Moose

Scientific Name: *Alces alces*
Species Code: M-ALAL

Status: Yellow-listed

Distribution

- **Provincial Range**

Moose are mainly distributed throughout the mainland of the province. They are abundant in the central and northern portion of the province. They are found on the coast of British Columbia in low densities but are absent from the drier parts of the southern Okanagan Valley.

- **Elevational Range:** Sea level to the alpine. Areas higher than 1300 m seldom used in the winter.

- **Provincial Context**

Moose are widespread throughout a variety of habitats from sea- level to alpine. Moose populations are most abundant in the central and northern areas of the province. The 1997 provincial population is estimated to be 170 000 individuals of which 16 000 individuals were in the Caribou region (Hatter 1997).

- **Range in Project Area:**

Ecoprovince: Central Interior
Ecoregions: Fraser Plateau
Ecosections: Chilcotin Plateau (CHP)
Biogeoclimatic Zones: IDFxm; IDFdk4; MSxv; SBPSxc

Ecology and Key Habitat Requirements

- **General**

Moose utilize a variety of different biogeoclimatic zones. In the Cariboo Region, the SBPS, MS and IDF zones all provide important moose habitats. In the SBPS and MS zones, the best moose habitats occur in the wetlands, floodplains and riparian areas (Sopuck *et al* 1997).

The wetland and riparian areas of the MS and SBPS are used for calving because of the abundant forage and dense security cover. However, the extensive lodgepole pine forests of the SBPS provide little forage for moose (Meidinger and Pojar 1991).

Moose are generalist herbivores and their diet consists of a variety of different species. They are mainly browsers but will also feed on aquatic vegetation, grasses, sedges and forbs. Browse, an important component of their diet, varies depending on the availability, palatability and nutritional values of other available plant species. In the winter moose browse on the twigs of shrubs and trees; in the summer they mainly browse on the leaves of deciduous trees and shrubs (Stevens and Lofts 1988).

Moose prefer semi-open succesional stages of forested habitats with abundant browse. Mature and old-growth coniferous forests are also important habitats, especially if they are nearby wetlands and ponds. Moose will forage in cut-overs and burns if abundant browse is present and security cover is in close proximity. Sedge meadows are important habitats in spring, as sedges are among the first plants to emerge from dormancy. Graminoids and forbs are preferred in spring and early summer as they become less nutritious in fall and winter (Himmer and Power 1999). Woody browse is important in the fall and winter because of the higher protein content. Moose will also feed on the bark of deciduous trees, especially aspen in late winter.

Moose are easily heat-stressed even at temperatures as low as –5°C. In the summer extreme panting (to dissipate heat and maintain a constant body temperature) occurs at temperatures from 14°C to 20°C (Renecker and Hudson 1986). Areas with climates having temperatures that exceed 27°C for long periods and lack shade, do not support moose (Kelsall and Telfer 1974). Lakes, ponds, bogs, wetlands and the forests associated with these habitats are important in the summer to alleviate heat stress and provide abundant forage.

Winter is the critical season for Moose and the presence of forest cover adjacent to foraging areas is essential. Snow depths greater than 1 m can seriously impede their movements. Their winter distribution is often limited by the availability of woody food plants and by snow conditions, especially when the snow depth exceeds 80cm. In the winter they prefer forested areas and move into denser, conifer dominated forests. Moose have been found to prefer Spruce wetlands and mature spruce forests during the winter as these habitats provide both good foraging habitat and cover (Sopuck *et al*. 1997). Due to the snow cover, mature pine forests, grass and sedge habitats were used less than the more closed canopy spruce forests, as foraging species are less accessible (Sopuck *et al*. 1997). Coniferous and mixed-wood stands are used for security and thermal cover, bedding and as travel corridors (Sopuck *et al.* 1997). Within the study area regional wildlife officials have recognized two important moose wintering areas. Randy Wright and Chris Swan (2000) have indicated that the Nazko Chain and willow area along Clinchintampan Creek host moose during the winter months.

Moose may migrate seasonally from high elevations in the summer, to elevations below 1300 m in the winter (Sopuck *et al.* 1997). The extent of seasonal migrations may vary depending on topography, snow fall patterns and forage availability in certain areas. Due to the very subtle topography in the Chilcotin west study area a seasonal migration is not expected

Seasonal home ranges average 5-10 km2 in size and vary depending on the season. Typically home ranges are larger in the summer as they are not limited by mobility as they are by the winter snow (Sopuck *et al.* 1997).

The rutting period begins in mid to late September and usually lasts for approximately three weeks, but may last longer. Habitat requirements for rutting appear to be varied with respect to vegetation, topography, and proximity to human disturbance (Stevens and Lofts 1988) (Sopuck *et al.* 1997). Calves are born during May through June. The most important habitat requirement in the summer is security cover for cows with young calves. This is required in order to minimize predation (Sopuck *et al.* 1997). Such sites are often found in large forest stands with dense cover of shrubs and forest canopy.

Habitat Use - Life Requisites

Habitats for moose were rated separately for two seasons: growing and winter. The life requisites rated were: food (FD) and security habitat (SH) and thermal habitat (TH) for the specified season. They are described in detail below.

· **Food**

Moose feed in a variety of forest types including coniferous, deciduous and mixed forests. Their diet varies with the season. Forage preferences are determined by both the seasonal variations in protein content and by the availability. Woody forage is eaten in all seasons, but is used more in fall and winter due to its availability combined with its high protein content. Important winter forage species includes willow, birch, highbush-cranberry, red-osier dogwood and aspen. In the spring and summer, moose feed on the succulent vegetation found in wetlands and riparian areas. Horsetails, sedges, grasses, forbs and aquatic vegetation are important spring and summer forage. The habitat types that provide suitable feeding opportunities for

moose are wetlands, ponds, shrub-carrs, riparian and semi-open forests with abundant shrubby species, the shrub stage of moist forests (3a and 3b), avalanche shrubland and subalpine parkland. Forage production in cutovers and burns changes over time, and therefore, can also provide winter foraging habitat for up to 35 years after the harvest or burn occurs (Sopuck *et. al.* 1997). The use of cutovers is usually restricted to distance from security cover, such as that provided by a forest. Often moose won't venture farther than 100m from the forest edge into the cutover or disturbed area (Hamilton *et al*. 1980).

Preferred browse species

Moose have access to a wide variety of forage species in British Columbia. The most important winter food for moose is willow, as it is both palatable and abundantly available (Ritcey, MOE). However, to meet their nutritional needs, moose need to feed on a variety of forage species. A varied diet has also been found to improve digestibility (LeResche and Davis 1973). Diet preference depends on factors such as nutritive quality, palatability, availability and possibly even an individual's preference. In the summer browsing is confined to the leaves and terminal tips of shrubs and trees, while woody browse is more commonly a fall and winter diet. Foraging areas with suitable cover or within close proximity to cover may be preferred over areas without suitable cover.

During the winter, Moose also feed on the twigs of trees such as trembling aspen, cottonwood, and subalpine fir (Stevens and Lofts 1988). The bark of trembling aspen may also be eaten especially in late winter.

Red-osier dogwood and high bush cranberry are preferred browse species but because they rarely occur in abundance in central British Columbia they are not considered important winter forage. Saskatoon is also a highly palatable forage species, but because it does not occur in dominant proportions it is also not considered to be a very important winter forage species.

Foliose lichens and mosses (*Hylocomium splendens, Sphagnum* spp.) are reported to be in the diet of moose in late winter and spring (LeResche and Davis 1973).

Table 1. Important forage species, by season for Moose. The most important or preferred species are in bold type.

	Growing Season Forage Species	Winter Season Forage Species
Trees	**black cottonwood** *Populus balsamifera* **trembling aspen** *Populus tremuloides*	**black cottonwood** *Populus balsamifera* **trembling aspen** *Populus tremuloides* subalpine fir *Abies lasiocarpa* lodgepole pine *Pinus contorta* Douglas-fir *Pseudotsuga menziesii*
Shrubs	**willow** *Salix* spp. **red-osier dogwood** *Cornus stolonifera* **high bush cranberry** *Viburnum edule* **sitka mountain ash** *Sorbus sitchensis* **saskatoon** *Amelanchier alnifolia* false box *Pachistima myrsinites* dwarf birch *Betula glandulosa* kinnikinnick *Arctostaphylos uva-ursi* prickly rose *Rosa acicularis* *Vaccinium* spp. thimbleberry *Rubus parviflorus* twinflower *Linnaea borealis* red alder *Alnus rubra* Sitka alder *Alnus sitchensis* trailing rubus *Rubus pedatus*	**willow** *Salix* spp. **red-osier dogwood** *Cornus stolonifera* **high bush cranberry** *Viburnum edule* **sitka mountain ash** *Sorbus sitchensis* **saskatoon** *Amelanchier alnifolia* false box *Pachistima myrsinites* dwarf birch *Betula glandulosa* prickly rose *Rosa acicularis* *Vaccinium* spp. thimbleberry *Rubus parviflorus* red alder *Alnus rubra* Sitka alder *Alnus sitchensis*
Forbs	lupine *Lupinus* spp. fireweed *Epilobium* spp. horsetail *Equisetum* spp. goldenrod *Solidago* spp. *Penstemon* spp. Solomon's seal *Smilacina* spp. broadleaf arnica *Arnica latifolia* *Aster* spp. wild strawberry *Fragaria virginiana* *Anemone* spp. sitka valerian *Valeriana sitchensis* clasping twisted stalk *Streptopus amplexifolius*	
Aquatic and herbaceous plants	**yellow pond-lily** *Nymphaea polysepala* mare's tail *Hippurus vulgaris* pondweed *Potamogeton spp.* sedges *Carex* spp. grasses (*Poa, Festuca, Agrostis* spp.) rushes *Juncus* spp. narrow-leaved cotton-grass *Eriophorum angustifolium*	
Ferns	oak fern *Gymnocarpium dryopteris*	
Lichens	*Peltigera* spp. *Cladonia* spp. *Lobaria linita*	

· **Security Habitat**

Security habitat for Moose is essential for hiding from hunters and predators such as wolves and bears. Security habitat is provided by a combination of vegetation and topography. Class 1 security habitat is defined as: vegetation capable of hiding 90% of a standing adult animal from the view of a human at a distance of 60m or less. For moose, security habitat is provided by forest stands with trees at least 2 metres tall. Structural stages 3b, 4, 5, 6 and 7 generally provide suitable security habitat. In subalpine parkland, security habitat ratings depends on the tree heights, the density and distribution of trees and shrubs as well as the topography.

