ROCKY MOUNTAIN ELK

Scientific Name: *Cervus elaphus nelsoni*
Species Code: M-CEEN

Status: Yellow-listed

Distribution

- **Provincial Range**

Exists in relatively isolated populations in the southeastern corner, and north central portions of B.C.

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

- **Provincial Context**

Rocky Mountain Elk are most abundant in the East Kootenay and Muskwa areas of the province. Isolated herds have been introduced near Penticton, Princeton, Grand Forks, Lytton, Adams Lake, McNab Creek and Graham Island of the Queen Charlottes (Stevens and Lofts 1988). There are estimated to be 25 000 - 30 000 elk in the Kootenays with greater than 70% occurring in the east Kootenays (Ehlers, Bennett and Corbett 1998).

- **Project Area:**

Ecoprovince: Southern Interior Mountains
Ecoregions: Columbia Mountains and Highlands, Rocky Mountain Trench
Ecosections: Eastern Purcell Mountains (EPM), East Kootenay Trench (EKT)
Biogeoclimatic Zones: IDFdm2; ICHmk1; ICHmw1; MSdk; ESSFdk, ESSFdku; ESSFdkp; ESSFwm; ESSFwmu; ESSFwmp; AT

Ecology and Key Habitat Requirements

- **General**

Rocky Mountain Elk have a broad tolerance of successional stage, cover type and different types of landforms. They feed in a variety of different habitats including Douglas-fir - lodgepole pine forests, Engelmann spruce - subalpine fir forests, interior subalpine parkland, trembling aspen forests, deciduous riparian forests, subalpine wet meadows, avalanche shrubland and southern bunchgrass steppe (Stevens and Lofts 1988).

Summer habitat is comprised of subalpine basins and valleys with avalanche chutes (dominated by herbaceous vegetation) and floodplains. Adjacency of forest cover and wet seeps, bogs and springs are extremely important (Demarchi 1986).

Winter ranges consist of grasslands and pioneer seral shrublands on low elevation, moderately sloping terrain with medium to dense forest cover. Riparian areas are also a common winter habitat. In areas with a deep snowpack, mature coniferous forest cover becomes vital for thermal cover and snow interception (Demarchi 1986). Logging and forest fire suppression have both been identified as primary factors of elk winter range deterioration. Elk herds are often in conflict with agricultural demands of the landscape as elk frequently compete with cattle on rangelands and can cause significant damage to some crops (Ehlers, Bennett and Corbett 1998).

This species is primarily a grazer and prefers grasses and forbs. They may be forced to feed on shrubs and deciduous trees during the winter as their preferred forage species are covered with snow. However, they will paw through light snow cover to reach grasses during the winter.

The rutting period occurs from early September through early October in forest openings. The calves are born from late May to early June after a gestation of 249 to 262 days (Banfield 1981). Optimum calving habitat occurs on gentle terrain with good security and thermal habitat; usually dense shrub and/or closed canopy coniferous forest.

Rocky Mountain Elk have a variable home range size as some elk are resident while others are highly migratory between seasonal ranges. Herds may have an annual cruising radius averaging 24-72 km with maximum of 56-192 km (Stevens and Lofts 1988).

- **Project Specific Habitats**

It has been observed that elk utilize the Columbia wetlands and surrounding environs as their core winter habitat. Small groups of elk can be seen throughout the wetlands in early winter but by mid winter the animals have moved into large tight herds and are often found to remain in the same area for most of the mid-winter season. Local residents have observed that even in the coldest periods of the winter season the elk do not move from the wetlands to the adjacent forested areas but instead congregate into tighter herds and reduce their activity (Ehlers, Bennett and Corbett 1998). Ehlers *et al* . reports that higher in the TFL winter elk sign was limited due to this concentration of animals on the Columbia. Additionally some small herds were observed feeding within the TFL on food sources made available by recent logging. Logging roads in the TFL were commonly used as travel corridors.
As the ice pack begins to break-up on the Columbia the elk herds disperse as they move into the South and North Bench planning cells; occupying forests with snowpack < 44cm. It appears that although the TFL supports elk their critical range is on the Columbia wetlands not the TFL where timber/wildlife issues are less important than private land ownership.

