



HABITAT ASSESSMENT

Delineating High-elevation Ungulate Winter Range for Woodland Caribou in North-central British Columbia

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APRIL 10, 2009

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Prepared for BC Ministry of Environment and Canadian Forest Products Ltd., Mackenzie Operations under contract #FIA08-773005-01 (Hewr)

CITATION: McNay, R.S., V. Brumovsky, R. Sulyma, and L. Giguere. 2009. Delineating high-elevation Ungulate Winter Range for woodland caribou in north-central British Columbia. Wildlife Infometrics Inc. Report No. 299. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada.

ABSTRACT

Over the period of three years, we iteratively applied and tested a Bayesian model to predict the location of high-quality winter range for woodland caribou at high elevations in four Recovery Planning Areas located in north-central British Columbia. The resulting area of High-Elevation Winter Range was scrutinized for the potential impact on the Timber Harvesting Land Base and rules were derived for systematically reducing the amount of range that could then be considered candidate Ungulate Winter Range under the Government Actions Regulation. HEWR was reduced by 22% from the original forecast to result in 877,087 ha of candidate UWR; 39,847 ha in 24 polygons in the Fort St. James Forest District and 837,241 ha in 133 polygons in the Mackenzie Forest District. We describe this candidate area by ecoregion and ecosection, biogeoclimatic zone and variant, wildlife management unit, and resource management zone. We also indicate the amount of area in guide-outfitter and trapper licenses that would be affected. Caribou and mountain goat use of candidate UWR area and previously protected HEWR (i.e., parks) accounted for 63% and 69% (respectively) of the relocation observations made during winter when animals were located above 1,200 m asl. Most (80%) of the use of high-elevation habitat by these animals was in Alpine Tundra and Subalpine Parkland. By comparison, these habitats made up only 28% of the study area. General Wildlife Measures consistent with recovery planning, are suggested as guidance for management of the candidate UWR.

ACKNOWLEDGMENTS

This 3-year study was funded by the BC Forest Investment Account Land Based Investment Program with additional support from the BC Ministry of Environment; it was completed under contract to Canadian Forest Products, Mackenzie Operations. We appreciate the assistance from Bill Arthur, Doug Ambedian, Russ LaRoche, and Dan Szekely in their management and administration of project funding. Greg Altoft and Ryan Madley did a great job flying us to sampling sites and putting us in a position to complete our field-based assessment of high-elevation winter range. Assistance in the field was provided by: Robin Steenweg, Brian Halvorson, and Daris Piper. Robin McKinley assisted with spatial modeling. The analysis of caribou habitat preferences was based on relocation data gathered from a variety research projects conducted in the area over the past 20 years; Morgan Rankin assisted with this analysis and took a lead in documenting progress on the project during Year 1. We used excerpts in this report with modification from a similar project (UWR U-9-004) – having prior consent from the authors and we thank Diane and Brad Culling, Janice Anderson, and Joelle Scheck for allowing us to do so.

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INTRODUCTION

Under the auspices of the Forest Practices Code of BC Act (Government Actions Regulation; GAR), the Government of British Columbia (BC), is authorized to designate areas of land necessary for the over-winter survival of ungulates as Ungulate Winter Range (UWR) and to set objectives for the management of those areas in the form of General Wildlife Measures (GWMs). In north-central BC, direction has been undertaken to delineate UWRs for northern caribou (*Rangifer tarandus caribou*) using a Bayesian modeling technique (McNay et al. 2006). The model was used to predict the quality of Pine-Lichen Winter Range (PLWR) and High-elevation Winter Range (HEWR), located with 1-ha resolution, within a three million hectare area of the Mackenzie and Fort St. James Forest Districts. The modeling results also contributed to decisions about planning for recovery of woodland caribou populations in the same area (McNay et al. 2008). While modeled PLWR values have been assessed for operational use (Schmidt and McNay 2002) and implemented through policy¹, those of HEWR have not. Here, we report on the activities undertaken and results obtained over a 3-year period to inventory and delineate two types of HEWR distinguished by the lichen forage type sought by caribou: terrestrial (*Cladina* and *Cladonia* species) or arboreal (*Bryoria* and *Alectoria* species).

Objectives

Our objective in year 1 (2006-07) was to determine if caribou preference for HEWR was consistent with predicted range values modeled (McNay et al. 2006) in the Finlay, Scott, Chase, and Wolverine herd areas of north-central BC. We considered and assessed the following hypotheses:

1. Preference, interpreted from relocations of radio-collared caribou, for modeled HEWR (terrestrial and arboreal) would be consistent with predicted range values;
2. Preference, interpreted from locations of caribou groups observed during a population survey, for HEWR (terrestrial) would be consistent with predicted range values;
3. Preference, interpreted from relocations of radio-collared caribou, for aspect classes in forested high elevations, would be significant with highest preference for northwest aspects and lowest preference for southeast aspects; and
4. Sampled observations of arboreal lichen biomass would be consistent with modeled HEWR (arboreal) predictions of lichen abundance.

Our objectives in year 2 (2007-08) were to:

1. Refine HEWR model structure based on results and recommendations from the previous assessment (Rankin and McNay 2007);
2. Re-apply the new model and make predictions of HEWR values within the application area;
3. Augment information on lichen abundance by collecting additional data; and
4. Develop and implement aerial- and ground-based reconnaissance techniques to field-check the location of modeled, high-value, high-elevation winter range.

Our objectives for the third and final year (2008-09) were to:

¹ <http://wlapwww.gov.bc.ca/omr/esd/eco/uwr.html> accessed 09.10.19

1. Re-test the resulting model using relocations of radio-collared caribou;
2. Delineate polygons that could potentially contribute to UWR designation;
3. Recommend General Wildlife Measures to be conducted within the HEWR polygons; and
4. Provide analytical services to support the development of a formal UWR application.

Outcomes

Outcomes from this work were:

- A science-based rationale for:
 - o spatial depictions of HEWR UWR and
 - o management strategies and GWMs implemented under GAR;
- Measures, targets, and thresholds for monitoring indicators of ecological values associated with Sustainable Forest Management Plans;
- Rationale for, and greater accuracy of, forecasted range values for use in recovery plans for woodland caribou; and
- Effective conservation and management of critical habitat for woodland caribou in north-central BC.

Background

Application area

The application area was the recovery planning areas for the Wolverine, Chase, Finlay, and Scott caribou herds in north-central BC (McNay et al. 2008) (Figure 1). In general, the area extends from the town of Mackenzie (N55°18'16", W123°07'56") in north-central British Columbia throughout the Rocky Mountain foothills on the east side of Williston Reservoir north to the Peace Arm and in the Omineca Mountains on the west side of Williston Reservoir north to the Ingenika River. It also included an area north of the Williston Reservoir and east of Fort Ware (N57°30'00", W125°24'00") through the Rocky Mountains to Red Fern Lake. Planning areas were partially based on the ranges of three woodland caribou herds described by Heard and Vagt (1998): the Wolverine herd, named after the Wolverine Mountain Range; the Chase herd named after Chase Mountain; and the Finlay herd which was named after the primary river drainage in the Rocky Mountain trench. A fourth study area, the Scott area, was not identified by Heard and Vagt (1998) but was known locally to have a small herd of caribou originating around Scott Creek north of Mackenzie and seasonally using low-elevation habitats west of the Williston Reservoir. The Wolverine area was 8,443 km² in rolling, high-elevation foothills; the Chase area was 17,330 km² and situated in relatively more steep, mountainous terrain, the Finlay area was 14,187 km² with a range of terrain from steep mountainous areas to the broad U-shaped Finlay River valley; and the Scott area was 5,949 km² with rolling foothills east of the Williston Reservoir and a relatively flat plateau west of the Williston Reservoir. The boundary between the Mackenzie and Fort St. James forest districts bisects the Chase and Wolverine herd areas. Valley bottoms and mid-slopes of the areas were dominated by relatively cool and dry, or cool and moist, macroclimates of short growing seasons leading to boreal ecosystems of white and black spruce (*Picea glauca* (Moench) Voss) and *P. mariana* (P.Mill) B.S.P) (Meidinger

