

APPENDIX TEN
HABITAT MATRIX FOR MAMMALS

DFMP

DETAILED FOREST MANAGEMENT PLAN

TEXT REPORT



BLUE RIDGE LUMBER INC.
A SUBSIDIARY OF WEST FRASER MILLS LTD.

MAMMALS IN THE BLUE RIDGE LUMBER INC. FMA

1. **Masked Shrew**
2. **Vagrant Shrew**
3. **Water Shrew**
4. **Arctic Shrew**
5. **Pigmy Shrew**
6. **Silverhaired Bat**
7. **Hoary Bat**
8. **Snowshoe Hare**
9. **Beaver**
10. **Least Chipmunk**
11. **Woodchuck**
12. **Red Squirrel**
13. **Northern Flying Squirrel**
14. **Deer Mouse**
15. **Southern or Gapper's Red-backed Vole**
16. **Northern Bog Lemming**
17. **Heather Vole**
18. **Muskrat**
19. **Meadow Vole**
20. **Rock Vole**
21. **Meadow Jumping Mouse**
22. **Porcupine**
23. **Coyote**
24. **Wolf**
25. **Red Fox**
26. **Black Bear**
27. **Grizzly Bear**
28. **Marten**
29. **Fisher**
30. **Short Tailed Weasel**
31. **Mink**
32. **Wolverine**
33. **Striped Skunk**
34. **River Otter**
35. **Lynx**
36. **Mule Deer**
37. **White-tailed Deer**
38. **Moose**
39. **Elk**

1. Masked Shrew (*Sorex cinereus cinereus*)

Live in a wide variety of habitats from dense forest to alpine meadows. Humidity is very important. Ground cover in the form of leaves, stumps, decayed logs, and herbaceous vegetation seems to be ideal for this species.

2. Vagrant Shrew (*Sorex obscurus obscurus*)

Found seldom far from water in the form of marshes and streams and in moist coniferous forests or streams. Mossy forests, willow-clad brook banks, horsetail stands along streams, and sphagnum bogs appear to be their favorite haunts.

3. Water Shrew (*Sorex palustris palustris*)

These shrews are physically adapted to an aquatic environment and seldom found far from water. They inhabit stream banks, lakeshores and marshes, in the coniferous forest region. Favorite haunts are the mossy banks and logs along the banks of swift-flowing streams in dense climax coniferous forests. Seldom taken more than 30 feet from such locations.

4. Arctic Shrew (*Sorex arcticus arcticus*)

This shrew has been frequently taken from the edge of sphagnum bogs and marshes and often on the edge of alder or willow shrub zones. Suggests that it will inhabit a little drier zone, as versus the other shrews, therefore it is typical of the subclimax or transitional vegetation stages.

5. Pigmy Shrew (*Microsorex hoyi hoyi*)

Inhabits the boreal forest zone, and more like the grassy glades or opening within the forest. Found in the shrubby borders of bogs and wet meadows. Prefers dry uplands in brush and forests.

6. Silverhaired Bat (*Lasionycteris noctivagans*)

Found flying over and around lakes within the forest. Feeds on aquatic bugs and insects. Found in semi-open deciduous woods and heavy coniferous forests.

7. Hoary Bat (*Lasiurus cinereus*)

Is a forest dweller particularly in the northern coniferous forest. It also inhabits the more southern broad leaf forests. Seen frequently hunting over lakes and opening in the forest's canopy.

In Alberta, they are predominately associated with conifers. They require tall trees due to the need to drop in height after take-off. Forages in open areas as it has an echolocation system consistent with long range prey detection and it has poor maneuverability. Have

small feeding territories. Information is lacking on densities and home range. Feeds on larger insects, moths, beetles and dragonflies. Feed along 40 to 50m strips. Roost during the day in coniferous trees and in late evening hunts. Mostly associated with conifers and infrequently associated with aspen. Medium versatility rating and narrow strips of forest are not adequate as habitat because the hoary bat needs good thermal cover. Residual blocks of 100 m X 100 m will provide for several females.

Logging that creates clear-cuts will during the initial stages, reduce insect population that the bat depends upon. Logging that eliminates the larger trees is detrimental because the animal needs taller trees for take off and raising broods or the removal of narrow strips of forest will not be sufficient because the bat needs good thermal cover.