Habitat Use and Life Requisites

The life requisites that will be rated for Rocky Mountain Elk are: feeding and security/thermal cover which are described in detail below.

- **Feeding Habitat**

During the growing season elk use mid elevation to sub-alpine and alpine forests; typically preferring early successional stages such as natural forest openings, avalanche tracks, clearcuts, burns and roadsides. Alpine and sub-alpine meadows also provide suitable summer range providing these sites have adequate soil development and slopes are not to steep. Elk generally avoid large expanses of cool aspects, instead directing their foraging behavior toward south and west facing slopes (Demarchi 1986). Their preferred summer diet includes bluegrass, brome, junegrass, bluebunch wheatgrass and sedge (Banfield 1981).

During the winter Rocky Mountain Elk use Douglas-fir and ponderosa pine bunchgrass forests on south facing slopes between 500 -1500m elevation . Low elevation wetland and riparian habitat is also utilized during the winter, especially if the snow pack is not too deep (Stevens and Lofts 1988). Logging roads with in forested areas can be used as travel corridors. Winter diet consists of browsing on shrubs including willows, aspen, balsam, red-osier dogwood, chokecherry and wild rose (Banfield 1981).

Table 1. Important forage plants for Rocky Mountain Elk.

	Winter forage	Spring forage	Summer forage
Trees and Shrubs	Foliage of Douglas-fir Twigs and branches of: willow spp. Douglas maple red-osier dogwood		

	trembling aspen *Vaccinium* spp. *Rosa* spp.		
Herbs	bluebunch wheatgrass *Poa* spp. junegrass	bluebunch wheatgrass bluegrasses bromes *Carex* spp cow parsnip fireweed golden-rod vetch alfalfa	bluebunch wheatgrass bluegrasses bromes *Carex* spp cow parsnip fireweed golden-rod vetch alfalfa

- **Security/Thermal Habitat**

Thermal habitat allows elk 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, nighttime thermal cover should trap long-wave radiation and maintain warmer air temperatures (occurring under a closed canopy above an animal's head or above 3 m), reduce wind at elk 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, in clearcuts) or intercept excessive solar radiation (canopy closure).

Winter, represents a critical season due to the associated energetic costs of maintaining body temperature and moving through snow,. Forest cover influences snow depth, density and surface hardness (Nyberg & Janz 1990), and elk typically expend most energy walking through crustless, dense, deep snow (i.e., sinking depths greater than 25 cm). Conditions that produce favourable snow conditions include dense young-growth (>10 m tall) and old-growth forests (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 elk movement (Bunnell *et al.* 1985). Coniferous trees 12 m or higher with a crown cover of greater than 70% provides elk with good thermal cover (Stevens and Lofts 1988). They will also utilize areas with low vegetation as these areas restrict air movement. Old growth Douglas-fir forests at low elevations, on south-facing slopes with moderate to high crown closure are the preferred winter habitats for elk. (Strategy Committee 1996).

Security habitat for Rocky Mountain Elk conceals them from hunters and predators. For elk, escape cover has been defined as vegetation over 2 m with a stem density of between 50 and 2000 stems per ha or vegetation capable of hiding 90% of the animal from a distance of 61 m (Stevens and Lofts 1988).

Seasons of Use

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

Table 1. Monthly Life Requisites for Rocky Mountain Elk.

Life Requisite	Month	Season
Feeding, Security/Thermal	January	Winter
Feeding, Security/Thermal	February	Winter
Feeding, Security/Thermal	March	Winter
Feeding, Security/Thermal	April	Winter
Feeding, Security/Thermal	May	Spring
Feeding, Security/Thermal	June	Spring
Feeding, Security/Thermal	July	Summer

Feeding, Security/Thermal	August	Summer
Feeding, Security/Thermal	September	Fall
Feeding, Security/Thermal	October	Fall
Feeding, Security/Thermal	November	Winter
Feeding, Security/Thermal	December	Winter

Habitat Use and Ecosystem Attributes
Table 2 outlines how each life requisite relates to specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics).

Table 2. Terrestrial Ecosystem Mapping (TEM) Relationships for each Life Requisite for Rocky Mountain Elk.