and Pojar 1991). Large and frequent wildfires were characteristic prior to fire control policy (DeLong 2002). Common in these ecosystems were large, relatively flat areas of well-drained fluvial deposits, which in combination with frequent fires gave rise to large

areas of forest dominated by even-aged lodgepole pine (*Pinus contorta* Dougl). Generally, a cold moist macroclimate with long, cold winters characterized upper slopes where Engelmann spruce (*P. engelmannii* Parry ex Engelm.) and subalpine fir (*A. lasiocarpa* (Hook.) Nutt.) dominated. At the northern extent of the Chase and Finlay areas, deciduous shrubs can dominate the upper slopes. Alpine tundra prevailed above tree line (~1,600 m) throughout all study areas.

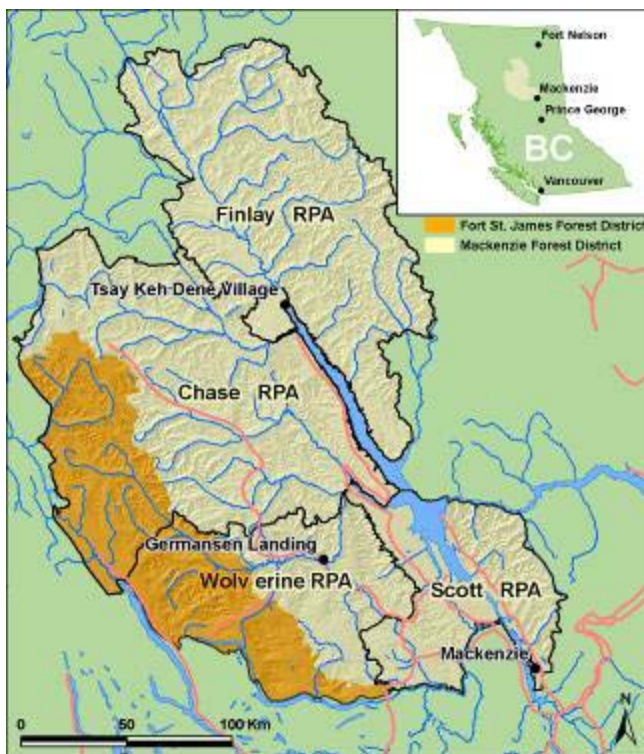


Figure 1. Location of the Chase, Finlay, Scott, and Wolverine Recovery Planning Areas (RPA) within the Mackenzie and Fort St. James Forest Districts in north-central British Columbia.

Woodland caribou herds, population status, and patterns of habitat use

In BC, three ecotypes of woodland caribou have been classified based on their habitat use and forage preferences: mountain, northern, and boreal (Seip and Cichowski 1994; Heard and Vagt 1998). Mountain caribou are primarily found in the southern part of the province, reaching as far north as the Hart Ranges. Mountain caribou use high elevation, old forests that provide abundant arboreal lichens during the winter months. Northern caribou winter either in low elevation forests characterized by abundant terrestrial lichens or in higher-elevation, windswept, alpine areas and sub-alpine forests. Northern ecotype caribou are primarily found in the northern part of the province, but also exist in west-central BC and west-central Alberta (Seip and Cichowski 1994; Seip 1998). Boreal caribou inhabit the low elevation BWBS forests of northeastern BC. In their review of the status of caribou in BC, Heard and Vagt (1998) identified 28 distinct herds of caribou belonging to the northern ecotype, including the Wolverine, Chase, and Finlay herds.

Thomas and Gray (2002) reported a population size of 400 for the Wolverine herd, 700 for the Chase herd, and 200 for the Finlay herd. We estimated the Scott herd to be 23 animals (Giguere and McNay 2007). Our own population surveys of these herds place the Chase herd at 475 animals (CI = 378 to 572) and the Wolverine herd at 378 (CI = 271 to 484) (McNay and Giguere 2008). The Finlay and Scott herds have not had

consistent or detailed surveys but we estimate these herds at 53 (Zimmerman et al. 2002) and 23 (Giguere and McNay 2007) animals, respectively.

With the exception of the Finlay herd, all of our study herds are located in the Southern Mountain Population within the Southern Mountains National Ecological Area and are currently listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2002) as *Threatened* (i.e., a species likely to become endangered if limiting factors are not reversed). Population trends were listed as either *unknown* (Wolverine) or *stable* (Chase) (COSEWIC 2002, Thomas and Gray 2002, IWMS 2004). The Finlay herd is part of the Northern Mountain Population within the Northern Mountains National Ecological Area and is considered by COSEWIC as a species of Special Concern. All of the herds in our study were *blue*-listed (*special concern* status) provincially by the British Columbia Conservation Data Centre (CDC 2002). The Chase and Wolverine herds were considered to have a high percent frequency of concern relative to the threat for all limiting factors (e.g., predation, access and disturbance, forestry and other developments, available habitat, isolation, and low numbers) except fire and hunting. By comparison, the Finlay herd was considered to have only a moderate percent frequency of concern relative to threats, the highest being hunting and predation (Thomas and Gray 2002).

Thomas and Gray (2002) reported the herd ranges as: Finlay – 3,084 km², Wolverine – 8,315 km², and Chase – 11,390 km². Results of a recent restructuring of the provincial caribou herd map² indicate areas of occupancy as follows: Finlay – 8,175 km², Wolverine – 10,541 km², Chase – 12,465 km², and Scott – 4,149 km².

In winter, northern caribou use alpine/subalpine and forested habitats in varying proportions, with differences displayed by individuals and between years (Poole *et al.* 1999, Terry and Wood 1999, Apps *et al.* 2001, Culling *et al.* 2005). Annual variations are associated with snow depth, density, and hardness (Hatler 1986, Johnson *et al.* 2000, Culling *et al.* 2005). While northern caribou feed primarily on terrestrial lichens, arboreal lichens are also consumed, particularly during winters of high snow accumulations. Differences in habitat use between individual herds may be associated with range-specific distribution and abundance of terrestrial and arboreal lichens. Important sources of terrestrial lichen forage occur on wind-swept alpine and sub-alpine habitats (Johnson *et al.* 2000, IFS 1997) and mature and old lodgepole pine (*Pinus contorta*) stands (Hatler 1986, Edmonds 1988, Terry and Wood 1999).

Specific winter habitat requirements include windswept alpine and sub-alpine areas that provide low snow depths, abundant terrestrial lichens and ground forage (IWMS 2004), and space to segregate from predators and alternate prey species adapted to early seral habitats. Subalpine krummholz habitats are also an important component of the high elevation winter range as they provide expanded areas of lower snow depths and foraging opportunities. In addition, northern caribou use mid- to high-elevation subalpine forests and lower to mid-elevation pine forests that provide abundant foraging habitat (Seip and Cichowski 1994; IWMS 2004).

