berries
soopolallie	*Shepherdia canadensis*	berries
common dandelion	*Taraxacum officinale*	foliage, flowers
clover	*Trifolium* spp.	foliage, flowers
stinging nettle	*Urtica dioica* spp. *gracilis*	foliage
dwarf blueberry	*Vaccinium caespitosum*	berries
black huckleberry	*Vaccinium membranaceum*	berries
grouseberry	*Vaccinium scoparium*	berries
Sitka valerian	*Valeriana sitchensis* spp. *sitcensis*	foliage
highbush-cranberry	*Viburnum edule*	berries
tree cambium	*Picea* spp., *Pinus* spp.	cambium under bark
Animal Foods		
ants	Formicidae	larva, adults
wasps	Vespidae	larva, adults

beetles	Coleoptera	larva, adults
moose	*Alces alces*	Carcasses, fresh kills
mule deer	*Odocoileus hemionus*	Carcasses, fresh kills
mountain goat	*Oreamnos americanus*	Carcasses
California bighorn sheep	*Ovis canadensis californiana*	Carcasses
caribou	*Rangifer tarandus*	carcasses, fresh kills
grizzly bear	*Ursus arctos*	carcasses, fresh kills
black bear	*Ursus americanus*	carcasses, fresh kills
voles	*Microtus* spp.	fresh kills
marmot	*Marmota caligata*	fresh kills

Security Habitat

Security habitat for grizzly bears can be divided into two types:
1/ Bear/bear avoidance – During the growing season shrub and tree cover are used as security from other bears. To avoid aggressive males, females with cubs may rely on wildlife tree patches (with a structural stage greater than 4). In alpine areas, females with cubs will descend below the treeline for secure bedding habitat or they may use cliff ledges and talus slopes which provide good visibility.
2/ Bear/human avoidance – Grizzly bears typically will avoid high-traffic roads (e.g. highways or active logging roads) and human settlements, unless attracted there by human food sources (e.g. garbage dumps, fruit trees, etc.). Suitable habitats adjacent to such non-habitat features are less suitable.

Thermal Habitat

Grizzly bears will temporarily seek shelter from precipitation and heat under old growth trees, forests, or forest patches with low canopy or rock overhangs. Shrub structural stage forests and mature forests provide the most cover for grizzly bears. Optimal grizzly bear cover is forested areas interspersed with grass and shrubland. Optimal thermal cover consists of coniferous trees at least 12m tall with a 70% canopy cover. Grizzly bears will utilize the forests as shelter against the rains of the frequent summer thunderstorms. Bears will also seek relief from heat by using open water (e.g. ponds, lakes, rivers, streams and springs). On warm summer days grizzly bears will seek shade in dense shrubby areas or in pockets of moist sand or snow.

- **Hibernating Habitat**

In late autumn, winter dens are established in caves, or in excavated soil. These are found in high elevation ESSF forests or shrubland. If a den is excavated they are usually in sites with slopes greater than 30 %, deep medium textured soil, that are well drained and on aspects where snow accumulates. Between January and March grizzly cubs are born to the sow (Stevens and Lofts 1988) (Lofroth) (Banfield 1981).
For the purposes of this study reproducing habitat is to be considered as the same as hibernating habitat as the cubs are born during the winter in the same dens excavated for winter denning. Due to the time of year that birthing takes place no food or security/thermal life requisites will be evaluated.

Seasons of Use

Table 2 summarizes the life requisites required for each month of the year.

Table 2. Monthly life requisites for grizzly bear.

Life Requisite	Month	Season
Hibernating	January	Winter
Hibernating	February	Winter
Hibernating	March	Winter
Hibernating	April	Winter
Living	May	Spring
Living	June	Spring
Living	July	Summer
Living	August	Summer
Living	September	Fall
Living	October	Fall
Hibernating	November	Winter
Hibernating	December	Winter

Habitat Use and Ecosystem Attributes
Table 3 outlines how each life requisite relates to specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics).

Table 3. Mapping attributes considered for each life requisite for grizzly bear.

Life Requisite	PEM Attribute
Living	- site: site disturbance, elevation, slope, aspect, - soil/terrain: bedrock, terrain texture, flooding regime - vegetation: % cover by layer, species list by layer, cover for each species, for each layer, coarse woody debris -mensuration: tree species, dbh, height
Hibernating Habitat	- site: site disturbance, elevation, slope, aspect, - soil/terrain: bedrock, terrain texture, flooding regime - mensuration: tree species, dbh, height

Table 4 Life requisites and Habitat use rated for grizzly bears.

Life Requisite	Habitat-Use	Month	Rating column title
Hibernation	General Living-Winter	Nov,Dec,Jan,Feb,Mar, Apr	MURAR_HI
Living	General Living-Spring	May,Jun	MURAR_LIP
	General Living-Summer	Jul,Aug	MURAR_LIS
	General Living-Fall	Sept,Oct	MURAR_LIF

There is a high level of knowledge on the habitat requirements of grizzly bears in British Columbia and thus, a 6-class rating scheme will be used.

