

DESIRED CONDITIONS FOR COASTAL MOUNTAIN GOAT WINTER RANGE

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INTRODUCTION

The Government of British Columbia is establishing ungulate winter range areas (UWR) for Mountain Goats throughout the Province. To ensure that winter ranges are established and managed consistently, the Ministry of Water, Land and Air Protection (MWLAP) convened a workshop of technical experts on 21 April 2004 (Appendix A) to develop objectives and general wildlife measures for Mountain Goat winter ranges in coastal areas. The objectives and general wildlife measures are designed to achieve “desired conditions” for winter range areas and are to be implemented under the *Forest and Range Practices Act*.

This report outlines

- the regional biological criteria for Mountain Goat winter ranges;
- knowledge gaps relevant to establishing winter ranges for Mountain Goats;
- “desired conditions” for Mountain Goat winter ranges in coastal areas;
- objectives and general wildlife measures to achieve the desired conditions;
- general methods available to delineate Mountain Goat winter ranges.

BIOLOGICAL CRITERIA FOR MOUNTAIN GOAT WINTER RANGES

From the May 2000 Memorandum of Understanding:

MWLAP regional staff are responsible for determining the location of UWRs critical for the winter survival of ungulates based on regional biological criteria. These criteria are to be based on our current understanding of ungulate habitat requirements in winter, as interpreted by MWLAP regional staff from current scientific and management literature, as well as local knowledge.

UWR areas must meet at least one of the following criteria:

1. A combination of topographic and vegetative features defining high-quality winter range, as appropriate for the species and the locality, as determined by MWLAP regional staff in

consultation with species experts.

2. A documented history of winter use, as determined by MWLAP regional wildlife staff.
3. In localities that are regularly occupied by an ungulate species during the winter but that do not have sufficient high-quality winter range as defined under criteria 1 or 2, winter range areas can be identified by recognizing a combination of topographic and vegetative features that provide the most suitable habitat available for winter range. This criterion is the least preferred of the three and should be used only when criteria 1 or 2 cannot be met.

Typical topographic and vegetative features to be used in delineating UWRs are:

- slope
- aspect
- elevation
- topographic shading
- presence of rock outcrops or cliffs
- forest cover type (species composition, height, age, volume or basal area, canopy closure of overstorey)
- species composition and abundance of understorey vegetation
- species composition and abundance of arboreal and terrestrial lichens
- stand heterogeneity
- size and configuration of area.
- adjacency of other important habitats such as early winter and spring ranges
- proximity to other winter ranges.

Topographic Features

The principal antipredator strategy of Mountain Goats is the use of escape terrain—namely, rock bluffs and cliffs that provide good visibility and that are generally inaccessible to predators (Fox and Streveler 1986; Fox et al. 1989; Shackleton 1999). Interior Mountain Goat populations tend to winter at high elevations on windswept south- and southwest-facing slopes, but heavy snow loads in coastal mountains force goats to move to low-elevation areas in search of

food sources not buried by deep snow (Fox and Smith 1988, Fox et al. 1989; Shackleton 1999). Mountain goats in the Cascades have habitat use characteristics intermediate between coastal and interior ecotypes (Gilbert and Raedeke 1992).

Rock bluffs are rarely associated with abundant food sources, so winter habitat is characterized by the trade-off between escape terrain and adequate food. This trade-off leads to the use of mid-elevation (<1200 m) bluffs and cliffs with low snow loads, as well as nearby forests with good snow interception cover. Snow loads on steep south and southwest-facing slopes are generally low because of melt and sublimation with sunlight, and because of frequent slides in steep terrain (Fox et al. 1989). Hebert and Turnbull (1977) found that most winter ranges in Knight Inlet were located on south-facing slopes at elevations of 366 to 1372 m and were characterized by mature tree canopies overhanging steep bluffs. Taylor and Brunt (2003) found winter use in the Kingcome drainage to be concentrated at 600 to 1200 m elevation and 41- to 60-degree slopes on southerly aspects. Observations in the Soo TSA found Mountain Goats using southerly aspects almost exclusively (Rochetta 2002).

Coastal Mountain Goats are also known to use caves under overhanging rock, and snow bowls under mature tree canopies (Leigh-Spencer 1997). Mountain goats normally remain less than 400 m from adequate escape terrain (Fox et al. 1989). Taylor and Brunt (2003) found that the mean distances between winter telemetry locations and rock outcrop polygons was 100 m and were never more than 571 m (although this was similar to distances from random points). Demarchi and Johnson (1998) found that goats and goat sign in the Nass were rarely found farther than 50 m from escape terrain, although sign was evident in adjacent forests within 100 m of escape terrain. No sign was found in recently harvested areas.

