



✓ Small wetland habitats buffered from clearcut blocks by coniferous leave strips.

✗ The visual screening cover retained adjacent to the wetland at centre could have been wider to provide undisturbed foraging opportunities for moose.

✓ Vegetation and topography separate this narrow strip of riparian habitat from the road. Although the coniferous/deciduous buffer is less than the recommended width, i.e. 200 m minimum, site topography has been utilized to increase the effectiveness of the coniferous buffer. Here the road lies well above the riparian corridor.



Lillooet Forest District Moose Habitat Handbook

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- ✓ A complex of clearcut blocks separated by coniferous leave strips and patches. These leave strips provide security cover and travel corridors within the cutblocks.
- ✗ A more suitable approach from a moose habitat perspective would have been to retain these leave strips along the riparian corridor at centre. To minimize disturbance, in-block roads should be rehabilitated following silvicultural work.



- ✓ An extensive wetland habitat shielded from timber harvesting activities by generous coniferous buffers. Impacts of future harvesting will be mitigated by sensitive road layout and delaying adjacent harvesting until 5 m green-up is achieved in existing blocks.



✓ This high quality wetland habitat has been preserved through the maintenance of coniferous buffer zones adjacent to the existing cutblocks and road. Forested corridors connecting wetland components have also been retained, permitting animals to travel undisturbed between foraging sites. These connecting corridors should be a minimum of 5 m in height and in excess of 100 m in width.



✗ Little or no security cover has been retained between the high quality aquatic habitat and the road. Where possible, roads should be situated a minimum of 200 m away from these high value sites, with intervening vegetative or topographic cover. Where roads exist through high value forage areas, they should be rehabilitated once silvicultural commitments area met.

Moose Habitat Handbook

Objective of the Project

The objective of this project is to provide government and private industry foresters and forestry workers with a concise reference document with which basic assessments of moose habitat values within operational areas may be completed. In the absence of a trained wildlife habitat specialist, this document will assist planning foresters in identifying areas of high value to moose, and provide guidelines for integrating these zones into current and future development plans. It is anticipated that access development and management planning on and adjacent to important moose ranges will also be facilitated via these guidelines and recommendations.

Layout of the Handbook

This handbook documents, photographically, and in text, the attributes of important moose habitats within the Lillooet Forest District. Each photograph is accompanied by a detailed description of the important cover and forage values depicted. The operational section provides examples of past and current forest management practices on the landscape, and discusses their impacts, positive ✓ and negative ✗, on moose habitat. Specific features discussed in the text are indicated on the photographs by black arrows. All photographs herein depict habitats within the Lillooet Forest District, as they appeared in September 2000. ↑

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Basic Moose Biology and Habitat Requirements

The moose, *Alces alces*, the largest member of the deer family, is a northern animal adapted to life in regions of cold climate and deep snow. These ungulates are primarily shrub browsers, but do graze on sedges, grasses and aquatic plants, particularly in spring and summer. The moose population within the Lillooet Timber Supply Area (TSA) consists of numerous small, scattered subpopulations. The total population is currently estimated between 200 and 300 animals, and appears to be expanding slowly in both distribution and abundance.

Winter habitat is generally thought to be of critical importance to the overall health of moose populations, and the quantity and quality of suitable winter range may limit population levels. A negative energy balance between forage intake and energy expended on metabolism, thermoregulation and locomotion lead moose to minimize daily movement during this time of year and utilize readily available food items. High value winter habitats include shrub-dominated wetland complexes where willow is a dominant species. Coniferous stands provides important thermal (refuge from extreme weather) and security (screening from human disturbance and predators) cover values. Dense coniferous growth acts to intercept snowfall, creating travel corridors with reduced snow depths where energy requirements for movement between forage areas are minimized.

In spring, moose must replace fat and weight losses incurred by subsistence on low quality forage over the winter months. Cow moose in the late stages of pregnancy are especially in need of high quality forage for fetal development and lactation. Wetland, meadow and riparian habitats attract moose with their flush of succulent new vegetation. Mixedwood stands also provide an abundance of fresh, green forage in combination with important cover values.

During summer, most habitats can fulfill nutrient demands; however, the use of aquatic habitats increases, while wetlands and meadows continue to be preferred foraging sites. These habitats provide abundant forage as well as water and cool bedding sites. As in winter, dense coniferous stands provide important thermal cover values, offering relief from extreme temperatures; in this case, from summer's heat.



- ✓ This extensive wetland complex is bounded by adequate coniferous buffer zones.
- ✗ The integrity of the complex is compromised by the road layout. In the upper section (inset), the road bisects a significant section of the habitat, including the adjacent coniferous corridor. Where possible, roads should be located away from important forage sites and identified mineral licks (a minimum of 200 m; preferably 400 m).





✓ The cut and leave pattern provides connectivity between wetland areas. Additional blocks adjacent to the wetlands should not be harvested until the existing block exhibits a 5 m green-up.