8. Snowshoe Hare (*Lepus americanus americanus*)

It inhabits aspen bluffs and is also found in mixed deciduous and coniferous forest and feeds among the raspberry canes

9. Beaver Castor (*Canadensis canadensis*)

It inhabits a primarily riparian association (inhabits slow-moving streams, lakes, rivers and marshes) within the forest. Even when the climax forest is chopped down the beaver does very well in a second-growth forest. Aspen groves are preferred for food, but they can also live where shrub willows and alders grow. Needs an ample supply of aspen popular, willow and birch along streams and lake shores.

10. Least Chipmunk (*Eutamias minimus borealis*)

The least chipmunk occupies a wide variety of habitats from alpine tundra to evergreen coniferous. It is a characteristic mammal of the boreal forest. It seldom inhabits the dense climax forest of coniferous stands. It occupies forest edges, openings, stream valleys and lakeshore where there is a break in the forest canopy. It is also abundant in open stands of lodgepole pine on the sandy ridges and in the second growth after logging and fires. Prefers dry to damp situations.

Occurs throughout the alpine meadows where rocky or bushy cover exists and penetrates the margins of the spruce forests for a short distance.

11. Woodchuck (*Marmota monax canadensis*)

Prefers rolling land with mixed woodlots with stumps and large boulders. Has prospered as a result of forest practices.

12. Red Squirrel (*Tamiasciurus hudsonicus preblei*)

Inhabits the boreal coniferous forest, and makes its home in the climax coniferous forests, but also lives in the deciduous forests to a minor degree. Prefers mixed wood forest containing conifer. The squirrel prefers white spruce seed, fir, black spruce and then pine, coniferous and deciduous buds and nuts, with some fungi or mushrooms being eaten.

Requires conifer forests for moderate to high densities. Cone producing spruce forests of greater than 50% canopy closure represents the highest suitable habitat. In Alberta, the squirrel does inhabit deciduous trees in low densities. Mature white and engelmann spruce is the optimum habitat. Black spruce seeds are less preferred, but cone production of black spruce is less variable than that of white spruce so it probable provides a buffer during extreme white spruce cone failure. Pine stands of lodgepole or jack do have moderately good capability, where as balsam fir is intermediate between spruce and pine. Dense and wet areas are preferred as versus open and dry areas for habitat for the winter to spring period of time. Burrow in the soil or duff for the winter months. Very active in the sub-nivean environment.

Home ranges are less than 200 yards across and 4 ha in size and they will protect nesting sites and food ranges.

Are exclusively withdrawn from clear-cut areas except at time of logging when there is a lot of cones. Multi layered stands are not suitable. Recommendations include the maintenance of trees of sufficient size in deciduous forest to provide cavities, maintain coniferous trees in managed mixed forests, preserve mature densely branched trees that have interlocking crowns that are close to intensively managed coniferous stands. Creation of multi stored stands is most desired, and large even aged 2 cut logging systems are not as desirable for red squirrels.

13. Northern Flying Squirrel (*Glaucomys sabrinus sabrinus*)

Inhabits the boreal forest belt, which is composed primarily of coniferous species.

Favorite environment appears to be the mixedwood forest of tall trees, not overly dense and interrupted by glades and semi-wooded terrain of lofty spruce.

14. Deer Mouse (*Peromyscus maniculatus borealis*)

Exhibit a large tolerance for different habitats. May be found in short grass steppes to deep dark coniferous forests. The constant factor is that the habitat must be dry. They seldom occur in low wet habitats.

15. Southern/Gapper's Red-backed Vole (*Clethrionomys gapperi athabasca*)

Prefers forest where mossy rotten logs and stumps provide cover for foraging among the plant cover of the forest floor. Riparian, coniferous forests are preferred but some hardwood forests are inhabited. Water availability is very important and this vole can be found in swampy forest edges. Can also be found in aspen bluffs and shrubby vegetation.

Abundance of red-backed vole is correlated with dense debris cover and mesic habitats. They feed on a variety of plants and invertebrates, and they have a high content of fungi in their diet. Avoid xeric conditions.

Prefer densely forested areas with moist soil and litter conditions. Dense ground cover can produce conditions of soil and litter moisture similar to those in uncut forest areas. Red-backed voles play a positive role in the western coniferous forest ecosystem because they disperse the mycorrhizal inoculum that is necessary for the establishment and successful growth of conifers. Voles may be rare or absent on clear-cuts for up to 15 years where as deer mouse densities will be similar to uncut forests. It is likely the lack of cover that makes clearcuts unsuitable for this type of vole.