All herds in the study area consist of animals that display a varied combination of migratory and resident behaviour. Seasonal movements for caribou in some of the area

² Unpublished data; British Columbia Ministry of Environment, Victoria, BC

were first described by Wood and Terry (1999). Migratory caribou of the Chase herd have summered in remote mountainous areas as far west as the Sikanni Range. In the Wolverine herd, animals have summered as far west as Diver Peak and West of Mitchell Range or Takla Lakes. Wintering areas generally include the Ingenika Range, Butler Range, and Chase Mountain for the Chase herd, and the Wolverine Range, Germansen Range, Nina and Discovery creeks areas for the Wolverine herd. Our knowledge of the Scott herd indicates that caribou generally used the Misinchinka Ranges (east of the Williston Reservoir), range just east of the Clearwater Creek, and Mount Bickford area. We have knowledge of one male captured west of the Williston Reservoir in the Blackwater swamp area and have anecdotal information of about 20 caribou that move through that area annually during early winter. The Finlay herd once used low-elevation winter range near Isola Lake west of the Finlay River and high-elevation winter range in the Mount Yuen area east of the Finlay River. We have recorded some use of the Akie River area and east of the Rocky Mountains as far as Trimble Lake but an association with the adjacent Pink Mountain caribou herd is evident by these movements and herd boundaries have not been unequivocally defined.

UWR types and timber supply impact budgets

The BC Ministry of Environment (MOE) may establish three types of UWR (Types 1, 2, or 3) each with their own timber supply allowances and sources (Province of BC 2003). Timber supply impact assessments are based on both the spatial overlap of each UWR unit with the timber harvesting land base (THLB) (i.e. areas of contributing and partially contributing forest stands) and associated management from the proposed GWMs within each UWR unit.

Previous UWR designations in the Mackenzie and Fort St. James Forest Districts have included those for goats, elk, sheep, mule deer and caribou and have generally been categorized as Type 1, except for U-7-009 and U-7-003 which were Type 2 (Table 1). The UWR areas under consideration here, for HEWR, are categorized as -Type 2 in both forest districts. To date no Type 3 areas have been proposed in the Omineca Region, but if it necessary to accommodate all area proposed for HEWR-UWR in the Mackenzie forest district, a proposal for Type 3 UWR areas will be made.

Modelling rationale and general results of previous work activities

Although we had access to information about the use of habitat by radio-collared caribou in the application area, we also recognized the unlikely condition that this information was comprehensive enough to depict all critical winter range (i.e., all groups of caribou were unlikely to be represented by the collected data which, if used as the basis for depicting UWR, would have resulted in false-negative error). By comparison, we did consider the accumulation of relocation data to represent a representative sample of caribou range use and hence the characteristics of range used by the actual population and therefore useful data for testing the modeled depiction of winter range. This same approach was used successfully before (Doucette and McNay 2003, McNay and Doucette 2003). For example, prior to identifying UWRs based on modeled PLWR for the same caribou herds, predictions were assessed by comparing modeled range values to observations of habitat preferences (Chesson 1983) where the latter were calculated using relocations of radio-collared caribou. We expected to use the same general approach for identifying HEWR UWR including two other post modeling steps used for

PLWR UWR: 1) the locations of modeled PLWR were confirmed spatially through an

Table 1. Ungulate Winter Range (UWR) designations and their respective timber supply impact budgets for the Mackenzie and Fort St. James Forest Districts.

Forest District	UWR	UWR Label	Budget (ha)	
			Type 1	Type 2
Mackenzie		TSR Budget (ha)	4,045	Unspecified¹
	U-7-001	Northern Caribou Kennedy Siding	0 ²	
	U-7-004	Mountain Goat Peace Arm	101	--
	U-7-005	Elk Peace Arm	440	--
	U-7-006	Stone Sheep Peace Arm	440	--
	U-7-008	Elk Ingenika	1058	--
	U-7-009	Northern Caribou Pine Pass	1733	5260
		Remaining	272.5	Unspecified
Fort St. James		TSR Budget (ha)	8,000	37,205³
	U-7-002	Mule Deer	1,144	--
	U-7-003	Northern Caribou Takla	0 ²	--
	U-7-015	Northern Caribou Omineca	--	2,993
	Current Proposal	Mountain Goat	≈2,000	--
	Current Proposal	Mule Deer	≈400	--
		Remaining	4,456	34,212

¹ The Mackenzie Land and Resources Management Plan (BC Govt 2000) identified provisions for caribou management but impacts on timber supply have not yet been finalized.

² Netdowns for these UWR areas were directly incorporated into a Timber Supply Review (TSR) and were not calculated as part of a TSR budget.

³ The budget identified as Type 2 UWR in Fort St. James has been included in a TSR analysis, as a result it could be considered Type 1, but the rationale for it was based on caribou management recommendation identified in the Fort St. James LRMP.

an aerial reconnaissance technique (McNay and Sulyma 2003) and 2) modeled results were then generalized into polygons that could be more easily referenced spatially for the purposes of implementing UWR policy.

The available model of high-elevation winter range was a Bayesian belief network (McNay et al. 2003) which we used to express the value of this range type in relative terms within a probabilistic framework. This entailed developing an influence diagram using the modeling shell Netica (version 3.24, Norsys Systems Corp., Vancouver, British Columbia). Our anecdotal observations of actual winter range use by caribou, and field observations from the previous work on this project, led to several modifications of the original HEWR model. Sulyma and Alward (2003) modified the model by adding a tree height input node to enhance the prediction of arboreal lichen-bearing winter range. This model was published by McNay et al. (2006). At the onset of this project, we attempted to enhance the prediction of terrestrial lichen-bearing areas by generalizing the Digital Elevation Model used to identify convex shaped slopes. Convex slopes at high elevations were assumed to be relatively free from snow due to persistent winds thereby exposing terrestrial lichens for access to foraging caribou. We also eliminated steep, rough terrain from the resultant maps by using a portion of another model built to predict escape terrain used by mountain goats (*Oreamnos americanus*). The resulting high-elevation winter range model, and the one that we assessed in Year 1, is presented in Figure 2A. In this model, preferred arboreal lichen range was characterized as: ecological units capable of supporting arboreal lichens, ≥1300 m asl, aspects between

45° and 315°, forests dominated by subalpine fir with trees >140 years old and >15 m tall, and sites not suitable as mountain goat escape terrain. Preferred terrestrial lichen range was characterized as: ecological units capable of supporting terrestrial lichens, ≥1550 m asl, aspects between 45° and 315°, flat or convex hill shapes, and sites not suitable as mountain goat escape terrain. In Year 1 we also sampled arboreal lichen abundance based on a two-factor random block sample design (factors were elevation – <1450 m asl and >1450 m asl and aspect – northwest and southwest).

Results of the Year 1 assessment led to the following general conclusions (Rankin and McNay 2007):

- Arboreal lichen abundance was related to classified elevation, aspect, and tree species. However, Lodgepole pine tended to support arboreal lichens more than we had expected.
- Relocations of caribou at high-elevations during late winter were reasonably related to the modeled terrestrial HEWR.
- Relocations of caribou at high-elevations, in forested habitats, during late winter were not strongly related to modeled arboreal HEWR. Caribou showed stronger selection for southwestern aspects than the model would have predicted. At the time we could not investigate potential ecological reasons for this because we had no empirical information on arboreal lichen abundance for that aspect class.