· **Thermal Habitat**

Moose use thermal habitats to assist them in maintaining a constant body temperature as they can easily experience cold stress at temperatures as low as –5C in the winter and heat stress at temperatures of around 20 C in the summer. (Renecker and Hudson 1986).

As with security habitat, the combination of vegetation and topography provide moose with thermal habitat. Old, multi-layered, close-canopied coniferous forests provide the best thermal cover for moose. However, they will also use pole-sapling forests for thermal cover in the winter and summer. Moose seek the dense coniferous forests in the winter as they provide good snow interception, therefore reducing their expended energy. Ideal winter range consists of conifers taller than 6m, with a canopy closure of 75% or greater for cover (U.S. Forest Service 1998). Forest cover in winter provides protection to moose from cold, wind and heat. Moose have been found using residual islands of trees as wind breaks and benefiting from shallower depths on the lee sides of residual cover stands (McNicol and Gilbert 1978). Immature and mature spruce forests are used more frequently than mature pine forests for cover (Sopuck *et al* 1997).

In the summer months lakes, ponds, bogs other wetlands and shrub and forest cover associated with these ecosystems are used to alleviate heat stress by cooling the animal. Furthermore forested habitat may be used as shelter from solar radiation (Fraser *et al* 1983*)*

Seasons of Use

Moose require food, security and thermal habitats throughout the year. Table 2 summarizes the life requisites rated for each month/season of the year.

Table 2. Monthly life requisites for moose.

Life Requisite	Month	Season
Food, Security and Thermal Habitat	January	Winter
Food, Security and Thermal Habitat	February	Winter
Food, Security and Thermal Habitat	March	Winter
Food, Security and Thermal Habitat	April	Winter
Food, Security and Thermal Habitat	May	Growing (Spring)
Food, Security and Thermal Habitat	June	Growing (Spring)
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	Winter
Food, Security and Thermal Habitat	December	Winter

Two seasons were rated for moose: Winter and Growing (which is an amalgamation of Spring, Summer and Fall)

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) considered when rating each life requisite.

Table 3. Terrestrial ecosystem mapping (TEM) attributes considered for each life requisite for moose.

Life Requisite	TEM Attribute
Food	- site: site disturbance, elevation, slope, aspect, structural stage - soil/terrain: 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: terrain texture - vegetation: % cover by layer - mensuration: tree species, dbh, height
Thermal Habitat	- site: elevation, slope, aspect, structural stage - soil/terrain: terrain texture - vegetation: % cover by layer - mensuration: tree species, dbh, height

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

· **Provincial Benchmark**

Ecosection:	Peace Lowland (PEL)	
	Winter	Growing
Biogeoclimatic Zone:	BWBSmw	BWBSmw
Broad Ecosystem Unit:	Boreal White Spruce-Trembling Aspen (structural stage 2-3)	White Spruce-Balsam Poplar Riparian (structural stage 2-3)

· **Ratings Assumptions**

1. Sedge meadows have low to moderate (suitability rate up to 3) value for spring feeding.
2. Wetlands, riparian areas and fens of structural stage 3, when dominated by deciduous shrubs should provide abundant forage for feeding for both winter and growing seasons. If shrub cover is > 15% then class 1, if 10-14% then class 2, if 5-10% then class 3, if 1-4% then class 4, otherwise class 6.
3. Generally habitats that have snow depths greater than 1 meter have little value (suitability 5) for winter feeding habitat (because food sources are covered with snow) as well as for security habitat (because individuals will have difficulty with mobility) (Wright 2000, Stevens and Lofts 2000).
4. Riparian forests and floodplains with shrubs > 1m and > 50% cover of palatable species (i.e. willow and dogwood) have a high value for food, security and thermal.
5. Wetlands and ponds with emergent and submerged plants (e.g. water lilies, pondweed, horsetails) provide high value (suitability up to 1) habitat for summer feeding, and summer thermal habitat.

6. Forested habitats will receive moderate ratings for security and thermal habitat (suitability 3 or 4), if canopy is open (.<20% crown closure), while closed canopy forests (crown closure >25%) will receive high ratings (suitability 1 or 2) for security and thermal habitat ratings. Furthermore young – old forests (structural stage 4-7) will be rated slightly higher than tall shrub structural stage (structural stage 3) for security thermal values.
7. Open exposed habitats such as very large graminoid dominated wetlands and grasslands rate low (suitability 4-5) for security and thermal habitat
8. Ponds, lakes, open water and inundated wetlands will receive moderate to high ratings for feeding values (depending on the abundance of emergent vegetation; while also rating up to high for thermal habitat in the growing season (cooling).

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Mule Deer

Scientific Name: *Odocoileus hemionus hemionus*
Species Code: M-ODHH

Status: Yellow-listed

Distribution

- **Provincial Range**

Mule Deer occur throughout much of the province east of the Coast Range to the Alberta border. They are most common in the southern interior and Peace River area. They are absent or rare in coastal forests and the northwestern portion of the province.

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

- **Provincial Context**

The mule deer population is estimated at 125,000 (Stevens and Lofts 1988).

- **Range in Project Area:**

Ecoprovince: Central Interior
Ecoregions: Fraser Plateau
Ecosections: Chilcotin Plateau (CHP)
Biogeoclimatic Zones: IDFxm; IDFdk4; Msxv; SBPSxc

Ecology and Key Habitat Requirements

Food and habitat requirements vary across its range but typically mule deer are found in open coniferous forests and early structural stages where it feeds on a variety of grasses, forbs and shrubs in varying proportions depending upon season (Ehlers *et al.* 1998).

During the spring areas of early green-up are important for feeding. This occurs on moderate to steep, south and west facing slopes at medium elevations. During the summer season mule deer are usually found at higher elevation habitats such as subalpine parkland, alpine tundra and shrubby alpine and wet subalpine meadows. The fall finds mule deer in the same habitat areas as in the spring season. The winter season forces them from high elevation habitats to low elevation areas with specific habitat characteristics to ensure their survival. Winter survival for mule deer is dependent on old growth or mature Douglas-fir stands with well developed canopies that intercept snow, provide security and thermal cover and provide food. If snow accumulations exceed 50 cm then an area is generally avoided (Ehlers *et al*. 1998).

Mule deer are capable of digesting a wide variety of plants. They are mainly browsers of shrubby vegetation, but they will also eat forbs and grasses, especially during the spring season. Forage preferences are determined by both the seasonal variations in forage digestibility and protein content, and by the nutritional requirements of the animals.

Within the Chilcotin West IFPA study area there are 4 documented mule deer winter ranges. Two very important ranges occur along the Chilcotin River the West Chilcotin range and the Anahim Creek range. These areas are of importance because of their low snowpack. The other two ranges are between Temapho lake and Nazko lake (Temapho lake east and west), and are important because they fall into the moderate snowpack zone.

Mule deer breed during mid-October and early December (Stevens and Lofts 1988). Fawns are born in June after a gestation of approximately 210 days (Banfield 1981). Optimum fawning habitat has a dense understory of low shrubs or small trees from 0.6 - 1.8 m tall and a tree overstory of approximately 50% crown closure. Good fawning habitat is in close proximity to suitable foraging areas (Stevens and Lofts 1988).

Average home range for mule deer varies widely between individuals, sexes, and habitat occupied. Bucks generally use larger areas than the does. Deep snow can impede movements, especially young animals and therefore winter ranges are smaller than summer ranges.

Table 1. Important habitat features for different seasons and snowpack conditions for mule deer.

Season/ Snowpack	Habitat Feature
Winter/moderate to deep snowpack	• topographic features that reduce snowpack (i.e. slopes, southerly aspects) • tall, large-crowned conifers with 65-70% average canopy closure • arboreal lichens • tall shrub understory • small forest openings
Winter/shallow snowpack	• topographic features that reduce snowpack (e.g. slopes, southerly aspects) • patches of cover with shrub understory
spring	• topographic features that encourage early growth • openings that encourage early growth of herbaceous forage • security and thermal cover near forage habitat (i.e. within 200 m) • closed canopy forest with shrubby understory for fawning
summer/fall	• abundant forage, especially herbs and shrubs • patches of cover interspersed with food.

Habitat Use and Life Requisites

The life requisites that will be rated for mule deer are food (FD) and security habitat (SH) and thermal habitat (TH) which are described in detail below.

· **Food**

Feeding requirements for mule deer are related to the availability of forage species and season. During the spring areas of early green-up are important for feeding. This occurs at low elevations on moderate to steep, south and west facing slopes. Important spring forage species include *Poa* spp., junegrass, bluebunch wheatgrass and big sagebrush. Summer habitat consists of areas with a suitable mix of young to old forest areas, with an adequate supply of forage and cover elements. Key summer forage species include the leaves and buds of saskatoon, Oregon grape, red-osier dogwood and arboreal lichens.

Winter forces mule deer from high elevation areas to low elevation mature - old growth, multi-aged moderately closed canopy Douglas-fir forests with south-facing, warm aspect slopes where the snowpack is lower. Forage quality and quantity are at their lowest value during the winter (Mule Deer Winter Range Strategy Committee 1996). As the snowpack increases the accessibility to forage species declines. Good nutrition during the winter season is especially important. In the Cariboo Region, Douglas-fir foliage from large, old trees is the most common forage species in the winter season. At Knife Creek, near Williams Lake, Douglas-fir constituted approximately 62 - 89 % of their winter diet (Waterhouse *et al*. 1994). More specifically Douglas-fir becomes most valuable after trees reach age class 6 or greater (100+ years or structural stage 5 and above). Sage is another important forage species that was found

in abundance in the diets of mule deer at Churn Creek (Waterhouse *et al*. 1994). Litterfall from Douglas-fir trees combined with arboreal lichens, saskatoon and red-osier dogwood are also eaten during the winter. Table 2 illustrates important forage plants for mule deer.

Table 2. Important forage plants, by season, in the diets of mule deer in the central interior of British Columbia. The most important or preferred species are in bold type.