- **Provincial Benchmark**

Ecosection: Border Ranges (BRR)
Biogeoclimatic Zone: MSdk
Habitats: Spruce - horsetail moist floodplain; and Willow - cow-parsnip active floodplain

- **Ratings Assumptions**

Assumptions for MURAR_HI	
TEM Attribute	**Assumptions**
Slope	Moderately steep to steep slopes rated up to class 1, very steep slopes rated as high as 3.
Structural Stage **(no structural model for TFL 23 PEM-ratings for capability only**	Stages 2 and 3 rated up to class 2 Stages 4, 5, 6, and 7 rated up to class 1
Elevation (BEC subzones)	Subzones receiving greater snowpack, that will last longer in the year, will be used more that the lower elevation habitats ie ESSF will be chosen for hibernating over lower elevation IDF habitats
Site modifiers	shallow soil and very shallow soil rate up to 4 and 5, respectively.
Aspect	no effect
Assumptions for MURAR_LIP, MURAR_LIS & MURAR_LIF	
Crown Closure	Crown closure > 50% rated up to class 1
Structural Stage **(no structural model for TFL 23 PEM-ratings for capability only**	Stages 1 and 2 rated up to class 5 Stage 3 rated up to class 2 if dense cover of tall shrubs Stages 4 and 5 rated up to class 3, and up to class 1 or 2 if shrub cover or canopy closure is dense Stages 6 and 7 rated up to class 1
Substrate	Floodplains rated up to class 1 if canopy closure is dense >50% or shrub cover is dense >40%.
Site Series	Avalanche chutes rated up to class 1 if plant species from table 1 are represented in abundance (>40% total cover). Often avalanche chutes are dominated by alder or krummholtz conifers and therefore rate up to 3 or 4.
Elevation (BEC subzones)	Grizzlies tend to follow the melting snow as it retreats to higher elevations. Therefore low elevation riparian habitat rates up to 1 or 2 early in the growing season while ESSF habitats and Alpine rate up to 1 or 2 in the summer.
Site modifiers	Shallow and very shallow soils rate down one or two respectively depending on elevation and desired forage or prey (ie ground squirrels in the ESSF are more abundant in deep soils)
Plants	EUs that contain the plants listed in Table 1 rated up to class 1 depending on the density of forage species

- **Ratings Adjustment Considerations**

Final capability and suitability map products may incorporate 1) landscape heterogeneity and connectivity; 2) habitats adjacent to significant anthropogenic disturbance regimes (e.g. settlements); 3) interspersion of different structural stages within the landscape.

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Northern Goshawk

Scientific Name: *Accipiter gentilis atricapillus*
Species Code: B-NOGO

Status: Yellow-listed, but considered at risk in B.C. because it is associated with habitats that are becoming rare.

Distribution

- **Provincial Range:**

The northern goshawk is an uncommon resident and breeder throughout the province, with species more common in the north of its range (Stevens and Lofts 1988).

- **Elevational Range:** Sea level to 2290 m

- **Provincial Context**

This essential non-migratory bird is widely distributed throughout the province, being least numerous along the coast and most abundant in the northern interior (Campbell *et al* 1990).

- **Range in Project Area:**

Ecoprovince: Southern Interior Mountains
Ecoregions: Columbia Mountains and Highlands and Selkirk Bitterroot Foothills
Ecosections: Central Columbia Mountains and Selkirk Foothills
Biogeoclimatic Zones: IDFun, ICHdw, ICHvk1, ICHwk1, ICHmw2, ICHmw3, ESSFwc1, ESSFwc4, ESSFvc, ESSFvcp, ESSFwcp

Ecology and Key Habitat Requirements

Although primarily a bird of mixed, open and dense forests, it has been recorded in almost every forest type in BC. Forest edge habitats are where this bird is most commonly observed, this is likely because they are more easily seen here than in dense forests (Campbell *et al* 1990).

Northern goshawk nests in dense mature and old growth coniferous stands (structural stage 6-7) from April to mid June. During this time they lay from 1- 5 eggs that are incubated for 32 -34 days.

Northern goshawk is essentially non-migratory, but will occasionally move south in response to reduced prey availability during extreme winter conditions (M.O.E. 1997).

Habitat Use and Life Requisites

The life requisite that will be rated for northern goshawk is living and reproducing which are described in detail below.

- **Living Habitat**

Food

A mature breeding pair may require up to 2400 ha for foraging, encompassing a variety of habitats (M.O.E.1997). Their foraging area ideally incorporates a diversity of landforms and forest cover types, preferred by the goshawks' preybase. These areas usually have a mosaic of structural stages and abundant coarse woody debris both standing and on the ground. Telemetry studies have shown that goshawk will avoid foraging in open habitats. Instead sites with relatively large trees, increased canopy closure, an open understory, and trees with significant basal area are used most frequently for feeding (M.O.E.1997).