On the basis of these results, we refined the HEWR model with the following modifications:

- The number of states in the elevation node was increased so that we could allow elevation to influence the abundance of arboreal lichens with more sensitivity and consistent with field observations (Rankin and McNay 2007). The sole purpose for this node in the original model was to distinguish between HEWR and PLWR, with 1300 m asl as the threshold. This purpose was retained (see Figure 2Bi) and by adding additional states to the node, we were able to increase abundance of arboreal lichens as a function of increasing elevation above 1300 m (see Figure 2Bii).
- Lodgepole pine was determined to be a superior host of arboreal lichens (Rankin and McNay 2007) and so was added to the list of species that could be used to help distinguish varying lichen abundance (see Figure 2Biii).
- We refined aspect classes from >315-45 and >45-315 to the following three states (see Figure 2Biv): 1) 181-315, 2) 316-360 and 136-180, and 3) 1-135. This change allowed us to de-emphasize the importance of north and eastern aspects as a source of forage lichens.
- In the original model, escape terrain for goats was used to mask areas at high-elevation that were unlikely to be used by caribou. In the modified version, we used all steep terrain (not just that likely to be used by goats) to represent area with exceedingly high energetic cost of locomotion (see Figure 2Bv).

With the additional observations of lichen abundance from southwestern aspects collected in Year 2, aspect, elevation, branch characteristics, and tree species all contributed significantly ($n = 422$, Wald $\chi^2 = 720.2$, $P < 0.001$, AUC = .688) to the estimate of arboreal lichen abundance (McNay et al. 2008). However, the actual abundance of lichens on the southwestern aspect class was not consistent with the observed preference by caribou leading us to contemplate reasons other than forage that caused

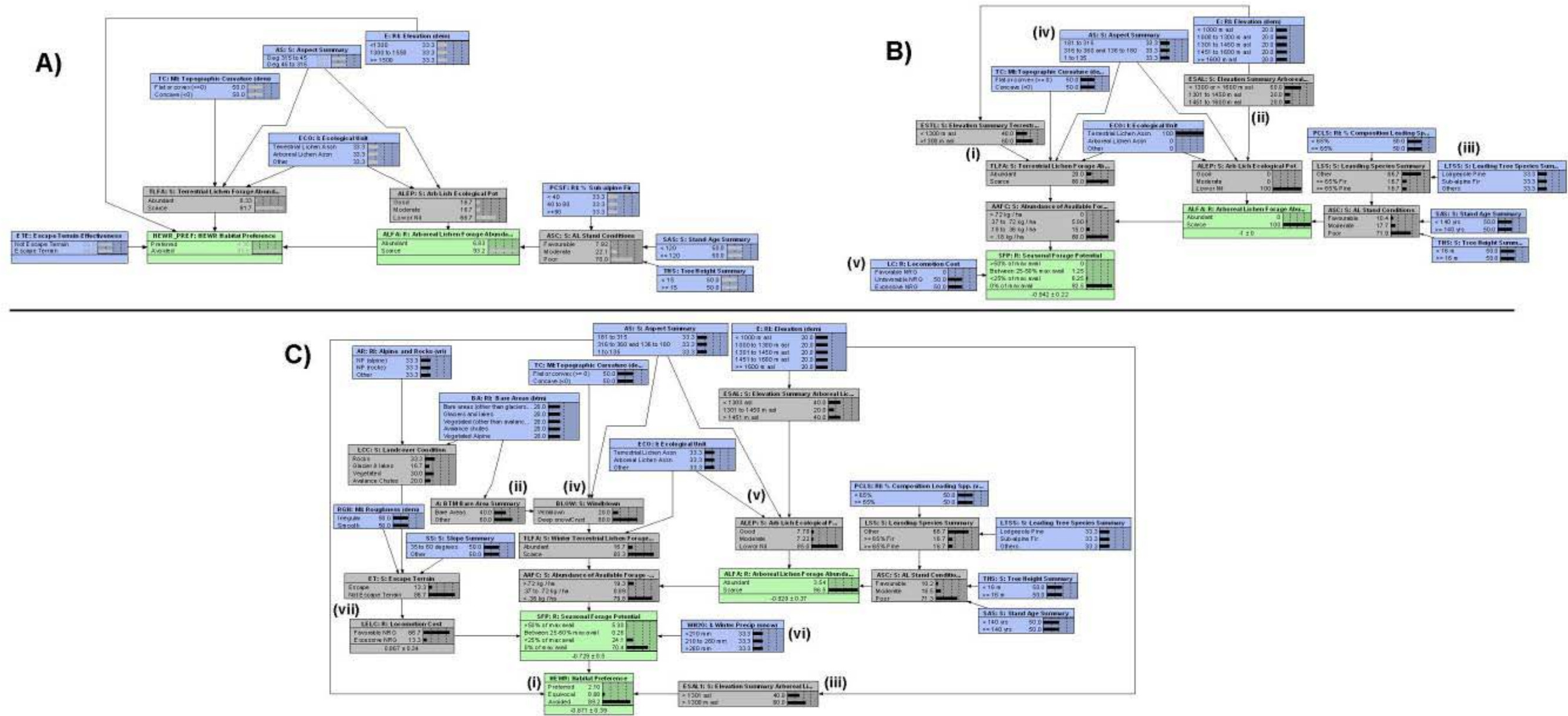


Figure 2. The original (A) and modified (B and C) versions of a Bayesian belief network used to predict the likely potential value of high-elevation winter ranges used by woodland caribou in north-central British Columbia. Model input nodes are represented in blue, output nodes in green, and summary nodes in grey. Lowercase roman numerals are used for easy reference to specific parts of the network from the text.

the preference. Nevertheless, aerial reconnaissance of modeled UWR revealed relatively low (<0.20) and balanced (both positive and negative) error rates and gave us confidence that digital mapping of this range was relatively accurate (McNay et al. 2008). As a result subsequent model refinement in Year 3 was relatively minor but did include the following:

- We added a node to summarize the range preference behavior of caribou that appeared was related to the topographic “warming” influence of southwestern aspects (see Figure 2Ci).
- The influence of topographic areas bare of vegetation was added as a contribution to the identification of windblown areas where this was previously assumed only to exist based on convex slope shapes calculated from topographic curvature (see Figure 2Cii). The actual reason for this change was essentially to restrict terrestrial lichen sites to alpine (rather than forested) areas thereby allowing us to delete the need for an elevation input to this part of the network.
- The elevation node was still used to influence arboreal lichen abundance and was refit to distinguish HEWR from PLWR much as it had been used in the original model (see Figure 2Ciii).
- We allowed for the limited possibility of some windblown sites (and therefore the possibility of terrestrial lichens) on west and southeast aspects in concave depressions and also on east aspects in flat/upwardly convex areas (see Figure 2Civ).
- The potential for arboreal lichens was slightly decreased on west and southeast aspects (see Figure 2Cv).
- We took advantage of relatively new scale-free climate data for western Canada (Wang et al. 2006) and added a node to aid in the identification and exclusion of areas having potential for relatively deep snow packs that would: a) bury terrestrial forage resources or b) make locomotion to access forage difficult (see Figure 2Cvi).
- We removed one state from the Locomotion Cost node and brought in the full network that originally was used to predict this node value (see Figure 2Cvii).

METHODS

Model Application

We used ArcView 3.2 (Environmental Systems Research Institute, Redlands, California) and Microsoft Access 2000 (Microsoft Corp., Redmond, Washington) to construct and manage case files of environmental correlates taken from 1-ha cells in the study area. The environmental correlates that we used came primarily from the BC Forest Inventory Planning attribute database³ and the BC Terrain Resource Information Management program⁴. Our decision to map results at 1-ha resolution was based on our interests in focusing the management problem and did not imply accuracy of the input data. We used Netica in batch mode, and a modified version (Figure 2C) of the HEWR model, to

³ See Ministry of Sustainable Resource Management web site at <http://srmwww.gov.bc.ca/gis/Databases/>

⁴ See Ministry of Sustainable Resource Management web site at <http://srmwww.gov.bc.ca/bmgs/trim/>

process the case files before preparing the modeled results in Access as UWR maps for display in ArcView and analysis in SAS (SAS Inst. Inc., Cary, North Carolina). We displayed seasonal range values on maps as the expected value from the seasonal range preference node (i.e., the probability of a state multiplied by the state value, summed across all states) classified into three outcomes of avoided, equivocal, or preferred based on equidistant intervals of the potential outcome. The expected value ranged from -1 (avoided - low range value), through 0 (equivocal - medium), to +1 (preferred - high range value). Further, the Netica BBN model also displayed the standard deviation of the expected value, calculated under the plausible assumption of a Gaussian error distribution.