	Growing Season Forage Species	**Winter Season Forage Species**
Trees	**Douglas-fir** *Pseudotsuga menziesii* black cottonwood *Populus balsamifera* trembling aspen *Populus tremuloides*	**Douglas-fir** *Pseudotsuga menziesii* subalpine fir *Abies lasiocarpa* lodgepole pine *Pinus contorta* black cottonwood *Populus balsamifera* trembling aspen *Populus tremuloides*
Shrubs	**Foliage of:** **saskatoon** *Amelanchier alnifolia* **red-osier dogwood** *Cornus stolonifera* **high bush cranberry** *Viburnum edule* **sitka mountain ash** *Sorbus sitchensis* **Oregon grape** *Mahonia aquilfolium* *Rabbit brush* ***Chyrsothamnus nauseosus*** **snowbrush** *Ceanotheus velutinus* **red-stemmed ceanothus** *Ceanothus sanguineus* **Douglas maple** *Acer glabrum* **soopolallie** Sheperdia canadensis birch-leaved spirea *Spirea betulifolia* willow *Salix* spp. black twinberry *Lonicera involucrata* choke cherry *Prunus virginiana* pin cherry *Prunus pensylvanica* snowberry *Symphoricarpos albus* false box *Pachistima myrsinites* scrub birch *Betula glandulosa* kinnikinnick *Arctostaphylos uva-ursi* prickly rose *Rosa acicularis* *Vaccinium* spp. thimbleberry *Rubus parviflorus* twinflower *Linnaea borealis*	**Twigs, buds and branches of:** **red-osier dogwood** *Cornus stolonifera* **high bush cranberry** *Viburnum edule* **saskatoon** *Amelanchier alnifolia* **soopolallie** Sheperdia canadensis **snowbrush** *Ceanotheus velutinus* **red-stemmed ceanothus** *Ceanothus sanguineus* **Douglas maple** *Acer glabrum* sitka mountain ash *Sorbus sitchensis* willow *Salix* spp black twinberry *Lonicera involucrata* choke cherry *Prunus virginiana* pin cherry *Prunus pensylvanica* snowberry *Symphoricarpos albus* false box *Pachistima myrsinites* scrub birch *Betula glandulosa* prickly rose *Rosa acicularis* *Vaccinium* spp. thimbleberry *Rubus parviflorus*

	Growing Season Forage Species	**Winter Season Forage Species**
Forbs	lupine *Lupinus* spp. pasture sage *Artemisia frigida* fireweed *Epilobium* spp. horsetail *Equisetum* spp. arrow-leaved balsamroot *Balsamorhiza sagittata* goldenrod *Solidago* spp. *Penstemon* spp. Solomon's seal *Smilacina* spp. broadleaf arnica *Arnica latifolia* wild strawberry *Fragaria virginiana* *Aster* spp. wild sarsaparilla Aralia nudicaulis *Anemone* spp. sitka valerian *Valeriana sitchensis* clasping twisted stalk *Streptopus amplexifolius* bunchberry *Cornus canadensis* northern bedstraw *Galium triflorum* yarrow *Achillea millefolium* *Arnica spp.* pussytoes *Antenarria spp.* clover *Trifolium pratensis* old man's whiskers *Geum triflorum* timber milk vetch *Astragalis miser*	
Graminoids	sedges *Carex* spp. **bluegrasses** *Poa spp.* **bunchgrasses** *Elymus spp.* **Fescues** *Festuca spp.* **junegrass** *Koeleria macrantha* pinegrass *Calamagrostis rubescens* bluejoint *Calamagrostis canadensis* timothy *Phleum pratens* rushes *Juncus* spp.	bluegrasses *Poa spp.* bunchgrasses *Elymus spp.* Fescues *Festuca spp.*
Lichens	*Bryoria spp.* *Alectoria spp.*	*Bryoria spp.* *Alectoria spp*

· **Security Habitat**

Security habitat for mule deer is essential for hiding from hunters and predators. For mule deer the most effective security cover hides 90% of the animal at a distance of 60 m or less, and security patches need to be 180 m or more in diameter (Nyberg & Janz 1990). In general, old growth forests with a patchy conifer understory and most well-stocked stands of young trees with live branches will satisfy security cover requirements. Areas of steep broken terrain can also be used as security habitat. (Nyberg & Janz 1990).

· **Thermal Habitat**

Thermal habitat allows deer to expend less energy to maintaining body temperature, allowing allocation of conserved energy to growth and reproduction. Thermal habitat can vary daily, seasonally, with prevailing weather conditions, and age, size and nutritional condition of the animal. In general, night time thermal cover should trap long-wave radiation and maintain warmer air temperatures (occurring under a closed canopy above a deer's head or above 3 m). Nighttime thermal cover should also reduce wind at deer height (occurring in a forest stand or dense underbrush) and intercept precipitation (occurring under a closed canopy and large crown volume). In general, daytime thermal requirements are met by areas that gather heat (on or near rock bluffs) or intercept excessive solar radiation (canopy closure) (Bunnell *et al.* 1985).

Winter represents a critical season for deer species due to the associated energetic costs of maintaining body temperature and moving through snow. Forest cover influences snow depth, density and surface hardness, and deer typically expend most energy walking through crustless, dense, deep snow (i.e. sinking depths greater than 25 cm) (Nyberg & Janz 1990). Canopy closure (i.e., stands taller than 10 m with greater than 60% crown completeness) exerts the most influence on snow interception, and creates areas with snow conditions that don't limit deer movement (Bunnell *et al*. 1985). Multi-layered Douglas-fir forests with deep, wide crowns and high crown closures are the preferred winter habitats for mule deer.

Topography is also an important component in determining the value of winter habitat, specifically slope and aspect. Since a particular sloped areas receives less snowfall than an equivalent flat area (the same amount of snowfall is spread over a larger surface area), snow depth is also less and thus ease of movement is generally greater (Armleder *et al.* 1986). Slopes with warm aspects receive more direct sunlight than other aspects. This helps mule deer maintain body temperature but also helps to melt snow and thus reduce snow accumulations. As snow depths increase, slopes and warm aspects become more valuable (Armleder *et al.* 1986). Additionally north aspects also provide good snow interception in the winter, as they can support denser stands of higher crown closures and therefore, may be used during severe weather conditions (Strategy Committee 1996).

Seasons of Use

Table 3 summarizes the life requisites rated for each month/season of the year.

Table 3. Monthly life requisites required for mule deer.

Life Requisite	Month	Season
Food, Security and Thermal habitat	January	Winter
Food, Security and Thermal habitat	February	Winter
Food, Security and Thermal habitat	March	Winter
Food, Security and Thermal habitat	April	Growing (Spring)
Food, Security and Thermal habitat	May	Growing (Spring)
Food, Security and Thermal habitat	June	Growing (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	Winter
Food, Security and Thermal habitat	December	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) considered when rating each life requisite

Table 4. Terrestrial ecosystem mapping (TEM) attributes considered for each life requisite for mule deer.

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

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

· **Provincial Benchmark**

	Winter	Growing
Ecosection:	Fraser River Basin	Eastern Purcell Mountains
Biogeoclimatic Zone:	IDFxm	ESSFdk
Broad Ecosystem Unit:	Interior Douglas-fir Forest (structural stage 6)	Subalpine Meadow (structural stage 2)

· **Ratings Assumptions**
1. Low elevation (IDFxm & IDFdk4) mature to old growth (structural stage 6-7) Douglas-fir dominated forests with a closed canopy (>35% crown closure) on moderate to gentle slopes (<45% slope) with available understory forage rate 1 for feeding and cover. Structural stages 4-5 rate slightly lower for feeding and cover while structural stages 2 and 3 rate low (suitability 5) for winter feeding and cover.
2. Low elevation (IDFxm & IDFdk4) mature to old growth (structural stage 6-7) Douglas-fir dominated forests with an open canopy (<35% crown closure) on moderate to gentle slopes (<45% slope) with available understory forage rate 2 for feeding and cover. . Structural stages 4-5 rate slightly lower for feeding and cover while structural stages 2 and 3 rate low (suitability 5) for winter feeding and cover.
3. Low elevation (IDFxm & IDFdk4) mature to old growth (structural stage 6-7) Douglas-fir dominated forests with an open canopy (< 25% crown closure) on south facing slopes rate 1 for spring feeding.
4. Ecosystems with >15% cover of fescues, Poa's, junegrass and bluebunch wheatgrass rate up to 2 for spring feeding.
5. Low elevation riparian habitat with closed canopy (>35% crown closure) rates 3 in winter and up to 2 in growing seasons for feeding and cover.
6. Although south aspects have more direct sunlight and are therefore warmer and have lower snow depths; north aspects support denser stands of higher crown closures with good snow interception and

therefore closed canopy Douglas-fir forests with moderate cool aspects rate 1-2 for security and thermal habitat.

7. Moderate to gentle slope and south to west aspects with closed canopy forests (> 50 % crown closure) can rate up to 1 for winter security and thermal.
8. Higher elevation (SBPSxc and MSxv) mesic - subhygric closed canopy forests rate up to 3 for feeding in spring and fall if abundant understory shrubby vegetation is present (>>10% cover of palatable species).
9. Higher elevation (SBPSxc and MSxv) wetlands and wet marshes rate 5 in winter and up to 2-3 for feeding in spring and summer
10. The SBPSxc and MSxv subzones generally receive snowfall exceeding 100cm thereby seriously reducing mule deer's ability to find forage while also impeding mobility. Therefore open lodgepole pine stands in these subzones will rate low (suitability 4 at best) for winter feeding, security and thermal habitat. Conversely mature – old closed riparian stands of spruce will be rated higher (up to 2) for feeding (if abundant willow or dogwood present) and security and thermal habitat.

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Woodland Caribou

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

Species Code: M-RATA

Status: Yellow-listed (species of management concern). Protected as big game under the British Columbia Wildlife Act (1982).

Distribution

- **Provincial Range**

The woodland caribou in British Columbia are separated into three ecotypes based on biogeography differences rather than morphological differences (Paquet 1997, Nagorsen 1990). The mountain caribou ecotype are found within the Southern Interior Mountains Ecoprovince and the Hart Ranges ecosection in the north (Simpson *et al* 1997). They inhabit areas of high snowfall and therefore they are primarily arboreal lichen feeders. The northern caribou ecotype inhabits forested areas in the north and west-central portions of British Columbia. They usually overwinter on windswept mountain ridges or in pine forests at low elevations. The boreal ecotype live in relatively flat terrain of the boreal forests in northeastern B.C.