Gapper's red-backed vole is the only small mammal ecological indicator for old-growth conditions. (Red back voles do respond to the accumulation of thinning) Old growth is the optimum habitat for this vole. The availability of hypogeous fungi is the major food of this specie, which increases with increasing forest stand density and age. Optimum habitat is characterized as an evergreen forest stand of large diameter trees with a canopy closure in excess of 60%, an understory of little or no grass and 20% of the forest floor is covered with woody debris. (Microhabitats which favor hypogeous fungi growth). As logging takes place there is severe reduction or elimination of this fungi.

Red-back voles will disappear from clear-cut areas and be replaced by non-forest species such as the meadow vole, which will be a temporary vole.

16. Northern Bog Lemming (*Synaptomys borealis borealis*)

Bog lemming frequents sphagnum-Labrador tea-black spruce bogs and in the deep mossy spruce stands.

17. Heather Vole (*Phenacomys intermedius mackenzii*)

Most common in dry, open pine or spruce forests with an understory of blueberry, sheep laurel, dwarf birch usually near water. Another favorite habitat seems to be shrubby vegetation on the border of forests and in moist mossy meadows. (Shrubs in the form of willows and blueberry).

18. Muskrat (*Ondatra zibethicus spatulata*)

Found in a wide range of aquatic environments.

19. Meadow Vole (*Microtus pennsylvanicus drummondii*)

Preferred habitat is wet meadows, and will inhabit openings in the woods, where there is a protective carpet of grasses, edges or mosses. The meadow vole avoids deep forests and high, dry grasslands where it is replaced by the prairie vole.

20. Rock Vole (*Microtus xanthognathus*)

Choice of mossy and damp habitats as and underneath talus slopes. Can occur in small clearings in spruce-birch-balsam forests, and one colony has been found under a pile of logs in a recent clear cut.

21. Meadow Jumping Mouse (*Zapus hudsonius hudsonius*)

Prefer moist grasslands and are often found along grassy stream banks, marsh borders, alder-willow borders and low fields.

22. Porcupine (*Erethizon dorsatum myops*)

Found in both deciduous and coniferous forested regions. Chiefly spruce and pine stands in mixedwood forests.

23. Coyote (*Canis latrans*)

Is an adaptable animal, and will occupy boreal forests and aspen parkland. Will be found in the aspen grove belt and into the outer limits of the mixedwood forests.

24. Wolf (*Canis lupus occidentalis*)

Shows little preference for special places, and can be found in both coniferous and deciduous forests. Found in the mixed-wood coniferous stands.

25. Red Fox (*Vulpes vulpeds*)

Prefers semi-open country, forest openings and are seldom found in the heart of dense forests. Found in scattered grasslands and mixedwood forests and quite possibly the rugged highland environment. In summer the animals will keep secluded to timberland and in the winter they will roam into the rivers and marshes and lakes.

26. Black Bear (Ursus americanus americanus)

Inhabits coniferous, deciduous forest regions as well as swamps and berry patches. Habitat comprises the mixedwood forests that are commonly interlaced with streams and studded with lakes.

Mosaic of habitat is recommended for bear habitat. Forest mosaic is required for cover and denning and non-forested areas are used for feeding. The prevailing characteristics of black bear habitat is forest cover interspersed with small clearings and early stages of forest succession that provide a high degree of edge and diversity. Bears use cuts and shrubfield habitats for feeding, uncut timber for bedding, open timber and meadows for spring foraging, riparian and aspen types for fall feeding. Prefer areas where there is mesic vegetation.

Dramatic decline in use of clear-cuts beyond 183 meters. Bears prefer 14-23 year old clear-cuts as versus 5-12 year old and any of those older than 38 years. One source reported that bears did not avoid clear cuts that were older than 10 years.

Harvest in small and irregular shaped areas in a rotation that precludes adjacent placement of cuts within a 20-year period. Areas within each area should include dense timber stands on north aspects and strips along streams and roads should be maintained for bedding and hiding cover.

Need a variety of succession stages; maintain cover-type mosaic through cutting and burning; provide units of suitable forest cover in association with cliffs, rock outcrops and riparian zones; enhance production of soft and hard mast-producing vegetation. Establish a few slash piles per km² to enhance habitat value. Ideally forest management should maintain or develop 5-25% of the area in non-forest cover types to maximize diversity, productivity and availability of food producing plants. Forest cover should be in stands of all stand ages. Clearcuts should have irregular boundaries, islands of standing timber, and corridors of timber along ridges and drainages. Logging operations should avoid wetlands and low elevation areas during spring when these areas receive greater use by bears. Wetlands should be buffered from logging due to seasonal important foods. Scarification is greatly beneficial for the development of grasses and forbes but reduces the production of berries because of the damage to the roots and rhizomes. Herbicides kill most of the fruit producing species and is therefore undesirable. Seldom used roads can improve bear habitat by acting as travel routes and feeding areas.