Life Requisite	TEM Attribute
Feeding Habitat	- site: site disturbance, elevation, slope, aspect, structural stage - soil/terrain: bedrock, terrain texture, flooding regime - vegetation: % cover by layer, species list by layer, cover for each species list for each layer
Security/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 Rocky Mountain Elk in British Columbia to warrant a 6-class rating scheme.

- **Provincial Benchmark**

	Winter	Growing
Ecosection:	East Kootenay Trench	Muskwa Foothills
Biogeoclimatic Zone:	IDFdm	SWBmk
Broad Ecosystem Unit:	Interior Douglas Fir (structural stage 2-3)	Subalpine Meadow (structural stage 2)

- **Ratings Assumptions**

1. Habitats that lack abundant forage in the form of shrubby or herbaceous vegetation depending on season (< 5% total cover) rate 6 for feeding
2. Forest cover is necessary for security and thermal needs, and therefore forests with abundant canopy closure, and dense understory shrub cover rate (≤ 1).
3. Structural stage 1-4 have minimal winter value (suitability ≤ 4) for food and shelter.
4. Young forests (structural stage 5) may provide security and thermal habitat (suitability ≤ 2) depending on forage availability, subzone and snowpack.
5. Low elevation mature forests (structural stage 6) provide good winter habitat (suitability ≤ 1) because of the arboreal lichen abundance and canopy closure.
6. Old forests (structural stage 7) provide the best food availability in winter. With the appropriate slope, aspect, and adjacency with uneven-aged stands, old forests are elk habitat (suitability ≤ 1).
7. Structural stage 2 and 3 provide abundant forage and will be rated moderately high (suitability ≤ 2) during the growing season, when adjacent to security habitat.
8. Riparian habitat should provide good habitat throughout the growing and winter seasons (suitability ≤ 2).

- **Ratings Adjustment Considerations**

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

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United States Forest Service. 1998. *Cervus elaphus*. Biological data and habitat requirements. Internet.http://svinet2.fs.fed.us/database/feis/animals/mammal/CEEL/BIOLOGICAL_DATA_AND_HABITAT_REQUIREMENTS. html

MOUNTAIN GOAT

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

Status: Yellow listed

Distribution

- **Provincial Range**

In B.C. there are 3 known sub-species based upon their distribution and appearance. These sub-species groups are found from the Peace River region in the North and to the Crowsnest Pass region of the south east. They are also found in many of the coastal mountain ranges where suitable habitat exists.

- **Elevational Range:** Usually >1500 m

- **Provincial Context**

It has been estimated that approximately 100,000 individuals exist in B.C.

- **Project Area:**

Ecoprovince: Southern Interior Mountains
Ecoregions: Columbia Mountains and Highlands, Southern Rocky Mountain Trench
Ecosections: Eastern Purcell Mountains, East Kootenay Trench
Biogeoclimatic Zones: MSxk, ESSFdk; ESSFdku; ESSFdkp; ESSFwm; ESSFwmu; ESSFwmp; AT

Ecology and Key Habitat Requirements

Mountain goats inhabit rugged terrain composed of cliffs, ledges, projecting pinnacles and talus slopes. Habitat selection by Mt. goats is often determined by needs for security from predation rather than for forage requirements. One study showed that the distance to cliffs was the most important factor determining goat distribution and that summering goats made little use of foraging areas over 400m from cliffs (USDA Forest service 1997).

Within this high elevation security area mountain goats make use of a number of different habitat types throughout the year. Winters are spent on snow free, well ledged or fractured, cliffs, and very steep terrain with interspersed vegetation. Relatively open, unforested, steep, south facing slopes, with slopes greater than 40 ° (so snow is shed rapidly) are preferred. In extreme conditions upper elevation ESSF and ESSF parkland forests may be of benefit by intercepting and redistributing snow and providing forage (USDA Forest service 1997) (Wright).

During the summer months, goats often use areas of lush herbaceous forage in alpine grasslands, meadows, and grassy slide-rock slopes of the AT and ESSF parklands. Timbered areas and avalanche tracks in the ESSF subzones may also be used during migration or movement between cliff bands and feeding areas. When crossing areas that are without escape terrain goats repeatedly use the same trails (USDA Forest service 1997).
In general mountain goats will make use of higher elevation habitats in the summer and lower ones during the winter (USDA Forest service 1997).