The transition between the the mountain and northern ecotypes occurs between the Fraser River and Highway 97 in the Hart Ranges ecosection, and roughly corresponds to the northern limit of the Interior Cedar-Hemlock (ICH) biogeoclimatic zone in eastern British Columbia (Simpson *et al* 1997)

- **Elevational Range:** Wide variety of elevations thoughout the year from valley bottoms to alpine meadows. Generally found most often in habitats from 1300m -1900m (U.S Fish and Wildlife Service 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 with approximately 2500 of these being of the mountain ecotype (Paquet 1997). Within the proximity of the study area the Itcha/Ilgachuz and Rainbow herds, of approximately 1700-1800 animals, makes their home. This comprises roughly 10% of the provincial population (Young and Shaw 1998).

- **Range in Project Area:**

Ecoprovince: Central Interior
Ecoregions: Fraser Plateau
Ecosections: Chilcotin Plateau (CHP)
Biogeoclimatic Zones: MSxv, SBPSxc

The MS and SPBS zones have extensive dry lodgepole pine forests with substantial terrestrial lichen ground cover providing important caribou winter habitat.

Ecology and Key Habitat Requirements

· **General**

Caribou are primarily grazers, and display selective feeding habits, taking only the most palatable portions of selected forage. Northern caribou forage predominantly on terrestrial lichens but will also feed on arboreal lichens on both standing and windblown trees, litter-fall, grasses, sedges, forbs, mosses and fungi. In the winter forage is available on terrain that is generally open and windswept, enabling northern caribou to obtain food by cratering through shallow snow (Paquet 1997). In the spring and summer, mobility and food quality

are good and caribou therefore feed on a variety of shrubs, forbs and graminoids. Lichens are still eaten in these seasons but are not preferred (Cichowski 1993). Lichens become more important to caribou in winter, as they are the only forage item that is abundantly available.

The majority of caribou winter in the lower elevation lodgepole pine-dominated, mature/old-growth forests of the MS and SBPS zones. However, there are some caribou that winter in the higher elevation mature/old growth forests of the ESSF zone. The caribou in these higher elevation areas are found in the open, windswept alpine habitats where the snowfall accumulation is lower and the terrestrial lichens are more accessible.

The forest-dwelling caribou of the Itcha/Ilgachuz herd were predominantly found to use the MS zone from late fall to spring. They primarily used fescue meadows and mature open lodgepole pine forests with terrestrial lichens. The caribou herd that inhabit the Rainbow Range, also used the SBPS zone with use peaking in mid-winter (Young and Shaw 1998).

During the winter, the forest-dwelling Itcha/Ilgachuz caribou were found to use mature, moderately closed (> 36% canopy closure) lodgepole pine stands on poor quality sites, generally on flat terrain in the mid to lower elevations (1,200 – 1,600 m) of the MSxv zone. Meadows, open range and wetlands were predominantly used in the fall, early winter and spring. Clearcuts were used mostly in the Young and Shaw 1998).

The higher elevation alpine-caribou were found to use habitats between 1800 to 2000m and predominantly on slopes less than 20%. These sites generally have a lower snow depth due to exposure to prevailing winds (Young and Shaw 1998).

In spring caribou at low elevations feed on new vegetative growth including grasses, forbs and shrubs. Caribou that remain at higher elevations in the spring continue to feed primarily on arboreal lichens (Seip 1990).

The IFPA Chilcotin West study area borders an area of know caribou use by the Itcha-Ilgachuz herd. In the past high use of the Chilcotin lake area was observed (Young *pers comm* 2000). Therefore it is likely that the Chilcotin West study area could be utilized. Use of the study area would likely occur in April when clearcuts or other open areas in the SBPSxc are snow free and snow conditions are poor for cratering at higher elevations (Young *pers. comm.* 2000).

Habitat Use - Life Requisites

The life requisites rated for caribou are: food (FD) and security (SH) and thermal (TH).

· **Food**

In the winter, northern caribou predominantly forage on terrestrial lichens in the lodgepole pine-dominated mature/old-growth forests of the MS and SBPS zones. Caribou are capable of cratering through 65 –74 cm of snow to feed on these lichens (provided that the sinking depth is less than 70cm) (Young and Shaw 1998).. Terrestrial lichens are poor competitors against vascular plants and are therefore most abundant on nutrient-poor, dry, open sites (Hale 1983). In sites where terrestrial lichens are abundant, the trees are usually slow growing and of poor quality. Lichens also have slow growth rates and are therefore most abundant in late successional stages.

In late winter, as the snowpack deepens and hardens, caribou increase their use of arboreal lichens. This is because the deep and hard snowpack provides the lift needed to raise the caribou to the lichens in the trees. Arboreal lichens occur in all coniferous forests but they are most abundant on trees of age class 7 to 9 (121 to 251+ years).

During the summer, spring and fall caribou have a much more varied diet. They will feed on a variety of lichens, graminoids, forbs, shrubs, mosses and fungi in forests, wetlands, subalpine parkland and alpine tundra. Table 1 lists some of the important forage plants for northern caribou.

Table 1. Important forage species for northern caribou. The most important or preferred species are in bold type. (Himmer and Power 1999)

	Winter Forage Species	**Growing Season Forage Species**
Terrestrial Lichens	***Cladina* spp.** ***Cladonia* spp.** ***Stereocaulon* spp.**	***Cladina* spp.** ***Cladonia* spp.** ***Stereocaulon* spp.**
Arboreal Lichens	***Bryoria* spp.** ***Alectoria* spp.** ***Cetraria* spp.**	***Bryoria* spp.** ***Alectoria* spp.** ***Cetraria* spp.**
Shrubs	willow *Salix* spp. birch *Betula* spp. saskatoon *Amelanchier alnifolia* Alder *Alnus* spp.	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*
Graminoids	bluegrasses *Poa* spp. **altai fescue** *Festuca altaica* **fescues** *Festuca* spp. wheatgrasses *Elymus* spp. *Bromus* spp. sedges *Carex* spp.	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	cinquefoil *Potentilla* spp. **bracted lousewort** *Pedicullaris bracteosa* horsetail *Equisetum* spp.	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. yarrow *Achillae* spp. horsetail *Equisetum* spp. foamflower *Tiarella* spp. mitrewort *Mitella* spp. Solomon's seal *Smilacina* spp. bunchberry *Cornus canadensis* Sitka burnet *Sanguisosrba canadensis*
Other Forage	**mushrooms** mosses voles *Microtus* spp.	**mushrooms** mosses voles *Microtus* spp.

· **Security Habitat**

Although grizzly bears, black bears, lynx and wolverine are known to prey on caribou, wolves are believed to be their major predator throughout most of their range (Bergerud and Elliot 1986) (Paquet 1997). Caribou's anti-predator strategy is based of spreading out and not occupying the same habitat as other desired prey species such as moose. Northern caribou accomplish this by utilizing windswept alpine and subalpine areas in winter (Young *pers. comm.,* 2000*)*. For calving in the alpine, caribou also use the anti-predator strategy of spacing themselves out from other prey and predators (Young pers. comm., 2000).

Rugged, exposed alpine/subalpine terrain provides caribou with the best security habitat as it is here that they can distance themselves from other prey species and best detect and avoid predators. Caribou make use of forests during the winter season. When they use forested habitats they compromise security for foraging needs. Open forested habitats with low shrub cover are good for maximum sightability. Large frozen lakes and wetlands adjacent to forest stands can be used as escape terrain as caribou are better adapted to travel through deep snow than are their predators (Young and Shaw 1998).

During spring, forests serve mainly to provide safe movement corridors between high and low elevation ranges (Simpson et al. 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 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 thermal cover dependency (Young and Shaw 1998). When winter conditions do become unfavorable, -35 degrees Celsius 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, tree-islands in subalpine parkland, krummholz, 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 MSxv subzone are selected if they have dense canopy closure (40%). 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. 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 thermal, security and food habitat requirements of caribou vary with the seasons. Table 2 summarizes the life requisites rated for each month/season of the year.

Table 2. Monthly life requisites required for northern caribou.

Life Requisite	Month	Season
Food, Security and Thermal habitat	January	Winter
Food, Security and Thermal habitat	February	Winter
Food, Security and Thermal habitat	March	Winter
Food, Security and Thermal habitat	April	Winter
Food, Security and Thermal habitat	May	Growing (Spring)
Food, Security and Thermal habitat	June	Growing (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	Winter
Food, Security and Thermal 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) considered when rating each life requisite)

Table 3. Terrestrial ecosystem mapping (TEM) attributes considered for each life requisite for northern caribou.

Life Requisite	TEM Attribute
Food	- **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:** terrain texture - **vegetation:** % cover by layer - **mensuration:** tree species, dbh, height
Thermal Habitat	- **site:** elevation, slope, aspect, structural stage - **soil/terrain:** terrain texture - **vegetation:** % cover by layer - **mensuration:** tree species, dbh, height

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

· **Provincial Benchmark**

Ecosection:	Stikine Plateau (STP)	Stikine Plateau (STP)
	Winter	**Growing**
Biogeoclimatic Zone:	SWB/AT	AT
Broad Ecosystem Unit:	Lodgepole Pine/AG	Alpine Meadows
Habitats:	mature/old-growth mesic forests with terrestrial and arboreal lichens; subalpine parkland and alpine tundra with terrestrial lichens	Wetter forest types, sedge, meadows, with graminoids, forbs and deciduous shrubs; subalpine parkland and alpine tundra.

· **Ratings Assumptions**

1. In the MS and SBPS, immature forests (structural stage 4 and 5) may have moderate feeding or security habitat values for all seasons (suitability 3).
2. Mature/old growth MS and SBPS forests (structural stages 6 and 7) have moderate values for feeding and security habitat but mature/old growth lodgepole pine forests found on dry nutrient poor sites, with abundant terrestrial lichen cover will rate up to a suitability of 1for feeding and security habitat. Thermal habitat will rate up to 3.
3. Mature/old growth MS and SBPS forests (structural stages 6 and 7) have moderate to low values for thermal and will rate up to a suitability of 3.
4. Moist forests (seepage or wetland forests) have moderately high feeding values in spring and will rate up to a suitability of 2 for spring feeding.
5. Fescue – lichen meadows provide moderate (suitability 3) feeding habitat in the growing season.
6. Fescue – lichen meadows are poor feeding habitat in late winter due to the deep snow and will rate up to a suitability of 5.