27. Grizzly Bear (*Ursus arctos horribilis*)

The silvertip prefers open areas, and presently inhabits alpine meadows and subalpine forests.

Is a wide-ranging mammal, which feeds primarily on early succession vegetation. Species dependency on wilderness type is a management problem. Habitat enhancement efforts may be negated by the presence of roads in the area.

Grizzly bears occupy logged (0-5 years), grass-forb (5-10 years), shrub (10-20yrs) and young growth (15-40yrs) succession stages of numerous habitat types and need the adjacent timber cover for security cover. Non-forested habitats as a group had the highest importance values to grizzly bears; stream bottoms, wet meadows and burns. Diversity of habitat (areas of travel, sanctuary, resting, feeding and denning) is required so the bear can cope with climatic stresses, unexpected human impact and changes in status of the other wildlife. Grizzly habitat use patterns closely follow the seasonal variations in quantity and quality of important foods. The grizzly requires a high habitat diversity to ensure new food for each season.

Major food in decreasing order of importance: mammals, fruit, succulent vegetation and Hedysarum roots (roots occur almost entirely in willow-dwarf birch shrub fields in moist, fine deep soils that are in high water table). Animal matter is eaten at any time with ground squirrels being widely eaten in July, and horsetails were the most important food in July. (Monocots and insects were also eaten)

The overall objective would be to maintain a large proportion of the prime area in early succession stages and as open broken forest. Heavy forested blocks suitable for escape cover and denning are necessary. Blocks should be designed with irregular boundaries to provide nearby cover and patches of timber within cutting areas should be left to provide proximate cover. Travel corridors along rivers & creeks should be maintained. Road construction should be minimized and built to minimum specifications and road closure programs should be implemented.

For grizzlies to survive, human activities in their habitat needs to be restricted.

28. Marten (*Martes americana actuosa*)

Is a climax forest specie that prefers the coniferous forest, dominated by old growth spruce. They avoid burned over or logged areas.

Marten is an opportunistic predator, which feeds primarily on small mammals, birds, reptiles and berries. General assumed to be dependent upon mature and old growth coniferous forests. A marten population can be affected by a large-scale forest cover removal, so management needs to concentrate on the retention of adequate sized stands to allow for marten use.

Most abundant in mature coniferous forests but will occur in mixed wood stands, will avoid large areas with no protective cover. Prefer late succession forest whereas fisher prefers earlier forest stages. Large old trees and stumps are very important. Will use subnivean resting sites. Winter cover requirements are the key and is very important as versus the cover requirements during the other seasons. Tree canopy cover (>50%) and succession stage of the stand (>40% fir or spruce) are the two most limiting factors that determines the suitability of marten winter habitat. Stands with <25% crown cover are not suitable. Prefer habitat with 30-80% (some bibliography say 40-60%) coniferous canopy cover and avoid areas with no cover. Forests with various age and size classes will provide hunting sites and protective cover under different snow conditions. One source says the area of highest marten populations was the riparian forest.

Feed on red back vole (most common food), heather vole, snowshoe hare and red squirrel.

Islands of conifer within clearcuts were heavily used all year round. Should manage for diversity of tree species and age classes to provide for hunting sites and protective cover under different snow conditions and this can support more prey species. Prefer that the 2nd cut be delayed for 25 years or more. Block patterns that create this situation will minimize the impact of timber extraction. Artificially regenerated stands may lack shrub and canopy diversity and be devoid of standing snags or hollow trees for a substantial period of time. Where feasible, partial or selective cutting systems can effectively maintain marten habitat values, and from the perspective of marten habitat management is preferred. Suggest that an interim logging guideline for selective harvest in marten habitat should leave about 50% of the basal area or a minimum of 20m²/has basal area, should maintain a 30% canopy closure and sufficient coarse woody debris...page 99. To minimize the length of time for cut-overs to return to productive marten habitat will be minimized by leaving snags, logs and stumps left in clear cuts either scattered or in clumps. Leaving debris unburned is preferred and may create hunting and denning sites.