Suitable topography for winter ranges can occur in very small microsites within a matrix of less suitable terrain. For example, Jex (2004) found Mountain Goats using areas with shallower slopes and some cooler aspects than might be expected from the literature; however, these areas were often associated

with small outcrops that fit the criteria of winter range described in the literature.

Forest Cover Characteristics

As mentioned above, forest cover with good snow interception cover adjacent to escape terrain is an important characteristic of Mountain Goat winter ranges. These areas provide accessible forage during times of deep snow. During very severe winters, snow may make even low-elevation bluffs inaccessible, forcing goats into timbered stands far from preferred escape terrain, occasionally as low as sea level (Shackleton 1999; S. Gordon, pers. comm.). Old forests with high-diameter trees and multi-layered, closed canopies are most efficient at reducing the depth of snow on the ground (Kirchhoff and Schoen 1987).

Mountain goats in the Kingcome drainage used predominantly forested sites during winter and selected western hemlock-leading stands that were older than 250 years and of moderate volumes and crown closure (according to VRI mapping; Taylor and Brunt 2003).

Forest Understorey Characteristics

The characteristics of the forest understorey determine the availability of food for wintering Mountain Goats. Goats in coastal ranges subsist on forbs, ferns, conifers, lichens, and mosses (Hjeljord 1973). As snow depths increase, the proportion of forbs and ferns in the diet declines (Fox and Smith 1988). At snow depths greater than 50 cm, forbs and ferns become unavailable and goats forage on conifer leaves and lichens from standing trees and litterfall, and on mosses from substrates not covered by snow (Fox and Smith 1988). Older forests are generally associated with more abundant arboreal lichens and litterfall (Rochetta 2002).

Size and Arrangement of Winter Ranges

Winter movements of goats are very restricted, with ranges less than 0.2 km² recorded for some individuals in southeastern Alaska (Fox et al. 1989). Winter home

ranges of females in the Kingcome drainage averaged 84 ha, with 75% of ranges less than 100 ha (Taylor and Brunt 2003). Taylor et al. (2004) found that most female winter ranges were less than 200 ha and males less than 250 ha. Home ranges reported by Taylor et al. (2004) are more reliable than those reported by Taylor and Brunt (2003) because the ranges were based on larger samples of points and animals.

Taylor and Brunt (2003) also observed between-year fidelity in the use of home range for the 2 years of their study: 10 of 12 winter ranges overlapped in consecutive years. Taylor et al. (2004) reported similar results. These studies suggest that Mountain Goats occupy small and isolated areas on the landscape during winter and are unlikely to move between widely separated patches of suitable habitat.

Movements between seasonal ranges are generally small (<2 km, approximately 500 m in elevation), as are within-winter movements between areas of suitable habitat (<2 km; Taylor et al. 2004). In coastal Alaska, Mountain Goats used traditional routes to move between winter and summer ranges and distances averaged 1.2 km (Schoen and Kirchoff 1982).

Winter is a period of severe nutritional deprivation for Mountain Goats, and the size and distribution of suitable winter ranges determines the carrying capacity of areas (Fox et al. 1989). Like all ungulates, Mountain Goats in spring are in poor condition and seek out areas where green vegetation first appears, such as seeps and small meadows that are first to be snow-free.

Geographic Trends

Winter range habitat requirements change with the biogeoclimatic characteristics of coastal regions. The behaviour and habitat selection of coastal ecotype goats as described above occurs where temperatures are moderate and snow loads are heavy. Further inland where temperatures are colder and snow packs more moderate, Mountain Goats exhibit more “transitional” behaviour, with some herds or individuals using low-elevation winter ranges and others exploiting shallow snow areas elsewhere, such as high-elevation

windswept cliffs and ridges (Foster 1982; Demarchi and Johnson 1998; Lemke 1999). Mean changes in elevation between winter and snow-free seasons are generally smaller than on the coast, although the winter range areas tend to be at lower elevations and on more southerly aspects than other seasonal habitats (Lemke 1999). Mountain goats following the different strategies can sometimes be found in the same drainage (B. Jex, pers. comm.).

On the south coast, typical “coastal” winter range habitat use by Mountain Goats can extend inland more than 60 km. Farther north, the coastal influence is more restricted. In general, the distribution of Mountain Goats exhibiting typical coastal behaviour follows the distribution of the CWHvm biogeoclimatic subzone, although exceptions can occur throughout the range.