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Black Bear

Scientific Name: *Ursus americanus*
Species Code: M-URAM

Status: Yellow-listed

Distribution

- **Provincial Range**

In British Columbia, Black Bears inhabit the entire mainland, larger adjacent islands, Vancouver Island and the Queen Charlotte Islands. They inhabit all forested regions and can be found within all biogeoclimatic zones in British Columbia.

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

- **Provincial Context**

Black bears occur commonly throughout their range. Populations in BC are stable, and present day estimates account for approximately 120 000 - 160 000 black bears in the province (MOE 1997). Black bears occur from sea level in coastal estuaries up to high elevation alpine meadows and are present in every biogeoclimatic zone in the province. The highest coastal concentrations of black bears occur in the Kitimat Range (KIR) and Nass Ranges (NAR) ecosections, whereas, the Chilcotin and Okanagan areas have low densities.

- **Range in Project Area:**

  Ecoprovince: Central Interior
  Ecoregions: Fraser Plateau
  Ecosections: Chilcotin Plateau (CHP)
  Biogeoclimatic Zones: IDFxm; IDFdk4; MSxv; SBPSxc

Ecology and Key Habitat Requirements

Black bears prefer forested and shrubby areas but use wet meadows, ridge tops, burned areas and riparian habitats. Black bears prefer mesic over xeric sites and timbered over open areas (particularly in areas inhabited by grizzly bears) (Unsworth *et al.* 1989). After emerging from their winter dens in spring, they seek southerly slopes at lower elevations for forage and move to northerly and easterly slopes at higher elevations as summer progresses (U.S. Forest Service 1998).

Black bears are very adaptable and inhabit a wide variety of plant communities. They are omnivorous and opportunistic in their feeding habits. They eat a wide variety of foods, relying most heavily on green leafy material. They also feed on insects, fruits, berries, fish, carrion and small mammals. Occasionally, black bears will prey on sick, young or small ungulates.

Black bears use dense cover for hiding and thermal protection, as well as for bedding. During periods of inactivity, black bears will occasionally utilize bed sites in forest habitat with thick understory vegetation. These sites are often a simple shallow depression in the forest leaf litter but may become deeper with use. 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.

Seasonal movement of black bears within a geographic area are influenced by the availability of seasonally important food resources or habitat components, breeding activity, reproductive status of individuals and availability of denning habitat (Amstrup and Beecham 1976). Black bears sometimes make extensive

seasonal movements to areas of food abundance such as spring green-up sites, spawning sites, berry patches and garbage dumps (Amstrup and Beecham 1976). In particular, these extensive movements occurt to and from winter den sites and during the late summer and fall when foraging activities increase (Rogers 1987). Migrating black bears will use movement corridors such as game trails, human trails, open edges, ridges, creek beds, logging roads, sandbars or rivers (Stevens & Lofts 1988).

Adult male home ranges are generally larger than those of females. and home ranges may change seasonally to account for weather and food availability (Stevens and Lofts 1988). Females have home ranges of between 12 and 50 km2. Males have much larger home ranges, sometimes travelling 50km or more to a preferred food source or winter denning site. Home ranges may change seasonally to account for weather and food availability (Stevens and Lofts 1988).

Black bears are solitary for most of the year but pair up briefly during the mating season. Breeding occurs in May or June (Stevens and Lofts 1988). Gestation is 6 to 7 months long with one to three cubs being born from late November through February. Birth and early maternal care occurs in the winter den. The cubs remain with their mother for 1 to 2 years. Hollow trees, fallen logs or excavated dens are used for hibernating habitat.

Habitat Use and Life Requisites

The life requisites that will be rated for black bears are: food and security/thermal cover and hibernating which are described in detail below.

· **Food**

Black bears are opportunistic omnivores and alter their food habits according to the availability of food items throughout the seasons. They depend heavily on plant foods but will feed on fish, wildlife and domestic animals when available. Black bears will also feed on carrion and insects such as carpenter ants, yellow jackets, bees and termites. Black bears will also climb trees to eat young shoots (Stevens and Lofts 1988). The diet of black bears changes seasonally. Table 1 shows some of the preferred forage species of black bears.

Table 1. Known and potential forage species for black bears in the Chilcotin West IFPA study area (items in bold are known to be important or preferred) (Himmer and Power 1999).

Common Name	Latin name	Parts Consumed
saskatoon	*Amelanchier alnifolia*	berries
kinnikinnick	*Arctostaphylos uva-ursi*	berries
lady fern	*Athyrium filix-femina*	fronds
bluejoint reedgrass	*Calamagrostis 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 Name	**Latin name**	**Parts Consumed**
common horsetail	*Equisetum arvense*	foliage
wood horsetail	*Equisestum sylvaticum*	foliage
wild strawberry	*Fragaria virginiana*	berries

cow parsnip	*Heracleum lanatum*	leaves, stems, flowers, roots
arctic lupine	*Lupinus arcticus*	roots
black twinberry	*Lonicera involucrata*	berries
bog cranberry	*Oxycoccus oxycoccus*	berries
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* ssp. *acaulis*	berries
five-leaved bramble	*Rubus pedatus*	berries
trailing raspberry	*Rubus pubescens*	berries
willow	*Salix* spp.	catkins
mountain ash	*Sorbus* spp.	berries
soopolallie	*Shepherdia canadensis*	berries
common dandelion	*Taraxacum officinale*	foliage, flowers
clover	*Tirfolium* spp.	foliage, flowers
stinging nettle	*Urtica dioica* ssp. *gracilis*	foliage
dwarf blueberry	*Vaccinium caespitosum*	berries
black huckleberry	*Vaccinium membranaceum*	berries
grouseberry	*Vaccinium scoparium*	berries
sitka valerian	*Valeriana sitchensis* ssp. *sitchensis*	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 (calves)
mule deer	*Odocoileus hemionus*	carcasses, fresh kills (calves)
caribou	*Rangifer tarandus*	carcasses
grizzly bear	*Ursus arctos*	carcasses
black bear	*Ursus americanus*	carcasses, fresh kills
voles	*Microtus* spp.	Fresh kills
marmots	*Marmota caligata*	Fresh kills

Early Spring Food

In early spring, black bears feed on the early green vegetation found in meadows and seepage sites that become snow-free first. Grasses, sedges and horsetails are the most commonly selected spring food items of bears, mainly because these plants develop early (Lloyd & Fleck 1977). In early spring bears require high-protein, digestible forage and so feed on succulent vegetation in wet meadows, riparian areas, avalanche chutes and burns (Stevens and Lofts 1988). Warm aspect avalanche tracks, slides and clearcuts are important feeding habitats because of early exposed vegetation.

Growing season Food

Green leafy material and wild berries in old-growth and mid-seral, deciduous forests provide summer food for black bears. Recent clearcuts (5-15 years old) in moist habitats may be important feeding areas. Berries that are utilized as they become available include: black twinberry, red huckleberry, raspberry, blueberry, currants, elderberry, highbush cranberry, soopolallie, red-osier dogwood and crowberry. Insects, especially ants and wasps are also important summer food.

In the late summer and fall, black bears feed on the late-producing berry species and other available vegetation.

Security and Thermal Habitat

Security habitat for black 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 rely on wildlife tree patches (with a structural stage beyond pole-sapling), and will generally not forage greater than 100 metres from a stand that provides this kind of security habitat (Jonkel 1978). Black bears also prefer immature forest stands (14-23 yr. preferred over 5-12 yr. old stands and stands older than 38 yr.) possibly because of the cover value associated with these stands (Lindzey and Meslow 1977). Habitat use has been found to rarely occur beyond 183m of forest cover (Rogers and Allen 1987).

2 – Bear/human avoidance – Black bears typically will avoid high-traffic roads (e.g. highways or active logging roads) and human settlements, unless attracted by anthropogenic food sources (e.g. garbage dumps or fruit trees). Appropriate habitat adjacent to such non-habitat features are less suitable.

Black bears will temporarily seek shelter from precipitation under forests or patches with low canopy or rock overhangs. Bears will also seek relief from heat by using open water (e.g. ponds, lakes, rivers, streams, springs), and using beds in cool, sandy areas. Generally these habitat features are too small to map as TEM polygons, and are difficult to rate. When located, these features were identified in the "Evidence of Use" section in the Wildlife Habitat assessment form.

Hibernating Habitat

Black bears in the interior hibernate between October and May. Suitable sites for dens are warm, dry and secure. Typically dens in the interior are underground and in locations that catch early snow and maximize the snow's insulative qualities. Black bears normally den on the forest floor and sometimes dens are excavated under the roots of trees. Cavities in old-growth structures, including large old trees, stumps, root bolls and large logs having a diameter greater than 85cm are also suitable dens. Hibernation sites are likely based on den structure, rather than tree species. Hibernating in second growth forest stands is limited by suitable denning locations unless old-growth features such as large logs or stumps are present.

Seasons of Use

Food and security are required throughout the growing season while hibernating habitats are the only requirements for the winter months. In the Chilcotin Plateau black bears begin hibernating between mid-October and the end of November and emerge from hibernation between the middle of April and the end of May (Himmer and Power 1999). Table 2 summarizes the life requisites required for each month of the year.

Table 2. Monthly Life Requisites for Black Bears.

Life Requisites	Month	Season
Hibernation	January	Winter
Hibernation	February	Winter
Hibernation	March	Winter
Hibernation, Food, Security/Thermal	April	Winter/Early Spring
Food, Security/Thermal	May	Early Spring
Food, Security/Thermal	June	Growing
Food, Security/Thermal	July	Growing

Food, Security/Thermal	August	Growing
Food, Security/Thermal	September	Growing
Food, Security/Thermal, Hibernation	October	Growing
Food, Security/Thermal, Hibernation	November	Winter
Hibernation	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) considered when rating each life requisite).

Table 3. Terrestrial ecosystem mapping (TEM) relationships for each life requisite for black bears.