The diet of the goshawk changes seasonally. During the winter season diet consists of prey species that do not migrate or hibernate such as grouse, hare and squirrel. In the growing seasons its diet consists of mainly birds such as robin, Stellar's jay, crows, ducks and some small mammals (USDA Forest service 1997).

Security/Thermal Habitat
Security/thermal habitat consists of mature and old growth forests with moderately closed canopy and an open understory. This habitat is typically found on gentle slopes (usually less than 30% slope) with an abundance of habitat attributes critical for goshawk prey (snags, coarse woody debris, forest openings) (M.O.E. 1997). Northern goshawks may have many nest sites throughout their home range, which are used for all activities from roosting to incubating edges and raising fledglings (M.O.E. 1997).

Reproducing (Eggs)
Security/Thermal Habitat
Acceptable nesting sites are the limiting factor associated with Reproducing habitat, and it is these habitats that will evaluated. Nesting or breeding habitat requirements are considerably smaller; 1-2 ha for the nest sites and up to 170 ha for the post fledgling stage. Preferred nest sites are found in stands of large trees with dense canopies and relatively open understories. This habitat is typically found on gentle slopes (usually less than 30% slope and always < 60 % slope) with an abundance of habitat attributes critical for goshawk prey (snags, coarse woody debris, forest openings). Nest sites are often located <450m from quietly flowing water (Campbell, Morgan and Palmateer 1988).
Nests are built in the crook of a tree that forks in 3 directions or on large, straight, horizontal branches or up-curving branches, usually one third - one half way up the nest tree. Campbell *et* al report that trembling aspen, and Douglas fir are the preferred nest trees (1990). The most suitable post-fledgling sites are also found in mid slope forests; with many snags, and horizontal branches for fledglings to perch upon and a dense canopy overhead to protect from predation (M.O.E. 1997)

Seasons of Use
Table 1 summarizes the life requisites required for each month of the year.

Table 1. Monthly life requisites required for northern goshawk.

Life Requisite	Month	Season
Living	January	Winter
Living	February	Winter
Living	March	Winter
Living	April	Winter
Living, Reproducing	May	Growing
Living, Reproducing	June	Growing
Living, Reproducing	July	Growing
Living, Reproducing	August	Growing
Living	September	Growing
Living	October	Growing
Living	November	Winter
Living	December	Winter

Habitat Use and Ecosystem Attributes
Table 2 outlines the specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics) that are considered when rating each life requisite
Table 2. Mapping attributes considered for each life requisite for northern goshawk.

Life Requisite	PEM Attribute
Feeding Habitat	• site: slope, aspect , structural stage • vegetation: % cover by layer, coarse woody debris (CWD) (dbh, decay class, abundance) • mensuration: tree species, dbh, height, wildlife tree characteristics
Security Habitat	• site: structural stage, slope, aspect • vegetation: % cover by layer, coarse woody debris (CWD) (dbh, decay class, abundance) • mensuration: tree species, dbh, height, wildlife tree characteristics
Reproducing Habitat	• site: structural stage, slope, aspect • vegetation: % cover by layer, coarse woody debris (CWD) (dbh, decay class, abundance) • mensuration: tree species, dbh, height, wildlife tree characteristics

Table 3 Life requisites and Habitat use rated for grizzly bears.

Life Requisite	Habitat-Use	Month	Rating column title
Reproducing	General Living-Winter	May,Jun,Jul,Aug	BNOGO_RE
Living	General Living-All Seasons	All Year	BNOGO_LIA

Ratings
There is an intermediate level of knowledge on the habitat requirements of northern goshawk in British Columbia and thus, a 4-class rating scheme will be used.

• **Provincial Benchmark***
Ecosection: East Purcell Mountains (EPM)
Biogeoclimatic Zone: ESSFdk
Habitats: Mature-old growth spruce forests

***Currently no provincially standardized benchmark exists therefore benchmark hypothesized from review of available literature, and JMJ field expertise

• **Ratings Assumptions**

Assumptions for BNOGO_LIA	
PEM attribute	**Assumptions**
Slope	Gentle to moderate slopes rated up to high
Crown Closure	Crown closure > 35% rated up to high Crown closure 20 - 35% rated up to moderate Crown closure < 20% rated up to low
Sites Capable of Having Structural Stage:	Stages 2 and 3 rated up to moderate Stages 4 and 5 rated up to moderate Stages 6 and 7 rated up to high Forests with dense shrubs rate down one
Assumptions for BNOGO_RE	
Slope	Very steep slopes rated nil Gentle to moderate slopes rated up to high
Crown Closure	Crown closure > 35% rated up to high Crown closure 20 - 35% rated up to moderate Crown closure < 20% rated up to low
Sites Capable of	Stages 2 and 3 rated nil

Having Structural Stage:	Stages 4 and 5 rated up to low Stages 6 and 7 rated up to high

- **Ratings Adjustment Considerations**

Final capability and suitability map products may incorporate 1) landscape heterogeneity and connectivity; 2) habitats adjacent to significant anthropogenic disturbance regimes (e.g. settlements); 3) interspersion of different structural stages within the landscape.

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