Clear-cutting impacts are reduced by leaving cluster of trees, logs and slash. Left for foraging sites, winter dens and subnivean routes. Clear cuts represent poor habitat up to 15 years following logging. Clear cutting should be done in small patches and 25% of the area should be retained in forest cover of more than 25m² per hectare of larger trees.

29. Fisher (Martes pennanti)

Prefers the climax forest and close to the watercourses. The fisher will venture into the subclimax deciduous and old burns. It is less of a climax specie than marten.

Fisher is an opportunistic predator, which feeds upon porcupines, it is primarily dependent on snowshoe hares and other small mammals and birds for food. It is associated with mature and old growth coniferous forests and at certain times of the year they are more able to adapt to early succession forest stages than were marten. Large clear cuts eliminate fisher habitat but habitat may be managed through selective logging

or smaller clear cuts with retention of key areas of mature conifer forests. They use habitat edges more than marten.

Dense coniferous and mixed coniferous-deciduous forests are the preferred habitat of the fisher. Will inhabit second growth forests if suitable habitat is available. Clearcuts are avoided during the winter if there is poor canopy closure and as the block greens up in the summer it will be used by the fisher. As the clearcut greens in because of age, the fisher populations will decline and the marten will increase. The fisher is more adaptable than marten and is almost exclusively terrestrial. Will venture to the edge for food.

Fisher selectively used forested habitats with 80-100% canopy closure while stands less than 50% canopy closure were generally avoided. Will primarily use mixed forest with a diversity of species and ages. Fishers are very successful in killing porcupines, but will also feed on small mammals (rabbits), birds, reptiles, amphibians, fish and insects. A fisher will take larger prey than marten, and is predominately a nocturnal and terrestrial animal. Marten are more arboreal and more subnivean in nature and are less impacted by snow than the fisher.

Their travel is concentrated along creeks, lakeshores and ridges.

Fishers would be adversely affected by short rotation management over extensive areas, although they could benefit from the increased prey abundance along the edges between clearest and mature forests. Extensive cc areas may limit fisher populations due to subsequent reductions in suitable winter foraging areas. Small clear cuts well interspersed within uncut forest stands may not adversely affect the fisher populations. Uneven age forest management would generally favor fisher habitat quality and old snags and hollow trees should be retained as den sites.

The animal is not quite aquatic, however it haunts areas close to water; streams, lakes, and swamps. Very favored in black spruce-muskeg type of country.

30. Short Tailed Weasel (Mustela erminea)

This species shows a great preference for open country grasslands, aspen parkland, river bottoms, and is in the vicinity of water.

Has been seen in coniferous forests and aspen parklands. Prefer forest edges.

31. Mink (Mustela vison lacustris)

Inhabits stream banks, lakeshores, forest edges, and large swamps.

Is an animal of riparian zones, and are generally found within 200m of a stream or a lake with dense canopy cover. Dependent upon roots, debris and old stumps for den sites. Diet is primarily small mammals, fish and aquatic insects. Forest management for mink requires retention or management of streamside buffers to maintain specie habitat. Food

is muskrats, hares and small rodents, in summer the diet is supplemented by waterfowl and aquatic beetles and in the winter fish are eaten.

Lead a semi-aquatic existence and needs slow moving water with fish in it. It is adaptable in its use of habitat. The key components are permanent surface water, vegetative cover within and adjacent to wetlands and structural cover.

Habitat alterations by industry have limited effects, provided buffer strips of cover are left along watercourses.

Prefers soggy-soaked lakes, preferably in low-lying quaggy terrain cut by meandering sluggish streams.

32. Wolverine (*Gulo gulo*)

Formerly inhabit the boreal forests, they are found more in the alpine tundra today.

Found in heavy modified timbered regions, that are mostly situated in evergreen or mixed forests that are commonly interspersed with lakes, streams and bogs.

33. Striped Skunk (*Mephitis mephitis hudsonica*)

Do occur in forest and along river valleys. Well-drained prairies, parklands and coniferous forests; less commonly in wet bottomlands and swampy alluvial flats, such as the deltas of the Peace and Athabasca.

34. River Otter (*Lontra canadensis preblei*)

Prefers to spend its life on the shores of deep, clear water in lakes, rivers and large marshes.

35. Lynx (*Lynx lynx canadensis*)

The dense climax boreal forest with its dense undercover of thickets is the favorite haunt of the lynx. Habitat is linked with the typical habitats of the snowshoe hare.

36. Mule Deer (*Odocoileus hemionus hemionus*)

This is the deer of open coniferous forests, sub-climax brush, aspen parkland, and steep broken terrain and river valleys. It shuns the deep climax forests.

