

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 provincial population is estimated to be 240 000 individuals.

• **Range in Project Area:**

Ecoprovince: Southern Interior Mountains

Ecoregions: Columbia Mountains and Highlands, Southern Rocky Mountain Trench, Western

Continental Ranges

Ecoregions: Eastern Purcell Mountains, East Kootenay Trench, Southern Park Ranges

Biogeoclimatic Zones: ICHmk1; IDFdm2; MSdk; ESSFdk; ESSFdku; ESSFdkp; ESSFwm; ESSFwmu; ESSFwmp; AT

Ecology and Key Habitat Requirements

• **General**

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, forbs and lichen. 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 and occasionally windblown arboreal lichen; in the summer they mainly browse on the leaves of deciduous trees and shrubs (Stevens and Lofts 1988).

Moose prefer semi-open successional stages of forested habitats with abundant browse. Mature and old-growth coniferous forests are important habitats for security and thermal needs, especially if they are nearby wetlands and ponds and avalanche slide paths. 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. 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, and needles of coniferous trees especially in late winter.

Winter is the critical season for Moose and the presence of forest cover adjacent to foraging areas is essential. Snow depths greater than 80cm 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 expected, as foraging species are less accessible (Sopuck *et al.* 1997). Coniferous and mixed-wood stands are used for bedding down and as travel corridors (Sopuck *et al.* 1997).

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. It is not uncommon for moose to remain at high elevations in the winter, usually in mature riparian forests or mature forests adjacent to slide paths (Ingham *pers comm* 2000).

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 and Life Requisites

The life requisites that will be rated for Moose are (1) food, and (2) protection from predators and conspecifics - security habitat. In order to manage moose in this project area managing thermal habitat for moose is insignificant relative to the importance of food and security habitat, and therefore will not be rated. The life requisites 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 availability. Woody forage is eaten in all seasons, but is more commonly taken in fall and winter due to the higher protein content, and availability. Important winter forage species includes twigs of 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, in combination with the leaves of the shrubs taken in the winter, are important spring and summer forage. The habitat types that provide suitable growing season feeding opportunities for moose are wetlands, ponds, shrub-carrs, riparian and semi-open forests with browse species, 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 foraging habitat for up to at least 35 years after the cutting or burn occurs (Sopuck 1998). The use of cutovers is usually restricted to areas within 100m from the forest edge (Hamilton *et al.* 1980). The winter season may see moose restricted to those areas that have limited snow depths and therefore easy mobility. Areas such as mature closed canopy riparian forests and mature forests adjacent to avalanche paths are often selected during the winter (Ingham *pers comm* 2000).

Preferred browse species

Moose have access to a wide variety of forage species in British Columbia according to season (outlined in table 1). 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. 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.

Foliose lichens, windblown arboreal 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 (Himmer and Powers 1999)

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

● **Security Habitat**

Security habitat for Moose is essential for hiding from hunters and predators. Security habitat is most important in the growing season for cows with calves, and to some degree during the hunting season (Ingham *pers comm* 2000). Security habitat is provided by a combination of vegetation and topography. Class 1 security habitat is defined as dense 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, preferred security habitat is provided by forest stands with trees at least 2 metres tall. However, moose will also find

some security value in structural stages 1 and 2, where the trees are less than 2m tall. Structural stages 3b, 4, 5, 6 and 7 generally provide suitable security habitat. Dense canopy closure is of importance in the winter as a dense canopy will intercept snowfall and in turn decrease snow depths on the forest floor. This results in increased ease of mobility. In subalpine parkland, security habitat ratings depend on the tree heights, the density and distribution of trees and shrubs and the topography. Often dense coniferous forests, Aspen stands, mixed-wood forests, and mature riparian forests are used for security habitat for bedding and during travel.

Seasons of Use

Moose require food and security habitats throughout the year. Table 2 summarizes the life requisites required for each month of the year.

Table 2. Monthly life requisites required for moose.

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

Habitat Use and Ecosystem Attributes

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

Table 3. 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 |

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)

| | <u>Winter</u> | <u>Growing</u> |
|-----------------------|---|---|
| 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**

| Assumptions for Security Habitat in all Seasons | |
|---|--|
| TEM attribute | Assumptions |
| Slope | -Slopes greater than 100% rated class 6 -Slopes 60-100% rated up to class 5 -Decreasing slopes increase the rating up to class 1 |
| Structural Stage | -Mature and old, valley bottom, forested, riparian ecosystem units rated up to class 1 -Unvegetated and Herbaceous EUs rated down to class 5 |
| Stem density | -Moderate and high stem density rated up to class 1 -EUs with impenetrable crown closure and nudum understory rated class 6 -Low stem density rated down to class 4 |
| Assumptions for Security Habitat in Winter | |
| Snow Depth | -Snow depths > 100 cm throughout the winter rated class 6, as found in the ESSFdku and dkp and AT subzones -Snow depths 70-100 cm throughout the winter rated class 5 (valley bottom habitat of all subzones) -Snow depths 30-70 cm rate up to class 2(valley bottom habitat of all subzones) -Snow depths < 30 cm rated up to class 1 |
| Crown Closure | -Crown closure > 70% rated up to class 1 -Reduced crown closure reduces rating in EUs -Forested habitats will receive moderate ratings for security 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 habitat ratings because they intercept snowfall therefore reducing snow depth and increasing mobility. |
| Structural Stage | -Stages 1 and 2 rated up to class 3 if low snow depths -Stage 3 rated up to class 3 if low snow depths and high stem density -Stages 4, 5, 6 and 7 rated up to class 1 if low snow depths and high stem density |
| Substrate | -Unfrozen large rivers rated down to 6 |
| Assumptions for Security Habitat in Growing Season | |
| Crown Closure | -Forested habitats will receive moderate ratings for security 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 habitat ratings. |
| Structural Stage | -Stages 1 and 2 rated up to class 4 -Stage 3 rated up to class 2 if dense cover of tall shrubs -Stages 4, 5, 6, and 7 rated up to class 1 or 2 if high stem density |
| Substrate | -Large open lakes and rivers rated down to 4 -Open water, ponds and wetlands with emergent and submerged plants rated up to class 2. |
| Assumptions for Food in Winter | |
| Plants | -EUs that contain the plants listed in Table 1 rated up to class 1 if > 25% cover, and rated up to 2 or 3 if >15% cover |
| Snow depth | -Generally habitats that have snow depths greater than 1 meter have little value (suitability 5 at best) for winter feeding habitat (because food sources are covered) |
| Assumptions for Food in Growing Season | |
| Plants | -EUs that contain the plants listed in Table 1 rated up to class 1 if > 25% cover -Sedge meadows have low to moderate (suitability rate up to 3) value for spring feeding. -Wetlands, riparian areas and fens of structural stage 3, when dominated by deciduous shrubs (>15%) should provide abundant forage and be rated high (suitability up to 1) for food for both winter and growing seasons. -Riparian forests and floodplains with well developed shrub communities have high |

| | |
|--|---|
| | values (suitability up to 1) for food and security habitat. -Wetlands and ponds with emergent and submerged plants (e.g. water lilies, pondweed, horsetails) provide high value (suitability up to 1) habitat for summer food. |
|--|---|

• 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. roads, settlements); 3) interspersions of different structural stages within the landscape.

It has been found that use of cutover areas, with and abundance of preferred forage, is usually restricted to areas within 100m of class 2 or better security habitat (Hamilton *et al.* 1980). Areas of class 1 and 2 security habitat that are adjacent to class 1 and 2 food habitat are often selected during the winter (Ingham *pers comm* 2000).

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