Life Requisite	TEM Attribute
Food	- 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, coarse woody debris
Security/Thermal Habitat	- site: elevation, slope, aspect, structural stage - soil/terrain: terrain texture - vegetation: % cover by layer - mensuration: tree species, dbh, height
Hibernating Habitat	- site: site disturbance, elevation, slope, aspect, structural stage - soil/terrain: bedrock, terrain texture, flooding regime - mensuration: tree species, dbh, height

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

· **Provincial Benchmark**

Ecosection: Kitimat Ranges
Biogeoclimatic Zone: CWHvm1
Habitats: Skunk cabbage; floodplains; wetlands; estuaries / beaches; zonal sites for hibernating (Cw and Yc).

Highest densities of black bears are associated with extensive areas of early seral stages associated with logged areas (less than 15 years old), when combined with salmon streams and marine beach habitats.

Ratings Assumptions
1. Submesic thickets will serve as travel corridors as well as feeding and cover habitat in all of the growing seasons and if closed canopy and dense understory shrub layer, then rate up to 2 for feeding and cover.
2. Riparian areas and other ecosystems with preferred grasses and herbs are rated high in spring, as these areas should provide abundant, new, succulent forage.
3. Units with preferred species of herbs and berry-producing shrubs are rated high in summer. Structural stages 2-3 may provide abundant forage and have good spring and summer values. Clearcuts on rich, moist sites should provide moderate summer forage. Structural stage 4 stands generally have poor, year-round feeding value.

4. Hibernation is dependent on old-growth structures, but structural stages 2-5 may contain old-growth features (e.g. stumps or large logs) and so may similarly, be rated up to class 1.
5. In the MSxv young to mature forests on cool aspects with deep medium textured soils rate up to 3 for hibernating due to the fact that snow cover will be present here the longest, thereby providing insulation to the den.
6. Areas with an abundance of berry producing shrubs (soopolallie and huckleberry) will rate 2-3 (subsequently higher than spring) for summer and fall feeding.

Table 4 summarizes the habitat requirements for black bears in the Chilcotin West IFPA study area for the seasons and life requisites being modeled.

Season	Life Requisite	Structural Stage	Requirements
Spring Season	Food (FD) Security/Thermal (ST)	2-3, 6-7	Abundance of early green-up vegetation. Sedges, grasses and horsetails are important. Flood plains, valley bottoms, and lower snow-free side slopes with moist to wet soil moisture regimes and a rich soil nutrient regime support the best spring habitat.
Growing Season	Food (FD) Security/Thermal (ST)	3b, 5-7	Mature and old-growth coniferous forests. Riparian forests. Mixed conifer/deciduous mature forest. Shrub cover >50% and canopy closure >66%. Larger trees (>40cm DBH), within <200m of feeding areas are required for security cover, particularly for sows with cubs.
Growing Season	Food (FD) Security/Thermal (ST)	2-3, 6-7	Moist forests and meadows with cow parsnip and late berry producing shrubs are important feeding areas during this period. Shrubby forest openings or clearings adjacent to forest edge.
Winter Season	Hibernating (HI)	5-7	Mature and old-growth coniferous forests. Canopy closure >50% and tree compositions dominated by spruce and pine-spruce. Younger forests with residual old-growth features (e.g. stumps) and natural caves.

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Fisher

Scientific Name: *Martes pennanti columbiana*
Species Code: M-MAPE

Status: Blue-listed

Distribution

- **Provincial Range**

Fishers are distributed throughout the mainland of British Columbia, east of the coastal mountain ranges. They do not occur on Vancouver Island or any of the other coastal islands.

- **Elevational Range:** Sea-level to 1000m

- **Provincial Context**

The British Columbia - Yukon Border represents the northern limit of their range. Harvest data indicates that Fishers are absent throughout most of the province's southern extents (Bank 1989).

- **Project Area:**

Ecoprovince: Central Interior
Ecoregions: Fraser Plateau
Ecosections: Chilcotin Plateau (CHP)
Biogeoclimatic Zones: IDFxm; IDFdk4; MSxv; SBPSxc

Ecology and Key Habitat Requirements

Fishers primarily occur in forested areas that consist of a variety of structural classes and with many open patches that create edges. They are often found within forests that are associated with rivers and streams and forest edges, as they support a variety of prey species (MOE Wildlife Branch). Fisher generally stays in or near forests with canopy closure of at least 30%. Open areas, with no overhead cover such as roads and clearcuts, grasslands and alpine tend to be avoided. Fishers are generally not found at high elevations; due to the energetic cost of maneuvering through deep winter snow (Apps 1995).

Fishers are very adaptable and opportunistic and will often choose its prey or food source as it becomes available. Its diet can therefore be very diverse and includes snowshoe hare, porcupines, squirrels, grouse and rodents. They will also eat fruits, berries of Mt. ash and choke cherries and will scavenge on carrion when available.

During periods of inactivity, fishers will utilize dens for sleeping and resting. These den sites occur in closed canopy forests with abundant coarse woody debris. Habitat features that are used for resting dens include hollow trees and snags, logs, brush piles, old burrows, dens in the snow, and squirrel and raptor nests as well as large brooms in spruce trees (MOE Wildlife Branch). Fishers do not hibernate.

Fishers breed between February and mid-April (Bank 1989).). In a study by Banfield (1981), the average gestation period was 35 days long with one to four kits being born in March or April. They give birth and raise their kits in natal dens.

Fishers are thought to occur at naturally low densities maintaining large home ranges compared to carnivores of the same size. Over the course of a year male fishers have home ranges between 24-30 km^2 and females 15-19 km^2 (Apps 1995).

Habitat Use and Life Requisites

The life requisites that will be rated for fisher are: living and reproducing (birthing) which are described in detail below.

· **Living Habitat**

Food Habitat
Fishers are opportunistic omnivores and they are able to alter their food habits according to the availability of food sources. Important food items are those that occur throughout the fisher's range and these include snowshoe hares, porcupines, deer (as carrion), squirrels, small mammals, and birds (Bank 1989). However, they will also eat snakes, fish, eggs, vegetation, nuts, fruit and mushrooms. In the summer and fall fishers have a more diverse diet as they will eat fruit and nuts as they are available. Fishers prefer forests with high canopy closure and interspersed with small (<2 acres) clearings with good ground cover for feeding habitats (Apps 1995). Riparian habitat and forested habitat on the edge of openings are also highly favored because they support a wide variety of different prey species important to fishers. They also prefer areas with a high small mammal diversity (Stevens and Lofts 1988). They hunt for prey on the ground, in burrows, in overturned tree roots, downed logs and brush piles (Bank 1989).

Security/Thermal Habitat
Fishers require habitat that provides cover and has suitable sites for resting. Resting sites can be found in a variety of different sites including in hollow trees, logs, stumps, brush piles, old burrows and under snow and in spruce trees with large brooms.
Habitats with abundant coarse woody debris and standing snags are important for cover. Fishers utilize a variety of habitat types but have been found to prefer habitats with a moderate to high canopy closure. They also alter their movement patterns to avoid areas with soft snow, as it can inhibit their mobility. In a study northeast of Williams Lake Weir (1995) found that fishers selected habitats with intermediate canopy closures of conifers during winter. These habitats intercept snow and have denser snow packs and therefore permit more efficient movement. Although fishers are better adapted to younger forests, mature coniferous forests are also important (Bank 1989). A habitat suitability index has been developed for fishers and defines optimal habitat as having greater than 50% tree canopy closure, an average overstory tree dbh of more than 25cm, two or more stories in the tree canopy and a deciduous overstory of less than 50% (Apps 1995). During the summer, fishers have been found to use stands and patches of deciduous canopy closure, and avoid stands with no deciduous species as the prey in these habitats may be more abundant and diverse (Weir 1995). In northwestern Montana, fishers were found to use mesic, mixed stands on low elevation, flat or rolling, north facing sites near (<200m) water (Apps 1995). In another study in Montana they used flat areas and valley bottoms and avoided mid-slopes (Apps 1995). Riparian areas with the attributes described above have also been found to be important habitats for fishers.

· **Reproducing (birthing) Habitat**
Fishers give birth in natal dens which are found in closed canopy forests with abundant coarse woody debris. Unlike resting dens, most natal dens occur in cavities of large snags or hollow trees, and are usually located 7-12m above the ground (MOE Wildlife Branch). Large DBH cottonwoods associated with riparian areas are especially important. These natal dens are important for security and cover for the kits. Kits are born in the natal dens in March or April.

Seasons of Use

Food and security are required throughout the year while reproducing habitats for birthing are only required for March and April. Table 1 summarizes the life requisites rated for each month/season of the year.

Table 1. Monthly life requisites required for fisher.

Life Requisite	Month	Season
Living	January	Winter
Living	February	Winter
Living, Reproducing (birthing)	March	Winter
Living, Reproducing (birthing)	April	Winter
Living	May	Growing
Living	June	Growing
Living	July	Growing
Living	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) considered when rating each life requisite.

Table 2. Terrestrial ecosystem mapping (TEM) attributes considered for each life requisite for fisher.

Life Requisite	TEM Attribute
Living Habitat	- site: site disturbance, elevation, slope, structural stage - soil/terrain: - vegetation: canopy closure, % cover by layer, species list by layer, coarse woody debris - mensuration: wildlife tree characteristics
Reproducing Habitat	- site: site disturbance, elevation, slope, structural stage - soil/terrain: - vegetation: coarse woody debris - mensuration: wildlife tree characteristics

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

· **Provincial Benchmark**

Ecosection: Babine Upland (BAU)
Biogeoclimatic Zone: SBS
Habitats: Mature-old growth spruce forests

· **Ratings Assumptions**

1. Openings with poor and limited ground cover such as clearcuts, roads, grasslands and meadows rate nil.
2. Forests with a tree canopy closure > 40% will be rated Moderate to high, any lower than 40% will be rated up to low for living.
3. Optimal fisher habitat consists of mature and old growth forests with >50% crown closure, an average overstory dbh of >25cm; a structurally diverse tree canopy (>2 levels) having definite representation in each canopy level (A1, A2, A3), and <50% deciduous overstory spp. and abundant coarse woody debris and will be rated up to high.
4. Forests composed of a single species and of a single structural stage or continuous tree height will be rated low.
5. Deciduous dominated canopy (>50%) will be rated up to moderate when associated with riparian zones.
6. Habitats with an absence of understory vegetation will be rated up to low (necessary cover for prey animals).
7. Habitats with a high density of prey species (porcupine, snowshoe hare, squirrels, small mammals) will be rated up to high for living.
8. Habitats with an abundance (>50m^3/ha) of coarse woody debris will be rated up to high living.
9. Dry open forests rate low (at best) due to lack of cover and vegetative forage for prey species.
10. Habitats with a tree canopy closure > 50% and an abundance of coarse woody debris and standing snags will be rated up to high for reproducing (birthing).
11. Very steep slopes (>100%) will be rated Nil for all activities.
12. Riparian habitats associated with large DBH cottonwood will be rated high for Reproducing (RB).