Occurs primarily in shrub-forest edge areas. Winter habitat availability is the most critical component for this species. To minimize the impact of deep snow on mule deer survival, areas of dense conifer cover are required near forage areas. Habitat management for this species should concentrate on the maintenance of winter range.

In the boreal mixed wood forests, the mule deer utilizes steep south-facing slopes of major drainages. Mule deer range is characterized as 60 % forage and 40% cover would be optimum. Feed on grasses, forbes and shrubs at different times of the year.

Optimum opening size is 24 hectares, and doubling this size reduces the deer use by 1/2. Where snow levels reach critical winter levels, traditional winter habitat with little snow is critical for deer and elk, and these areas should be identified and avoided for construction and managed. Adjacent drainages should not be logged simultaneously with the remainder of the block. Over the short period, thinning second growth stands will result in more open canopy stands, where as over a longer time period, thinned stands may promote a multi-layered canopy with larger dominant trees, which will be generate good cover for the deer.

Poplar woods of southern valleys, aspen grove belts and mixedwood and coniferous forests.

37. White-tailed Deer (*Odocoileus virginianus dactensis*)

Contrary to common belief, extensive climax forests of mature hardwoods or conifers are not good deer habitat. The food has all grown out of reach of the animals, and the dense shade discourages new growth on the forest floor. Deer prefer an interspersion of cover types, edges of hardwood forests, swamp edges and banks of streams.

Utilizes edge habits. Shrub-sapling and grass areas provide browse while coniferous forests provide critical winter cover, which is the most important limiting factor for white-tailed deer. Small forest openings with abundant shrubs, forbes and grasses surrounded by forest with high canopy closure (>70%) are ideal for deer.

Snow depth is the key factor determining habitat partitioning between moose, elk and wt deer, with the later at the least snowfall. Areas with less than 35% tree cover provide unsuitable overwinter habitat. White tail deer feed in young growth (15-40 years) and immature stands (25-60 years) as well as logged (0-5yrs), grass-forbes (5-10 years) and shrub stages (10-20yrs).

Cut block widths of about 201.1 m in width is maximum for effective exploitation by deer. The number of white tail deer in the northern fringe is regulated by low temperatures and the duration of snow cover rather than the conditions of the range. In northern climates, white tail deer exhibit reduced activity in the winter, thus high quality thermal cover that helps maintain energy reserves by reducing thermo-regulation is very important.

38. Moose (*Alces alces andersoni*)

Although the moose is considered a forest dweller, it generally shuns monotonous climax coniferous forests for sub-climax stages of shrubby growth and later aspen-birch

parkland. The moose also favors lakeshores and alder swamps in summer, moving to drier hardwood slopes in the winter.

Is a forest edge species dependent on early succession forest (up to 20 years) for browse and mature to old growth coniferous forest for escape cover and winter cover during heavy snowfall. Feed on a wide variety of shrub species and depend on mineral licks or aquatic vegetation for essential minerals.

In logged areas in the winter time, the amount of coniferous forest present influenced the amount of use by the moose. Mixedwood, coniferous and deciduous forest provides the optimum habitat for moose. Retention of the deciduous component in logged areas was important in maintaining moose densities. Scattered coniferous shelter interspersed with large amounts of browse minimizes travel time and allows for optimal foraging, bedding and ruminating activities. Shrubland appear to be the year-round choice of moose, and early stages of mixed wood forest succession are prime habitat because of large forage yield. In shrubland there is reduced competition with the other species, which preferred forest cover or herbage-producing upland grass or sedge meadow. Moose move around more in forest than elsewhere, yet spent the most time feeding and bedding in shrubland. (A high diversity of plant species improves the moose habitat quality.) Sedge meadows are used extensively in the summer and spring, and in the early winter aspen forests are used. Typically moose spend the winter in areas of high browse production. Mixed and coniferous habitat supported most deer in winter and deciduous habitats supported most moose populations.