✗ Opening of high value wetland/deciduous habitats by clearcutting. Continuous exposure of the wetland is limited; however, visual screening cover is inadequate in a number of areas (one noted by arrow) to protect moose using these wetlands from disturbance. The option of well-placed wildlife tree patches could have been exercised here with positive results.



✓ The high value wetland habitat is separated from the road and adjacent cutblock by a coniferous buffer zone. The retention of this coniferous reserve, albeit not of optimal width (i.e. >200 m), minimizes disturbance of animals foraging in the wetland.



Quality forage increases in importance as animals prepare for the mating period (rut) in late September, and for the difficult conditions of winter. These periods are energetically expensive; the rut particularly for bulls, and the winter months for pregnant cows. The proportion of nutritious shrubs in the diet tends to increase at this time.

A pattern of seasonal altitudinal migration is evident, with animals generally inhabiting lower elevation (below 1500 metres, or 5000 feet) habitats during winter, and ascending to higher elevation sites for the summer months. These movements are in response to snow accumulation, plant phenology and traditional migrational tendencies within populations.

Preferred Moose Forage Species

The table below presents some of the most important forage species utilized by moose, and their relative seasonal values.

Forage Species		Season			
Common Name	Scientific Name	Spring	Summer	Autumn	Winter
Willow (wetland)	<i>Salix spp.</i>	M	H	M	L
Willow (upland)	<i>Salix spp.</i>	M	M	H	H
Red-osier dogwood	<i>Cornus stolonifera</i>	M	M	H	H
Birch	<i>Betula spp.</i>	L	L	M	M
Aspen, black cottonwood	<i>Populus spp.</i>	L	L	M	L
Douglas maple	<i>Acer glabrum</i>	L	M	M	L
Fireweed	<i>Epilobium angustifolium</i>	-	H	-	-
Falsebox	<i>Pachistima myrsinites</i>	M	L	H	H
Sedge	<i>Carex spp.</i>	H	M	L	-
Yellow waterlily	<i>Nuphar polysepalum</i>	M	H	L	-



Representative Moose Habitats of the Lillooet Forest District



Typical high value wetland habitat. Note the mix of conifer patches, wetland shrubs, such as willow and birch, and the sedge/grass component. This mosaic of vegetation types provides high forage values in close proximity to thermal and security cover offered by the coniferous component.



The wetland and aquatic vegetation provides abundant, high quality summer forage. The surrounding coniferous growth provides refuge from high summer temperatures, security cover from hunters and predators, and in winter, its snow interception function reduces snow depths, minimizing energy expenditures on movement.

Cover

- Develop the distribution of patches and use cut and leave patterns that, where possible, provide connectivity between riparian/wetland areas with 5 metre height security cover at least 100 metres wide.
- Maintain forest cover adjacent to old burns, non-productive brush, deciduous forest, mixed forest and riparian features. Strategic placement of Wildlife Tree Patches may fulfill this requirement in some situations.
- To address moose cover requirements, new blocks adjacent to existing clearcuts within important moose winter habitats should not be harvested until a 5 metre green-up has been attained.
- Preserve the integrity of wetlands and riparian areas by maintaining functional visual screening along edges.

Access

- Locate main haul roads at least 200 metres, preferably 400 metres away from high value forage areas or mineral licks.
- Where main haul roads currently exist through important moose winter range, restrict access using gates and berms, and minimize plowing during winter months when moose are vulnerable to harvesting.
- Branch and spur roads should be rehabilitated once silvicultural commitments are met.
- Maintain visual cover between roads and forage areas, or break up line-of-sight from roads by utilizing topographic features, if available.
- Avoid thinning and brushing 20 m either side of open main haul roads to provide security cover and reduce disturbance to moose.

Livestock Issues

- Livestock fencing in moose calving areas should not exceed 1.07 m (42") in height, and should be a minimum of 0.46 m (18") above ground to allow young moose to cross.
- No cutblock seeding where browse species exist. Grass seeding concentrates livestock, where they damage woody moose browse.



Forest Management Guidelines

The vision of the Lillooet Land and Resource Management Plan (LRMP) with respect to moose is to increase the distribution and abundance of the species through improvements in the quality and quantity of habitat. This objective can be achieved while accommodating other resource needs, such as timber harvesting and recreation.

In general, the goals of moose management within the Lillooet Forest District include: 1) increasing forage opportunities for moose, specifically on winter ranges, 2) ensuring the long term maintenance of thermal and security cover, and to provide access to that cover for moose and 3) minimizing adverse impacts of road access on moose populations.