Table 3. Summary of habitat requirements for fisher in the study area.

Season	Life Requisite	Structural Stage	Requirements
Winter	Living (LI)	5-7	Mature and old-growth forests. Canopy closure >50% and average dbh > 25cm. Diverse canopy (>two levels). Abundant coarse woody debris. Understory vegetation and high density of prey species. habitats associated with hares.
Spring	Living (LI)	5-7	Mature and old-growth forests. Canopy closure >50% and average dbh > 25cm. Diverse canopy (>two levels). Abundant coarse woody debris. Understory vegetation and high density of prey species. Riparian habitats.
Summer	Living (LI)	5-7	Mature and old-growth forests. Canopy closure >50% and average dbh > 25cm. Diverse canopy (>two levels). Abundant coarse woody debris. Understory vegetation and high density of prey species. Riparian habitats.
Fall	Living (LI)	5-7	Mature and old-growth forests. Canopy closure >50% and average dbh > 25cm. Diverse canopy (>two levels). Abundant coarse woody debris. Understory vegetation and high density of prey species. Riparian habitats.
Spring	Reproducing (RB)	5-7	Mature and old-growth forests. Canopy closure >50% and average dbh > 25cm. Diverse canopy (>two levels). Abundant coarse woody debris and standing snags. Riparian habitats.

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Marten

Scientific Name: *Martes americana*
Species Code: M-MAAM

Status: Yellow-listed

Distribution

- **Provincial Range**

Martens are distributed throughout the province including Vancouver Island and the Queen Charlotte Islands.

- **Elevational Range:**

- **Provincial Context**

Martens are most abundant in central and northern British Columbia.

- **Project Area:**

Ecoprovince: Central Interior
Ecoregions: Fraser Plateau
Ecosections: Chilcotin Plateau (CHP))
Biogeoclimatic Zones: IDFxm; IDFdk4; Msxv; SBPSxc

Ecology and Key Habitat Requirements

Martens are residents of mature coniferous and mixed forests throughout North America. Their preferred habitat is mature to old-growth forests dominated by spruce and balsam (MOE Wildlife Branch). They can also be found in moist areas with shrubby understory and coarse woody debris for both feeding and cover. They avoid wetlands, dry open areas and areas of disturbance such as burned or logged areas.

The diet of martens is varied and includes mice, voles, squirrels, snowshoe hares, grouse and smaller birds. Occasionally during the summer marten will also eat berries such as strawberries, blueberries and raspberries when they are available. Carrion in the form of deer and elk carcasses are also eaten by martens.

Preferred resting areas for martens are ground-level, sheltered areas under logs, and in dense vegetation. During the winter they will use natural cavities in the snow between rocks, stumps or downed trees (Stevens and Lofts 1988).

The male marten has a home range of between 2.5 - 15 km^2 and the female between 1.5 - 5 km^2 (MOE Wildlife Branch). Usually martens occupy their home ranges permanently, but in mountainous terrain they may undertake seasonal altitudinal migrations due to the changing availability of the food supply in the winter (Banfield 1981).

Breeding occurs in July and August (Banfield 1981). Gestation is 220 to 275 days long with one to four kits being born in late March or April.

Habitat Use and Life Requisites

The life requisites that will be rated for martens are: living, and reproducing (birthing) which are described in detail below.

· **Living Habitat**

Food Habitat
Voles are an important prey species for martens, but they will also eat squirrels, snowshoe hares, small mammals and birds. In the summer martens will also eat blueberries, strawberries and raspberries. Although martens spend most of their time hunting on the ground, they will occasionally hunt in trees. They prefer an overhead canopy, but will utilize natural clearings or small clear-cuts with low cover if food is available and forest cover is nearby. During the winter windfall and coarse woody debris are important for martens to gain access under the snow as they will tunnel under deep snow to hunt. Preferred hunting areas are mesic sites with blowdown, coarse woody debris, rotting stumps and herbaceous cover (Stevens and Lofts 1988).

Security/Thermal Habitat
Martens inhabit coniferous forests and mixed forests. They prefer mature to old growth seral stage habitats with mesic to hygric moisture regimes (Lofroth 1993). They have been found to use young seral forests, possibly during high population cycles to give them alternative prey species (Lofroth 1993). Good denning sites are moist areas with shrubby understory and abundant coarse woody debris. They select habitat based on the abundance of coarse woody debris, deciduous canopy closure, high shrub and low shrub closure, and abundance and size of trees and snags (Lofroth 1993). Martens can occupy a variety of habitat types but they always avoid wetlands, young seral stages, dry, open areas including open forests, extensive stands of aspen or lodgepole pine and sub-alpine shrubland with only scattered stands of trees (MOE Wildlife Branch). They also avoid areas of disturbance such as logged or burned areas.

· **Reproducing (birthing)**
Martens give birth in natal dens which are found in areas with an herbaceous overhead cover. Most natal dens occur in natural cavities in escarpments, under boulders, and in hollow logs and snags (Stevens and Lofts 1988). These natal dens are important for security and cover for the kits. Kits are born in the natal dens in March or April.

Seasons of Use
Living (food and security/thermal) are required throughout the year while reproducing habitats for birthing are only required for March and April. Table 1 summarizes the life requisites rated for each month/season of the year.

Table 1. Monthly life requisites required for martens.

Life Requisite	Month	Season
Living	January	Winter
Living	February	Winter
Living, Reproducing (birthing)	March	Winter
Living, Reproducing (birthing)	April	Winter
Living	May	Growing
Living	June	Growing
Living	July	Growing
Living	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) considered when rating each life requisite

Table 2. Terrestrial ecosystem mapping (TEM) attributes considered for each life requisite for martens.

Life Requisite	TEM Attribute
Living Habitat	- site: site disturbance, elevation, slope, structural stage - soil/terrain: - vegetation: canopy closure, % cover by layer, species list by layer, coarse woody debris - mensuration: wildlife tree characteristics
Reproducing Habitat (birthing)	- site: elevation, slope, structural stage - soil/terrain: - vegetation: coarse woody debris - mensuration: wildlife tree characteristics

Ratings
There is an intermediate level of knowledge on the habitat requirements of martens 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 - subalpine fir forests

· **Ratings Assumptions**
1. IDFxm subzones generally rate low for all activities and seasons (with the exception of riparian habitat which may rate up to high)
2. Mesic, mature - climax spruce and balsam forests with moderate to dense overstory (>30% crown closure) and sufficient understory hiding cover for prey species and abundant coarse woody debris will rate high for living in all seasons.
3. Mature - old mixed lodgepole pine, spruce and Douglas-fir stands with moderate to dense overstory (>30% crown closure) and sufficient understory hiding cover for prey species and abundant coarse woody debris will rate up to high for living.
4. Extensive stands of lodgepole pine and trembling aspen rate up to low at best, but are usually avoided.
5. Habitats with a high density of prey species (snowshoe hare, squirrels, small mammals) will be rated up to high for living.
6. Habitats with an absence of understory vegetation will be rated up to low (necessary cover for prey animals).
7. Subalpine and parkland forests rate nil.
8. Grasslands, open meadows and clearings < 90m from forest cover rate nil.

Table 3. Summary of habitat requirements for martens in the study area.

Season	Life Requisite	Structural Stage	Requirements
Winter	Living (LI)	6-7	Coniferous or mixed closed canopy, mature to old growth forests with abundant coarse woody debris. Understory vegetation and high density of prey species.
Growing (Spring)	Living (LI)	6-7	Coniferous or mixed closed canopy, mature to old growth forests with abundant coarse woody debris. Understory vegetation and high density of prey species.
Growing	Living (LI)	6-7	Coniferous or mixed closed canopy, mature to old growth forests

(Summer)			with abundant coarse woody debris. Understory vegetation and high density of prey species.
Growing (Fall)	Living (LI)	6-7	Coniferous or mixed closed canopy, mature to old growth forests with abundant coarse woody debris. Understory vegetation and high density of prey species.
	Reproducing (RB)	6-7	Coniferous or mixed closed canopy, mature to old growth forests with abundant coarse woody debris.

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Lynx

Scientific Name: *Lynx canadensis*
Species Code: M-LYCA

Status: Yellow-listed

Distribution

- **Provincial Range**

Lynx are widely distributed across British Columbia east of Coast Range. They are more abundant in northern British Columbia.

- **Elevational Range:** Sea-level to timberline.

· **Provincial Context**

The lynx population is cyclic, increasing and decreasing more than tenfold on a 8 to 11 year basis following the patterns of the snowshoe hare population (Goodchild and Munro 1980). The lynx has a very high reproductive capacity and can recover quickly from its cyclical lows. The provincial population is estimated to vary between 20,000 and 250,000 (Stevens and Lofts 1988).

- **Range in Project Area:**

Ecoprovince: Central Interior
Ecoregions: Fraser Plateau
Ecosections: Chilcotin Plateau (CHP)
Biogeoclimatic Zones: IDFxm; IDFdk4; MSxv; SBPSxc

Ecology and Key Habitat Requirements

· **General**

Lynx feed primarily on snowshoe hares, although rodents, birds and young ungulates are also taken. They therefore can be found in habitats that are closely associated with those of snowshoe hare.

Lynx inhabit the boreal forests of British Columbia. They can be found in or near dense undercover of thickets, windfalls or forest clearings, never too far from adequate cover. They typically inhabit white spruce forests, white spruce-subalpine fir forests and boreal spruce-trembling aspen mixed forests (ILC 1999)

Lynx are associated with dense climax forests. They also use early seral stage communities bordering dense forests. Their populations are closely tied to snowshoe hare numbers, lynx can also be found in second growth forests when hare are numerous.