The model best explaining moose habitat utilization included harassment, block size and dispersion index. A linear decline in use accompanied increased levels of harassment. Moose favored cutblocks 16.6-32.4 hectares that were buffered from adjoining forest openings by 221.2-402.2 m. (Tomm et al. - 1981- Alberta) Ideal late winter cover comprises tree canopy closure >75% and a stand height of >6m. The quality of winter cover increases as the proportion of conifers in the stand increases. Stands composed of > 60% coniferous species of sufficient height (>10.6 m) provide maximum protection and lower snow depths. (Allen et al.-1987, -Ontario)

Subaquatic plants rank high in importance as summer feed in the diet of moose. Preferred aquatic plants include pond lilies, potamogeton, water milfoil, bladderwort and macroscopic algae. Aquatic macrophytes are an important source of nutrients such as sodium, iron, potassium, calcium, magnesium and manganese. Good aquatic lakes are normally shallow. Besides water plants in summer, moose feed on twigs and foliage and in the winter moose subsist entirely by browsing on deciduous shrubs and trees. In spring and summer they have a strong desire for sodium which they find in aquatic plants and mineral licks. Twenty-two woody or shrubby species comprised 90-95% of the terrestrial diet of moose of northern hardwoods and northern boreal forests of Minnesota. Typical variety of plants include trembling aspen, white birch, balsam fir, willow, mountain ash, mountain maple, red-osier dogwood, baked hazel, pin cherry and Juneberry.

Very sedentary in good summer habitat, but movements to winter range can be extended several miles. In north central Alberta showed sex and age specific differences in seasonal home ranges in size. Young males will have a lot larger home range than females, and the adult males will have a larger range than the adult females.

Swan Hills moose had a larger home range than reported in other regions which may be related to the high degree of habitat interspersion in the boreal environments of north central Alberta and the resulting wide dispersal of food and cover. Winter home ranges were significantly larger than other seasons. (Lynch and Morgantini., 1984) Seasonal home ranges are approximately 20km² and ranges between 10-28 km² depending on sex and age. (Lynch 1976) Mean densities for various ecological zones in Alberta in animals/km² are: parkland 1.25, mixed wood 1.10, foothills 1.31 (AFWS)

Aspen regeneration is maximized when cut during dormant periods, and will provide a good source of forage for wintering ungulates. (Westworth et al., 1984). Clearcuts >100 ha should retain shelter patches 3-5 hectares with a basal area of 11 m/ha, 1/3 in conifer with a maximum distance between clumps of 200-300 m. Retain 120 m of reserve around mineral licks and calving areas. Winter habitat is the most critical component. (OMNR. 1984)

There is a statistically significant trend showing that decreasing trend in use frequency with increasing distance from cover, especially beyond 40 m. Cutovers less than 200 m maximum width are of small enough size that distance from cover does not significantly alter use patterns by moose. Clear-cuts wider than 300 m show decreasing use especially beyond 40 m and decline to 0 at around 10 m from the edge. (Hamilton and Drysdale, 1975)

An important consideration in designing cutblocks is the dependence of ungulates on cover. Relative use differentiated by areas of high or low harassment was examined as a function of distance from cover. The most important factor found in this study that influenced the use of the clear-cuts by moose was harassment. Management guidelines for winter cover shelter were a width of 321.7- 402.2 m was compatible with moose production in areas of low harassment, and in areas of high harassment the widths should be reduced to 120.6-160.9 m and priority should be placed on producing suitable cover. (Tomm et al. 1981)

39. Elk (*Cervus elphus nelsoni*)

It is quite flexible in its choice of habitat. It prefers open areas such as alpine pastures, marshy meadows, river flats, aspen parkland and is occasionally found in coniferous forests.

Is an edge species, which feeds predominately in grass-forbe meadows and requires hiding and thermal cover for security, temperature regulation and reduction of snow cover. Preference to forbes, grass and shrubs as fall and winter progress. Ranges are large due to herd behavior and summer/winter range distribution. Habitat management recommendations concentrate on protection of natural meadows and adjacent forests plus the creation of new forage areas in suitable configurations and protection of elk from human disturbance.

Is an ecotone species and they use the edge for foraging due to increased diversity and quantity of forage plant species. Habitat selection is conditioned by topography, weather, biological factors of forage and vegetation cover and escape from predation, insects and hunters. Elk prefer upper slopes regardless of season. Southerly slopes are critical for elk winter habitat. Will use stands with dense understory vegetation in the fall. Thermal cover and adequate cover from the hunters are very important. The interspersion of forage and cover areas in time and space, their relative quality and the effect of human disturbance from roads open to vehicles are the major factor affecting elk use. Decrease use occurs way from the cover- forage edge increases. Majority of the elk forage occurs within 100 yards of the edge with cover. Most elk use of the cover is within 300 yards of the edge. Elk use is dramatically and adversely affected by roads open to traffic and this only applies to areas where elk are hunted.

In Elk Island Park, upland grass is prime habitat and less use is indicated for shrubland meadows in winter and for wide use of sedge and shrub meadows in the summer. Grasslands are preferred.