Final results were modified to restrict and generalize the extent of UWR (i.e., as distinguished from modeled HEWR) by using: 1) a map query of the output node expected values⁵ >-0.333 and 2) a 1-cell circular maximum⁶ filter followed by a 2-cell circular majority⁷ filter. These generalized results were converted to vector (shapefile) format and the resultant cleaned by removing all polygons <10ha. The remaining polygons had their boundaries smoothed and annulus holes filled using the hole_filler.avx extension for ArcView 3.2 to create a less rasterized final UWR map⁸.

We stratified modeled HEWR by previously constrained land types (i.e. parks, approved UWRs, etc.), forest district, and herd RPA. HEWR polygons were identified by a unique unit number, centroid coordinates (Universal Transverse Mercator; NAD 83), elevation range (m asl) and the enclosed amount of Timber Harvesting Land Base (THLB). THLB was calculated as the product of polygon size and the THLB inclusion factor. We attempted to mitigate UWR impact on THLB in the Mackenzie Forest District in the two following ways:

1. We arbitrarily rejected (from UWR classification) all modeled HEWR polygons <500ha. Small HEWR units tended to be closely associated (spatially) with larger units so we considered that elimination of smaller units would not necessarily compromise overall value of UWR within a given geographic area. The smaller units also tended to occur at lower elevation than the large units and were therefore more likely to contain higher proportions of THLB.
2. We also rejected (from UWR classification) HEWR polygons that were more than 20% THLB. The 20% threshold was chosen as it represented the inflection point in a plot of polygon specific composition of HEWR and THLB. Above the inflection point or threshold, polygons were much more likely to include THLB than below the 20% threshold.

These methods to mitigate impacts on THLB provided a result that was mostly acceptable except for two areas where, in our opinion, the continuity and integrity of UWR was compromised⁹. These two areas were known to be important to caribou (Unpubl. data; Wildlife Infometrics Inc.; Mackenzie, British Columbia). In these cases

⁵ Expected values are calculated as the probability of each node state multiplied by the state value and summed across all states. In the case of the seasonal forage usefulness node, state values ranged from 1 to -1 in equidistant intervals hence -0.333 was used to distinguish UWR from non-UWR.

⁶ Used to compute the maximum value in the neighbourhood and assign that value to the processing cell.

⁷ Used to compute the value that occurs most often in the neighbourhood and assign that value to the processing cell.

⁸ See ESRI Support web site at <http://arcscripits.esri.com/details.asp?dbid=13821>

⁹ Regions affected were Gillis Mountain and an area south of Chase Mountain -- HEWR units u-7-025-35, u-7-025-61, and u-7-025-70.

HEWR was therefore retained as UWR by restricting UWR to >1,400m in elevation while the more heavily timbered areas below 1,400 were left out of the final UWR.

Assessment of Model Application

Implications of model revisions were assessed by comparing the amount and extent of HEWR that was predicted to occur within the application area. Final HEWR model application and identification of proposed UWR units was assessed by measuring the number of previously observed caribou relocations enclosed by the resultant UWR. We also assessed the degree to which proposed UWR polygons could provide additional services to the overwinter survival of mountain goats by measuring the number of previously observed goat relocations enclosed by the resultant. Because these animals use other seasonal ranges and other habitats at lower elevations (e.g., mineral licks, low-elevation winter range) we restricted the relocation data to those observations made during winter that were > 1200 m asl. Observations of caribou and goats were collected from two survey types compiled from 1991 to 2007: 1) relocations of radio-collared individuals and 2) periodic surveys for estimating population status. We insured relocations of each radio-collared animal contributed equally to the analyses despite sample size differences among animals and seasons following methods described by Apps and McLellan (2006). We assumed ≥ 5 temporally independent relocations were required to adequately describe spatial use of seasonal range (Johnson 1980). Six seasons were arbitrarily defined as: winter (January 01 to April 14), spring migration (April 15 to May 31), calving (June 01 to July 31), summer-rut (August 01 to September 30), post-rut (October 01 to November 14), and fall migration (November 15 to December 31). We assumed relocations were temporally independent if separated by an 8-day interval because movements were observed to asymptote at or before that interval (Rankin and McNay 2007). We therefore set a relocation weight X to 1 if ≥ 8 days had elapsed since the previous relocation; otherwise X was the proportion of 8 days that had elapsed. We also ensured that the temporal representation of data for each animal was balanced seasonally by establishing a relocation weight Y as the proportion of the total relocations represented by the seasonal locations (i.e., (total relocations / number of seasons) / number of season-specific relocations) observed for each animal in each season and a relocation weight Z as the proportion of the year represented by the season (i.e., (period length / number of seasons) / season length). Sample schedules for each animal were then standardized by applying a total weight ($[X * Y * Z] / \sum [X * Y * Z]$) to each relocation. The weighting essentially meant that each radio-collared animal contributed one sample to the analysis with each observation of that animal without bias due to relocation frequency or season. As long as the animals were relocated alone, an observation weight was equivalent to the location weight. However, if collared animals were relocated in groups, the observation weight was equivalent to the location weight multiplied by the group total for the first collared animal and nil for the remaining collared animals within the same group.

UWR and Caribou Range Use Descriptions

We used ArcMap (Environmental Systems Research Institute, Redlands, California) and available spatial data to characterize candidate UWRs and caribou use of range by

habitat type (based on forest cover information)¹⁰ and age, ecosection and ecoprovince¹¹, biogeoclimatic zone and subzone¹², resource management zones¹³, wildlife management unit¹⁴, guide-outfitter and trapper license¹⁵, and First Nation traditional territory¹⁶. We defined habitats as follows:

- Alpine Tundra – BGC code BAFA or nonproductive forest cover code Alpine;
- Subalpine Parkland – BGC subzone modifier code p and nonproductive forest cover code Rock (as long as the latter was not in Alpine);
- Pine – forest cover species PI;
- Spruce/Fir – forest cover species BL, B, S, SB, SW, or SE;
- Deciduous – forest cover species AT, AC, or EP;
- Wetland – nonproductive forest cover code Lake, River, Swamp, or Meadow;
- Other – nonproductive forest cover code Non-productive Brush, Non-productive and species was blank, Non-productive Burn, Open Range, Urban, or Clearing; and
- Unknown – not classes as any of the above and nonproductive forest cover code and forest cover species both blank.

Age classes for conifer habitats were: early seral (≤ 40 years old), young (41 -80 years old), mature (80-140 years old), and old (> 140 years old).

RESULTS AND DISCUSSION

Model Revisions and Application

Application of the revised HEWR model (Figure 2C) resulted in a marked change from the previous model (Figure 2B). We observed an increase in the amount of HEWR over the original model from 1,034,784 ha to 1,119,670 ha representing an 8% increase in modeled habitat. The increase in HEWR was however, concentrated into larger units in a more restricted geographic area (Figure 3A). This spatial distribution of HEWR polygons is expected to prove more amenable to management than the scattered smaller polygons of previous modeling efforts.