Knowledge Gaps

The habitat requirements of wintering Mountain Goats on the coast and in transitional areas are relatively well known. Detailed home range and movement data are available from limited areas (Taylor and Brunt 2003; Taylor et al. 2004), but the complexity of the topography and its latitudinal extent along the coast of British Columbia would suggest there is likely wide variation. One of the principal challenges in establishing desired conditions and related objectives for Mountain Goat winter ranges is that home range size and, in particular, movements between suitable areas within winters tend to be vary considerably. We also have few or no data collected from coastal areas during severe winters, which are obviously critical periods for which we must manage goat winter range. We can assume that home ranges and movements will shrink during severe winters and goats will tend to use habitats at lower elevations. They might also use habitats during these periods that they do not otherwise use.

Few data are available to determine forest cover requirements related to travel routes. Mountain goats are known to use traditional routes (often ridge tops) to move between seasonal habitats and between suitable areas within seasons. Although many of these

travel routes are located above the tree line, others are within operable forest (Lemke 1999) and there is little information on whether forest harvesting along or near these routes disrupts movements. A project is currently under way in northern British Columbia to study the issue (M. Wood, pers. comm.).

DESIRED CONDITIONS FOR MOUNTAIN GOAT WINTER RANGES

Based on available literature reviewed above, the desired conditions for Mountain Goat winter ranges are defined by a number of characteristics; however, goats have also been observed wintering in areas that do not meet one or more of the criteria listed below. Therefore, winter use by Mountain Goats should be the primary criterion for determining the suitability of areas. It is intended that the desired conditions outlined below will direct the identification, delineation, and management of Mountain Goat winter range.

Desired conditions for areas suitable for winter range for coastal and transition-area Mountain Goats include the following characteristics:

- Escape terrain:
 - Rock outcrops or cliffs that provide good visibility for vigilant goats and are sufficiently rugged to be generally inaccessible to predators.
 - Slopes generally between 30 and 60 degrees.
- Accessible and abundant forage close to escape terrain:
 - Areas of low snow-loading that allow goats to access available forage:
 - Forest canopies with high snow-interception characteristics in coastal or transition areas; and/or warm southerly aspects with high melt and snow-shedding characteristics in coastal and transition areas; and/or high-exposure, windswept slopes in transition areas.
 - Elevations <1200 m on the south coast, lower in northern coastal areas, no elevation preferences in transition areas.

- Areas that provide high-quality forage, e.g., available rooted forage and litterfall.
- Evidence of winter use by Mountain Goats or use by Mountain Goats in nearby areas (<1000 m across slope, <1200 m elevation).
- Areas of up to 250 ha are adequate to capture the ranges of most wintering goats.

METHODS FOR DELINEATING WINTER RANGES

A systematic inventory (e.g., Rochetta 2002) is the best way to define Mountain Goat winter ranges because both the fine-scale characteristics of the habitat and the presence of Mountain Goats can be determined from inventory flights. The resources required for this level of inventory are impractical for many regions of the coast (e.g., Skeena). In these areas, it might be necessary to identify “potential” winter range areas based on a topographic and forest cover model (e.g., Gross et al. 2002; Heinemeyer et al. 2003). However, these models often overestimate the availability of suitable winter ranges and some reconnaissance to confirm habitat characteristics and occupancy by goats is still necessary. Also, the detailed terrain characteristics of microsites used by wintering goats cannot be resolved by available mapping (e.g., Jex 2004). A blend of methods using maps, aerial photo interpretation, and survey flights is also an option (e.g., Pollard 2002).

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APPENDIX A. Participants of the Mountain Goat Winter Range Workshop held in Richmond, B.C., 21 April 2004.

Name	Affiliation
Ron Diederichs	B.C. Ministry of Water, Land and Air Protection, Region 1
Nancy Densmore	B.C. Ministry of Forests, Victoria
Ken Dunsworth	B.C. Ministry of Water, Land and Air Protection, Region 5
Greg George	B.C. Ministry of Sustainable Resource Management, Region 2
Steve Gordon	B.C. Ministry of Water, Land and Air Protection, Region 7
Stewart Guy	B.C. Ministry of Water, Land and Air Protection, Victoria
Jeff Hoyt	B.C. Ministry of Water, Land and Air Protection, Victoria
Bill Jex	B.C. Ministry of Water, Land and Air Protection, Region 2
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Sally Leigh-Spencer	Consultant
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David Shackleton	University of British Columbia, Vancouver
Shawn Taylor	Consultant
Wayne Wall	International Forest Products
Steve Wilson	Consultant

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