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

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

• **Feeding Habitat**

In the snow free seasons mountain goats will make use of the herbaceous forage provided on grassy slide-rock slopes, ridgetops and especially lush alpine grasslands and meadows; provided that each is within 400m of suitable rocky escape terrain. It has been documented that grasses make up the bulk of their summer diet.

During the winter mountain goats will tend to accumulate in areas of persistent or melt crusted snow along cliff bands as well as on steep bony terrain interspersed with pockets of vegetation. They will also winter on steep mostly south facing slopes where snow sheds rapidly. They will feed upon whatever plants are available or emerging from the snow, from dried grasses to conifer needles and even mosses and lichens.

Table 1. Important forage plants for Mountain Goat.

	Winter forage	Growing season forage
Trees and Shrubs	Foliage of: Subalpine fir Engelmann spruce Twigs and branches of: willow spp. Douglas maple *Vaccinium* spp	Foliage of: willow spp. Douglas maple *Vaccinium* spp
Herbs	*Festuca spp* *Poa spp* junegrass sedges lupines mosses ferns	*Festuca spp* *Poa spp* junegrass sedges lupines mosses ferns

• **Security/Thermal Habitat**

Very steep rocky bluffs or crags are the primary choice of security habitat for this mammal. Visibility is another important factor in security habitat selection. Lack of visibility may limit their use of dense stands of conifers far from escape terrain. In the interior where snowfall is great, goats tend to avoid dense stands of conifers where snow accumulates.

Seasons of Use

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

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Life Requisite	Month	Season
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Feeding, Security/Thermal	February	Winter
Feeding, Security/Thermal	March	Winter
Feeding, Security/Thermal	April	Winter
Feeding, Security/Thermal	May	Spring

Feeding, Security/Thermal	June	Spring
Feeding, Security/Thermal	July	Summer
Feeding, Security/Thermal	August	Summer
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Feeding, Security/Thermal	November	Winter
Feeding, Security/Thermal	December	Winter

Habitat Use and Ecosystem Attributes
Table 2 outlines how each life requisite relates to specific ecosystem attributes (e.g., site series/ecosystem unit, plant species, canopy closure, age structure, slope, aspect, terrain characteristics).

Table 2. Terrestrial Ecosystem Mapping (TEM) Relationships for each Life Requisite for Mountain Goat.

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

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

- **Provincial Benchmark**

Ecosection: NPK
Biogeoclimatic Zone: AT
Habitats grassy meadows

- **Ratings Assumptions**

1. IDFdm2 rates 6 for all seasons and all activities.
2. Warm aspect cliffs and steep rock outcrops will rate up to 1 for all life requisites cool aspects will rate slightly lower. These same habitats will rate down one if found in the MSxk subzone. Talus slopes rate up to 2 on warm aspects.
3. Warm aspect high elevation open mature to old growth forests (ESSF subzones) will rate up to 4 for feeding and cover in the winter season and as high as 3 in the growing season. Cool aspect forests rate down one as the vegetation will be much thicker and sightability will be reduced.
4. Level and gently sloping forests as well as structural stages 2-5 of forested landscapes will rate 6.
5. Alpine tundra lush herbaceous meadows (sedge dominated) rate 1-2 for feeding in the growing seasons and up to 2 in the winter season. Heather dominated meadows rate up to 2 in the growing seasons and 3 in the winter.
6. ESSF parkland and upper forested site series rate up to 4 for feeding and 3 for cover (if on steep warm aspect) in all seasons. While meadows in these zones rate up to 3 at best for feeding.

- **Ratings Adjustment Considerations**

Final capability and suitability map products may incorporate 1) landscape heterogeneity and connectivity; 2) habitats adjacent to significant anthropogenic disturbance regimes (e.g. settlements); 3) adjacency to escape terrain.

Literature Cited

United States Forest Service. 1998. *Oreamnos americanus*. Biological data and habitat requirements. Internet.http://svinet2.fs.fed.us/database/feis/animals/mammal/ORAM/BIOLOGICAL_DATA
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