The spatial pattern of the revised results was largely due to two changes made to the model. First, the increased effect of aspect on HEWR eliminated virtually all northeast aspects ($1^\circ - 135^\circ$). Some small areas in this aspect range do occur in the final result as a product of the shapefile generalization. The second cause of the HEWR pattern change was the introduction of the spatial climate data which made it difficult for any location with winter precipitation over 210 mm to be classified as HEWR. This had the greatest impact on the Chase, Wolverine, and Scott RPAs. These areas are subject to opposing influences from moist, warm, Pacific and cold, dry, Arctic air masses. A rain shadow effect occurs, with western portions of the application area receiving the highest

¹⁰ <http://srmwww.gov.bc.ca/gis/Databases/>

¹¹ <http://www.env.gov.bc.ca/ecology/ecoregions/index.html> accessed April 10, 2009.

¹² <http://www.for.gov.bc.ca/hre/hecweb/index.html> accessed April 10, 2009.

¹³ <http://aardvark.gov.bc.ca/apps/metastar/metadataDetail.do?recordUID=33538&recordSet=ISO19115>

¹⁴ http://www.gp.gov.bc.ca/statreg/reg/W/Wildlife/64_96.htm

¹⁵ Pers comm.; Glen Watts, British Columbia Ministry of Environment, Prince George, BC

¹⁶ Pers comm.; Glen Watts, British Columbia Ministry of Environment, Prince George, BC

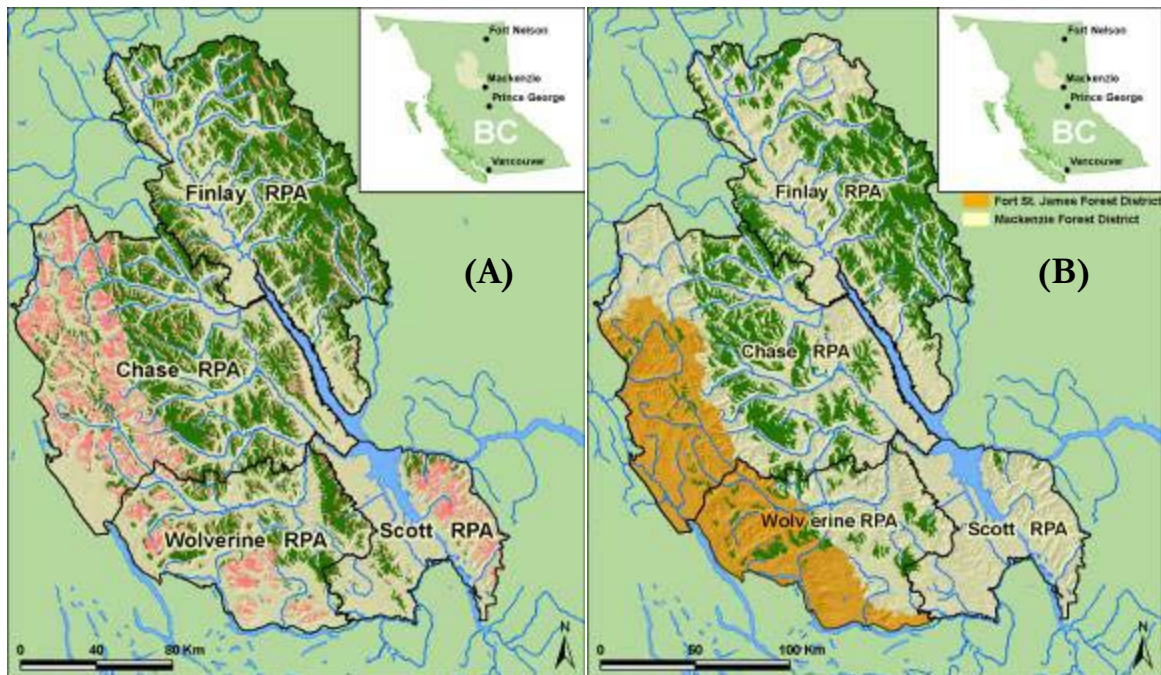


Figure 3. Extent comparison between the original (pink) and modified (green) modeled results for High Elevation Winter Range (HEWR) in the Scott, Wolverine, Chase, and Finlay caribou Recovery Plan Areas (RPA) in north-central British Columbia (A) and candidate Ungulate Winter Range (UWR) area (green) after removal of HEWR polygons in parks, other UWR, or composed of >20% timber harvesting landbase.

annual precipitation, declining in an easterly direction. The Williston Reservoir moderates winter severity and results in reduced snow accumulations on windswept alpine ridges and southwest-facing slopes. As a result, in the Chase and Wolverine RPAs, a southeast to northwest band of higher precipitation values running along the Swannell and Osilinka mountain ranges limited the amount of HEWR UWR in the western halves of the RPAs. In the Scott RPA a similar effect was seen over the Misinchinka range.

In the Fort St. James Forest District, 10,079 ha (55 polygons) of the total 54,400 ha (123 polygons) of HEWR was located in already constrained land types and a further 4,475 ha in 44 polygons occurred in polygons <500 ha (Table 2, Appendix A). The remaining 39,847 ha of HEWR was located within 24 polygons containing approximately 15,978 ha THLB (i.e., 40%). In general, the greatest THLB impact (59,817 ha) occurred within the Mackenzie Forest District (Table 2) within the Wolverine herd RPA (Appendix A). HEWR for the 4 herds was predominantly located in the Mackenzie Forest District where 119,783 ha of the total 1,064,899 ha (161 of the total 548 individual polygons) was previously constrained. A further 3,578 ha of HEWR existed in small polygons and 104,296 ha was rejected due to higher THLB content. Although the remaining 837,241 ha of candidate UWR area had the highest THLB impact, this impact represented only 7% of the selected area.

Table 2. A summary of Ungulate Winter Range area (UWR) predicted to be high quality range for woodland caribou, and the amount of Timber Harvesting Land Base (THLB) it contained, within two Forest Districts in north-central British Columbia. UWR was stratified into rejected and selected strata for the purposes of proposing legal status.

Forest District	UWR Type	UWR (ha)	THLB (ha)	Percent THLB
Fort St. James	Park or UWR	10079	818	8%
	Selected<sub>lt500ha	4475	1602	36%
	Rejected Total	14554	2421	17%
	Selected	39847	15978	40%
Fort St. James Total		54400	18399	34%
Mackenzie	Park or UWR	119783	139	0%
	Selected<sub>lt500ha	3578	424	12%
	Rejected	104296	44700	43%
	Rejected Total	227658	45264	20%
	Selected	837241	59817	7%
Mackenzie Total		1064899	105081	10%
Grand Total		1119299	123480	11%

Candidate UWRs

Twenty-four HEWR polygons were considered to be candidate UWR in the Fort St. James Forest District; a total of 39,847 ha. By comparison, 254 of the unconstrained polygons in the Mackenzie Forest District were rejected as UWR due small size, high proportion of THLB content, or both. The rejected polygons accounted for 107,598 ha HEWR which encompassed 45,124 ha THLB. The remaining 133 unconstrained polygons accounted for 837,241 ha HEWR were considered to be candidate UWR; most of which (473,858 ha) was located in the Finlay herd RPA probably due to the relatively more rugged mountain terrain in that area (Figure 3B).