Through the LRMP process, wildlife and forest managers are working together to develop and adopt strategies to achieve these objectives. The following is adapted from the DRAFT Lillooet LRMP Moose Management Objectives and Strategies, October 2000, and **applies to areas of high value to moose as wintering and foraging sites.**

Forage

- Design harvest patterns to maximize early seral forage opportunities, while maintaining cover requirements (see 'Cover' heading).
- Utilize site preparation and brush control methods that minimize impacts to moose forage. Scarification should be discontinuous where naturally regenerating forage species occur.
- Stocking levels for harvested areas on rich soils and mesic to sub-hygic sites where important moose forage species exist should approach the minimum stocking standards or be left to natural regeneration.
- Variable planting densities, i.e. cluster planting, with intermittent openings will maintain or enhance forage production.
- Commercial thin in high value habitats to promote the growth of browse species.
- Promote browse enhancement where willows have become old and grown out of reach of moose (i.e. 5 m) by burning, knocking down or cutting portions of these stands.
- Create herbicide 'no-treatment zones' where species such as willow, birch, aspen and red-osier dogwood occur. Rapid post-treatment and early planting will minimize the need for herbicide application.



High value wetland habitat. High forage value in the shrub fringe and wet sedge meadow, combined with a coniferous buffer for security and thermal cover.



Shrub/sedge wetland habitats can be important calving sites. Cow moose give birth in late April through early June. Note the very young calf in the centre of the frame, well camouflaged in the shrub/sedge layer.



High quality foraging habitat, including a healthy shrub layer, grasses and sedges. Adjacent coniferous thermal and security cover values increase the likelihood that this habitat will be



A seasonal sedge wetland of limited value to moose. Note the absence of a shrub component, which comprises the bulk of the moose diet, particularly in winter.

Forest Management

The three primary issues concerning forest management practices on important moose habitats in the Lillooet Forest District are cover, forage and access. Access management, in concert with the maintenance of an optimal mix of cover and forage values is crucial to maintaining habitat suitability for moose. Issues relating to domestic livestock operation on moose ranges, such as control fencing and browse competition, need also be addressed.

Vegetation must provide both security and thermal cover. Cover values are supplied by dense coniferous stands adjacent to and between important foraging sites and on migration corridors between seasonal ranges. These stands provide security from disturbance, moderate temperature extremes and reduce snow depths in winter through interception. Security cover, including escape and visual screening cover, is especially important adjacent to riparian or wetland foraging areas, where disturbance can reduce feeding efficiency or lead to habitat abandonment. Retention of coniferous buffer zones adjacent to and connecting key moose ranges will aid in maintaining habitat quality.

The maintenance and enhancement of forage is key to preserving the quality of moose habitats. The quality of winter forage is especially important where snow depths restrict movements. Riparian/wetland complexes are typically the core of winter ranges, where sufficient forage is available in this season of reduced forage quantity and quality. Specific timber harvesting and silvicultural regimes may be employed to maintain or even increase the quantity and quality of forage on moose winter ranges.

Road layout and uncontrolled vehicular access onto or near moose ranges can result in excessive disturbance and harvest, and may ultimately lead to alienation of the habitat. Location of haul roads should be sensitive to the features of moose habitat, and vehicular access must be managed.

Livestock control fencing may restrict the movement of young moose between important habitats and along their migration corridors, in addition to posing an injury risk to juvenile moose. Identified moose travel corridors and height considerations should be taken into account when designing livestock fencing.



A young bull foraging in a productive willow/sedge meadow habitat. Little security here while foraging; however, just out of view to the left is important coniferous cover to which this animal could escape at the first sign of disturbance.



An extensive high elevation willow/birch complex with high forage and adjacent cover values. The surrounding landscape is characterized by even-aged coniferous growth, likely created by past wildfire. Timber harvesting in these stands, through a combination of sensitive block and road layout, and appropriate silvicultural regimes (to encourage browse production) can create a diversity of moose habitats in the upland area, where currently they are lacking (see following section).



High value shrub/deciduous patch. Quality forage and, due to its height, summer security cover, are available. The surrounding coniferous growth enhances the value of this stand by providing additional cover values (thermal, security and snow interception).

This narrow drainage provides forage along its length as well as excellent cover values. Animals could move securely between other foraging sites through this corridor, feeding enroute.





A small, isolated wetland with deciduous fringe. The importance of such sites is apparent when considering the absence of forage production in the surrounding dry forest.

A productive riparian/wetland complex. The mosaic of forage species (shrub, sedges) and coniferous patches produces high quality moose habitat. At lower elevations, these features attract numbers of wintering moose, which may remain within such a restricted area for the duration of the season.



Wetland habitat of limited autumn/winter value to moose. In the summer months, however, the spruce bordering this wetland provide important thermal cover, and the water itself is a valuable resource. Aquatic vegetation, such as waterlilies and pond weeds, may provide important summer forage. From a winter forage perspective, however, the shores of this small lake are devoid of a shrub component.



The deciduous component on this otherwise dry landscape can provide important winter forage. Animals may venture from coniferous cover into these stands to browse on the current years' growth of deciduous species, such as willow, aspen, birch and red-osier dogwood.