The mating season for lynx takes place in late March or April. Kittens are born in May or June, after a gestation period of nine weeks. Lynx have one litter a year, and average two to three kittens per litter. The family unit remains together for the kittens' first winter, after which the male and female split up and the young go out on their own (Goodchild and Munro 1980).

Lynx are sedentary animals, but will migrate great distances when food is scarce. The lynx has a home range of 9.6 to 12.8 km and an average daily cruising range of 4.2 km (Goodchild and Munro 1980).

Habitat Use - Life Requisites

· **Living Habitat**

The snowshoe hare is the most important diet item for lynx, especially in winter. Good lynx feeding habitat is directly correlated with good hare habitat. Snowshoe hare are found in habitats that provide them with insulating cover, protection from predators and browse. Generally hare populations are greatest in dense, young forests, so these habitats will also be favorable feeding habitat for lynx. Such forests are often 10 to 30 years old, have a high stem density, with average tree heights of 7-20 feet and crown closure of 75-80% (ILC 1999). Riparian areas and mature forests with understories also provides important hare and thereby lynx feeding habitat. Snowshoe hare adjust their diet seasonally, according to the level of snow. Winter browse consists of woody stems, bark and needles. When hardwood species such as willow are available, snowshoe hare may prefer them over conifers (ILC 1999). However, cover is more highly correlated with snowshoe hare abundance than browse and conifers tend to provide better cover than deciduous vegetation (ILC 1999). Vegetation must extend approximately four feet above the snow to provide snowshoe hares with cover in the winter. During the summer snowshoe hare will continue to browse woody stems but their diet also includes forbs, grasses and other succulent vegetation.

Lynx will also prey on red squirrels, grouse, ptarmigan, mice and voles. However, it is thought that lynx cannot obtain enough energy from these prey items to maintain abundant populations (ILC 1999).

Lynx occur in both dense climax forests and second-growth stands. They require a mix of early and late seral habitats to meet their food and cover needs. Early seral habitats provide the lynx with a prey base, while mature forests provide denning space and hiding cover. Pockets of dense forest must be interspersed with prey habitat. In the winter lynx select early and late successional habitats while in the summer, they are found in mature conifer habitats (Stevens and Lofts 1988).

Areas that lynx avoid include natural openings and sparsely forested areas. Lynx usually do not cross openings greater than 90 m and use travel corridors with tree densities of 450 stems per hectare (ILC 1999).

· **Reproducing Habitat**

Kittens are born in May or June. Habitats such as boreal white spruce forests, white spruce - subalpine-fir forests and boreal spruce – trembling aspen forests are typically used for reproducing. The young are born in the spring in dens, usually in a hollow log, stump, windfall or thicket. Lynx will also utilize caves and rockslides as natal dens when their young are born.

Seasons of Use

Lynx require living (food and security/thermal) habitats throughout the year. Table 2 summarizes the life requisites rated for each month/season of the year.

Table 2. Monthly life requisites for lynx.

Life Requisites	Month	Season
Living	January	Winter
Living	February	Winter
Living	March	Winter
Living	April	Winter
Living, Reproducing (birthing)	May	Growing
Living, Reproducing (birthing)	June	Growing
Living	July	Growing
Living	August	Growing
Living	September	Growing
Living	October	Growing
Living	November	Winter
Living	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) considered when rating each life requisite

Table 3. Terrestrial ecosystem mapping (TEM) attributes considered for each life requisite for lynx.

Life Requisite	TEM Attribute
Living Habitat	- site: site disturbance, elevation, aspect, structural stage - soil/terrain: bedrock, rock outcrops - vegetation: % cover by layer - mensuration: coarse woody debris
Reproducing Habitat (birthing)	- site: elevation, aspect, structural stage - soil/terrain: bedrock, rock outcrops - mensuration: coarse woody debris

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

· **Provincial Benchmark**

Ecosection: Chilcotin Plateau (CHP)
Biogeoclimatic Zone: BWBS
Habitats: white spruce - subalpine fir forest

· **Ratings Assumptions**
1. Dense stands (> 10,000 trees per acre) of lodgepole pine, and second growth lodgepole pine, with a dense shrub layer (>30% cover of shrubs > 1.5 m tall), can be rated up to a high for living.
2. Dense stands of climax forests will be rated up to high for living.
3. Rock outcrops will be rated up to high for living and reproducing.
4. Broken rocky terrain will rate moderate if adequate cover (~20% crown closure) or >25% shrub cover is available. If cover is <20% then rate low.
5. Open grasslands rate nil due to their lack of security overhead cover.
6. Moderate to closed canopy (>25% crown closure) Douglas-fir forests with abundant coarse woody debris rate high for living. If coarse woody debris loading is low, rate moderate for living.
7. Moderate closed canopy forests with abundant understory shrub (good feeding habitat for prey such as snowshoe hare) rate high for living. If understory shrub layer is moderate then rate moderate for living.
8. Habitats that sustain high covers of preferred snowshoe hare forage such as scrub birch, grey-leaved willow, soopolallie, and lodgepole pine can be rated up to high for general living.

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Barrow's Goldeneye

Scientific Name: *Bucephala islandica*
Species Code: B-BAGO

Status: Yellow-listed

Distribution

- **Provincial Range**

Barrow's Goldeneye are widely distributed in the interior of British Columbia and also along the coast, including Vancouver Island and the Queen Charlotte Islands.

- **Elevational Range:** Sea-level to 2,400m

- **Provincial Context**

Barrow's Goldeneye occur more commonly in the south-central portion of the province. North of 53°N and west of the Coast Ranges they are an uncommon breeder.

- **Project Area:**

Ecoprovince: Central Interior
Ecoregions: Fraser Plateau
Ecosections: Chilcotin Plateau (CHP)
Biogeoclimatic Zones: IDFxm; IDFdk4; MSxv; SBPSxc

Ecology and Key Habitat Requirements

Barrow's Goldeneye's occur in a variety of marine and freshwater habitats. In the interior of British Columbia, birds are most often associated with lakes, ponds, rivers, sloughs, creeks, marshes and sewage lagoons (Campbell *et al*. 1990). Breeding occurs in a variety of habitats including aspen parkland, open ponderosa pine forests, farmland, rangeland, alpine meadows and the wetter, closed coniferous forests including those of the sub-alpine regions (Campbell *et al.* 1990). This species does not excavate its own nest cavities but uses natural animal-produced and man-made cavities. Nests typically occur in the main trunk of living and dead coniferous and deciduous trees. The breeding period extends from mid-March to August. In the summer their diet consists of primarily animal matter and some vegetable matter. This species requires overhanging shoreline vegetation for escape cover for ducklings (Campbell *et al*. 1988).

Habitat Use and Life Requisites

The life requisites that will be rated for Barrow's Goldeneye are: living and reproducing (eggs) which are described in detail below.

· **Living**

The diet of Barrow's Goldeneye consists of crayfish, pondweeds, aquatic insects, amphipods and molluscs (Campbell *et al*. 1988). This species occurs in a variety of habitats including lakes, ponds, rivers, sloughs, creeks, marshes and sewage lagoons. Barrow's Goldeneye's often utilize overhanging shoreline vegetation, fallen logs and clumps of emergent vegetation for escape cover for ducklings (Campbell et al. 1988).

· **Reproducing (eggs)**

Eggs are laid in May or June and hatch after an incubation of 31 to 32 days (Campbell et al. 1990). Fledging period is 56 days (Campbell et al. 1990). Breeding occurs in a variety of forested and semi-forested habitats and man-made habitats that are in close proximity to lakes, wetlands, ponds, rivers and creeks. Reproductive habitat contains suitable nesting sites, either natural or man-made. Barrow's

Goldeneye do not excavate their own cavity and often use cavities made by Pileated Woodpeckers or nest boxes. Nests are usually located between 0 and 6m above the ground. Tree species commonly used are trembling aspen, Douglas-fir, black cottonwood, and less commonly are ponderosa pine, spruces and lodgepole pine (Campbell *et al*. 1990).

Seasons of Use

Barrow's Goldeneye's only occur in the study area during the growing season. The living life requisite is required for the Growing season and the reproducing life requisite is required for the breeding season. Table 1 summarizes the life requisites rated for each month/season of the year.

Table 1. Monthly life requisites required for Barrow's Goldeneye.

Life Requisite	Month	Season
NA	January	Winter
NA	February	Winter
NA	March	Winter
NA	April	Winter
Living, Reproducing (eggs)	May	Growing
Living, Reproducing (eggs)	June	Growing
Living, Reproducing (eggs)	July	Growing
Living, Reproducing (eggs)	August	Growing
Living	September	Growing
Living	October	Growing
NA	November	Winter
NA	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) considered when rating each life requisite

Table 2. Terrestrial ecosystem mapping (TEM) relationships for each life requisite for Barrow's Goldeneye.

Life Requisite	TEM Attribute
Living Habitat	- site: structural stage - soil/terrain: flooding regime - vegetation: plant species - Riparian/deciduous, wetland, lakes, and open water habitats
Reproducing Habitat (eggs)	- site: structural stage - soil/terrain: flooding regime - vegetation: plant species - mensuration: tree species, wildlife tree characteristics - Riparian/deciduous habitats

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

· **Provincial Benchmark**
Ecosection: Cariboo Basin (CAB)
Biogeoclimatic Zone: IDF
Habitats: Ponds, lakes and wetland habitats (feeding), mature aspen parkland (nesting)

· **Ratings Assumptions**
1. Lakes, open water and ponds will be rated up to high for living in all.
2. Wetlands will be rated up to moderate for living.
3. Deciduous habitats will be rated up to low for living.
4. Riparian habitats of structural stage 2 will be rated up to low for living.
5. Riparian habitats (with either trembling aspen, black cottonwood or conifers) of structural stage 6 or 7 will be rated moderate to high for reproducing (eggs).

Table 3. Summary of habitat requirements for Barrow's Goldeneye in the study area.

Season	Life Requisite	Structural Stage	Requirements
Growing	Living (LI)	2	Wetlands, ponds, lakes, open water, marshes, deciduous habitats
Growing	Reproducing (RE)	6-7	Nest cavities in snags or living deciduous or coniferous trees at the edge of wetlands.

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