The average lower elevation for UWR candidates was normally distributed around 1,200 m asl in both the Fort St. James ($\mu = 1,200$, $se = 6$, $n = 24$) and Mackenzie ($\mu = 1,204$, $se = 7$, $n = 125$) forest districts (Figure 4). About 70% of the candidate UWR area was located in three biophysical units, all within the Mackenzie Forest district: 147,828 ha in the Northern Omineca Mountains, 157,261 ha in the Southern Omineca Mountains, and 321,824 of Western Muskwa Ranges ecosections of the Northern Boreal Mountains ecoregion (Table 3). By comparison, 80% of the candidate areas were located in two biogeoclimatic zones: 31% (268,034 ha) in alpine areas (BAFA) and 50% (435,723 ha) in the Englemann Spruce Subalpine Fir zone. Candidate UWRs were widely dispersed across trap lines (Table 4), although 39% was located in three traplines: 0737T006, 0740T002, and 0741T002. Four guide outfitter areas enclosed 62% of the proposed UWR: 700407, 700633, 701139, and 701140. Candidate UWRs were also widely dispersed among RMZs, the two highest represented were Ingenika and the Upper Akie at 10% (85-92,000 ha) of the UWR area (Table 5). Four WMUs enclose most (87%) of the candidate UWRs: 7-37 (16% - 144,499 ha), 7-38 (26% - 228,149 ha), 7-39 (13% - 112,486 ha), and 7-41 (31% - 274,878 ha).

Photographs that typify habitat within candidate UWRs are provided in (Figure 5). Alpine Tundra and Subalpine Parkland habitats made up 23% and 29% of the Fort St. James

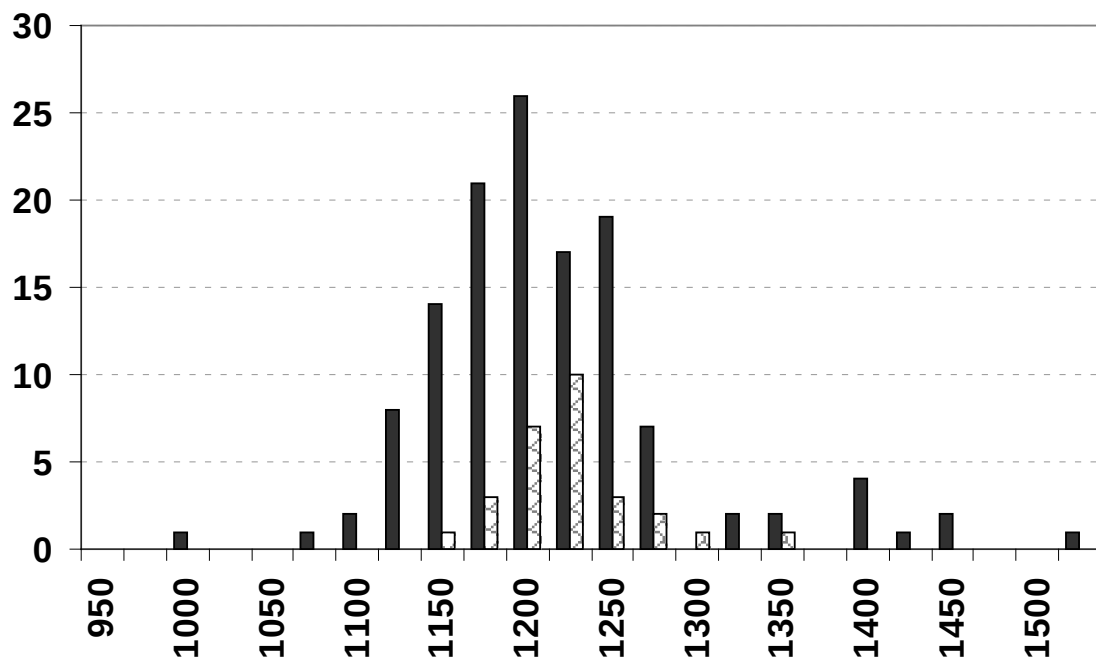


Figure 4. Frequency of the minimum elevation observed for a proposed set of Ungulate Winter Range units in the Fort St. James ($n = 36$, light bars) and Mackenzie ($n = 130$, dark bars) Forest Districts in north-central British Columbia.

and Mackenzie Forest Districts, respectively (Table 6). Other significant habitats in the study area were mature (12%) and old (34%) Spruce/Fir types in the Fort St. James area and mature (13%) and old (21%) Spruce/Fir and mature Pine (12%) in the Mackenzie area.

Animal Relocations

A total of 14,937 relocations that met eligible criteria were extracted from the accumulated data on relocations of radio-collared caribou ($n = 14,179$) and mountain goats ($n = 758$) for a total weighted location set of 15,203 (Table 7). Only 10% and 9% of caribou and goat (respectively) weighted relocations observed $>1,300$ m asl in winter were found in habitats other than alpine tundra and subalpine parkland. Most (63%) use of high-elevation habitat by caribou was within candidate UWR (41%) or HEWR that was already within protected areas (22%). Proportionally, mountain goats made even higher use of the candidate areas where they were relocated 69% of the time.

MANAGEMENT IMPLICATIONS

Our work has incorporated the latest field knowledge to further refining understanding and mapping of HEWR in north-central BC. We successfully focused the identification of UWR on a total amount of HEWR that was 21% less area than originally forecasted

Table 3. Broad ecological characteristics of candidate high-elevation Ungulate Winter Range area located in caribou recovery plan areas (RPA) of the Fort St. James and Mackenzie Forest Districts (FD), north-central British Columbia.

FD	RPA	Eco-Region	Eco-Section	Biogeoclimatic Zone and Variant									Total	
				BAFAun	BWBSdk	ESSFmv	ESSFmvp	ESSFwc	ESSFwcp	ESSFwk	SBSmk	SWBmk		SWBmks
Fort St. James	Chase	NBI	NOM									2103	52	2155
			ESM			2614	507							3121
		SBI	MP			698								698
			SOM			1421	321							1742
	Wolverine	SBI	MP	232		23821	4660							28713
			SOM			2974	444							3418
Mackenzie	Chase	NBI	NOM	53539	35	23186	21146					28556	21366	147828
			SOM	263		87	30							380
			NOM			1	9							10
		SBI	PT			1								1
			SOM	24632		68220	52143			7	5971	6286		157261
	Finlay		CR	4927		1524	1025					473	833	8782
			EMR	38921		1568	987					10644	5516	57636
		NBI	MR	96		24	4		27			2		153
			NOM	21344	2	9050	2674					6846	4720	44637
			WMR	112483	120	114298	40738	459	779			40614	12333	321824
			EMR											0
		SBI	MR	8415		6130	2357	11081	9868	864				38715
			WMR	83		137	644	726	432	88				2110
			MP			2282	814							3096
	Scott	SBI	MR	1594				2073	288	166				4120
			SOM	23		417	115							554
	Wolverine	SBI	MP	185		13740	6536							20462
			SOM	1296		18429	9945							29670
		Total		268034	157	290622	145101	14338	11394	1118	7	95209	51107	877086

1 – ecosections are: Sub-boreal Interior (SBI) and Northern-Boreal Interior.

2 – ecoregions are: Southern Omineca Mountains (SOM), Northern Omineca Mountains (NOM), Manson Plateau (MP), Misinchinka Ranges (MR), Western Muskwa Ranges (WMR), Eastern Muskwa Ranges (EMR), Cassier Ranges (CR), Eastern Skeena Mountains (ESM), Parsnip Trench (PR)

Table 4. The amount (ha) of candidate high-elevation Ungulate Winter Range within guide and trapper license areas located in caribou recovery plan areas (RPA) of the Fort St. James and Mackenzie Forest Districts (FD), north-central British Columbia.