The removal of residual blocks of mature timber in the spruce and mixedwood forests 10-15 years after the initial clearcut resulted in a major decline in winter big game use of the original clear cut, and this is because the winter shelter and cover requirements were still inadequate in the clear-cuts and residual blocks were still inadequate to provide winter habitat. Cover appears to be a greater determinant of habitat use than forage availability. (Stelfox, 1984-Weldwood FMA)

Elk do increase their use of clear-cuts because forage production is increased after logging. Partial cuts were used least because they neither afforded good cover nor increased forage availability. Elk use increased often following logging especially in 6-12 hectares clear-cuts because of the increased forage quantity or quality and increased edge effect. Clearcutting increased the use by elk in lodgepole pine types, and aspen clear cuts were used at about the same level as uncut aspen. Elk will make good use of a clear-cut because of better forage and abundance. However, they will avoid such areas if human disturbance exceeds a certain threshold, they may avoid areas that are within 200 m of a useable road.

Feed on grasses in the summer/fall/winter. Forbes are used early to mid summer /fall. Deciduous shrubs and saplings are browsed in late summer/fall/winter and will feed on domestic forage in the winter months.

Geist, 1989 noted that the foothills aspen/poplar groves fulfilled a vital role in elk ecology in late winter/early spring. In the spring the snow in the open areas is crusted, but in the forest it is relatively soft, but there is very little to eat in the forest. However in the aspen groves the snow is a little softer and can be removed by the animals to get at the food. Removal of these stands would deprive the elk of a forage source in the late winter.

Elk are less selective of plants than are mule deer and food remains in the elk rumen a lot longer than in the deer, so this gives a definite advantage to the elk. For spruce and pine clear-cuts, there was a real increase in forbe cover up to year 6, but by year 26 the coverage and utilization values had declined. This also was the same in mixed wood stands but declined less. (Stelfox, 1984)

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MAMMAL HABITAT MATRIX FOR BLUE RIDGE LUMBER FMA

● Primary Habitat

○ Secondary Habitat

Species	Riparian						Immature Stands			Mature Stands				Overmature Stands				Comments
	Aquatic	Grass /Ford	Upland Shrub-Sapling	Edge	Shrub Land	Forest	Conif	Mixed Wood	Decid	Conif	Conif Mixed Wood	Decid Mixed Wood	Decid	Conif	Conif Mixed Wood	Decid Mixed Wood	Decid	
Masked Shrew						○	○	○	○	○	○	○	○	○	○	○		
Vagrant Shrew				●		●												
Water Shrew				●		●												
Arctic Shrew				●	●													
Pigmy Shrew				○	○													
Silverhaired Bat	●			●														Flies around forested lakes
Hoary Bat				●					○				○					
Snowshoe Hare							○	○	○	○	○	○	○	○	○	○	○	
Mountain Beaver	●			●												○	○	
Least Chipmunk			○	●					○									
Woodchuck			○				○	○										
Red Squirrel										●	●	○	○	●	●	○	○	
Northern Flying Squirrel										●				●				
Deer Mouse		○			○	○	○	○	○	○	○	○	○	○	○	○	○	Seldom occur in low wet sites.
Southern Red-back Vole						○				●	●			●	●			Only small mammal associated with the Old Growth Forests
Northern Bog Lemming				●						○				●				
Heather Vole			○	○			○			○				○				Sites must be dry.
Muskrat	●			●														
Meadow Vole		●		●														
Rock Vole			○	●														
Meadow Jumping Mouse				●	●													
Porcupine							○	○	○									
Coyote		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Wolf		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Red Fox		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Black Bears		○	○	●	●													All forest edges.
Grizzly Bear		○	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○	Wilderness, grass shrub, all forest edges
Raccoon				○	○	○												
Marten						○				●	●			●	●			
Fisher						○				●	●			●	●			
Ermine			●	●	●	●												
Mink				●	●	●												
Wolverine			●															
Striped Skunk				●	●	●												
River Otter	●			●	●	●												
Lynx										○	○	○	○	○	○	○	○	
Mule Deer	○	○	○	●	○	○	○	○	○	○	○			○	○			Shrub conifer edge.
White-tailed Deer	○	○	○	●	○	○	○	○	○	○	○			○	○	○	○	All edges
Moose			○	●	○	○										○		Shrubs and all forest edges.
Elk		●		●		●				○	○	○	○	○	○	○	○	Meadow forest edge.