FD	RPA	Trap License	Guide License																			Total		
			NA	600447	601003	601005	700203	700361	700407	700633	701110	701125	701131	701139	701140	701153	701154	701222	701226	701231	701232		701233	701240
Fort St. James	Chase	TR0727T006			2											1335								1337
		TR0727T008			100	108										42								251
		TR0727T013			275	9										28								312
		TR0738T006														2665								2665
		TR0738T007			963																			963
		TR0738T012			865											130								996
		TR0739T006			1192																			1192
	Wolverine	TR0727T006			1495											4167								5662
		TR0727T014					1707								3659									5366
		TR0728T014					564				2145				109									2818
		TR0728T015					5916				158													6074
		TR0738T001					15		17															31
		TR0738T002					2825		1123															3948
		TR0738T013			593		631				1263				5745									8232
Mackenzie	Chase	TR0738T001						10989																10989
		TR0738T004						968																968
		TR0738T005						18529																18529
		TR0738T006						54217						3378										57595
		TR0738T007						5908						27738										33645
		TR0738T008						5451						9339										14790
		TR0738T009						8672						1723										10395
		TR0738T010												5930										5930
		TR0739T002												20622	22582									43205
		TR0739T003												1858	17173									19031
		TR0739T004												4991	226									5218
		TR0739T005													2213									2213
		TR0739T006			515																			515
		TR0739T008												1226	1656									2882
		TR0740T001												655										655
		TR0740T002												75621	3300									78921
	Finlay	TR0737T003												893										893
		TR0737T004												1710					3					1713
		TR0737T005												9081				12659						21740
		TR0737T006								26298				880				26441				30626		84245
		TR0737T007												19950				642						20592
		TR0739T008													124	305								429
		TR0740T001													1344									1344
		TR0740T002							357					53488	19179	4419		82						77525
		TR0740T003														8864								8864
		TR0740T004														7041								7041
		TR0740T006										5519												5519
		TR0741T002						155		87572					12607				63			178		100575

FD	RPA	Trap License	Guide License																				Total	
			NA	600447	601003	601005	700203	700361	700407	700633	701110	701125	701131	701139	701140	701153	701154	701222	701226	701231	701232	701233		701240
Scott		TR0741T003									429				7842									8271
		TR0741T004								79	817				23060					478				24434
		TR0741T005								543	203				314					15340		35481		51882
		TR0741T006										1013								3556				4569
		TR0741T007											16690							17782	18932			53403
		TR0742T001									0													0
		TR0742T002							C		0													0
		TR0742T003									0											0		0
		TR0742T004																			0		380	380
		TR0743T005									0												C	0
		TR0751T001																						358
		TR0751T002																			0	83		83
		TR0728T006						2326							5									2331
		TR0728T007						734																734
		TR0728T008						26																26
		TR0728T009						1						2										4
		TR0731T003																		467				467
		TR0737T001	3214																	440				3653
		TR0738T005													478									478
	TR0738T009													76									76	
Wolverine		TR0728T006					168							22										190
		TR0728T007					2510								9507									12016
		TR0728T008					6781																	6781
		TR0728T009					3714							564										4277
		TR0728T015					4515																	4515
		TR0729T005												3462										3462
		TR0738T001					1785		11010															12795
		TR0738T002					2		60															62
		TR0738T003					403																	403
		TR0738T004							5443															5443
	TR0738T005							178					10										188	
Total			3214	3535	2465	118	34622	155122564	115279	24241	3566	14126129825	173727	67780	17881	906	39827	37219	19373	36039	30626	877087		

Table 5. The amount (ha) of candidate high-elevation Ungulate Winter Range within Wildlife Management Units (WMU) and Resource Management Zones (RMZ) located in caribou recovery plan areas (RPA) of the Fort St. James and Mackenzie Forest Districts (FD), north-central British Columbia.

FD	RPA	RMZ	WMU														Total
			6-18	7-27	7-28	7-29	7-30	7-31	7-37	7-38	7-39	7-40	7-41	7-42	7-51	7-57	
Fort St. James	Chase	Driftwood		185													185
		Hogem								0							0
		Upper Omineca	40	310						4197							4547
		Upper Sustut	2981							3							2984
	Wolverine	Duckling Creek								0							0
		Germansen Mountain			0												0
		Hogem		2088	9321					20716							32125
		Twenty Mile Creek			0					5							6
Mackenzie	Chase	Chase								47							47
		Chunamon								27294							27294
		Duckling Creek								0							0
		Hogem								51							51
		Ingenika								17134	67790	1158					86081
		Mesilinka								67426	184						67610
		Osilinka								60024							60024
		Pelly									41339	19860					61199
		Thutade									3174						3174
		Upper Nina - Discovery								0							0
	Finlay	Akie River											25036				25036
		Buffalohead										41275	21412				62687
		Collins - Davis							62800				1818				64618
		Fox										11914	65549		182		77646
		Kwadacha Addition											404				404
		Kwadacha Park											265	8			273
		Lower Akie											32606				32606
		McCusker							58818				675		589		60082
		Ospika Cones							236								236
		Pesika							166				36003				36169
		Upper Akie							290				90830	505		7	91632
		Upper Ospika							22188				280				22469

FD	RPA	RMZ	WMU													Total	
			6-18	7-27	7-28	7-29	7-30	7-31	7-37	7-38	7-39	7-40	7-41	7-42	7-51		7-57
Scott	Blackwater					54				501							554
	Clearwater							488									488
	Gaffney				3096												3096
	Selwyn					2086	1546										3632
Wolverine	Duckling Creek									8221							8221
	Gaffney				2593												2593
	Germansen Mountain									1161							1161
	Hogem				110					122							232
	Jackfish				362	6				3772							4140
	Klawli				3389					23							3413
	Manson River - Eklund				5177	3467											8644
	Omineca				3	6				349							358
	Osilinka									0							0
	South Germansen - Manson				4159					3564							7723
	Twenty Mile Creek				111					5246							5357
	Upper Nina - Discovery									8291							8291
Total			3020	2582	28322	3532	2086	2033	144499	228149	112486	74207	274878	513	182	596	877087

Table 6. Availability (ha) of habitat within Ungulate Winter Range Types in the Mackenzie and Fort St. James Forest Districts, north-central British Columbia. See text for a description of habitat types.

Forest District	Ungulate Winter Range Type	Habitat Type												Total
		Alpine Tundra	Supalpine Parkland	Deciduous Early Seral	Spruce/Fir Young	Spruce/Fir Mature	Spruce/Fir Old	Pine Young	Pine Mature	Pine Old	Wetlands	Other	Unknown	
Fort St. James	Selected UWR Candidate	1211	5913	591	2590	4777	19985	459	2018	527	100	1620	39	39830
	Rejected UWR Candidate													
	Parks	339	523	45	308	668	1985	39	139	7	1	13		4067
	Non-UWR	102470	90260	26703	28312	101263	287175	42876	90262	31330	18766	22452	13636	855505
	Total	104020	96696	27339	31210	106708	309145	43374	92419	31864	18867	24085	13675	899402
Mackenzie	Selected UWR Candidate	367907	151029	12556	10470	73824	168442	3595	23844	10655	1417	8955	5216	837910
	Rejected UWR Candidate													
	Parks	4618	10552	4973	2089	24140	35569	2825	13099	3888	691	1530	424	104398
	Non-UWR	69492	14710	900	707	4301	19409	1018	6232	693	247	1523	710	119942
	Total	325291	128855	334483	52032	373685	559917	127393	393634	89486	138488	43100	62138	2628502
	Total	767308	305146	352912	65298	475950	783337	134831	436809	104722	140843	55108	68488	3690752
Total		871328	401842	380251	96508	582658	1092482	178205	529228	136586	159710	79193	82163	4590154

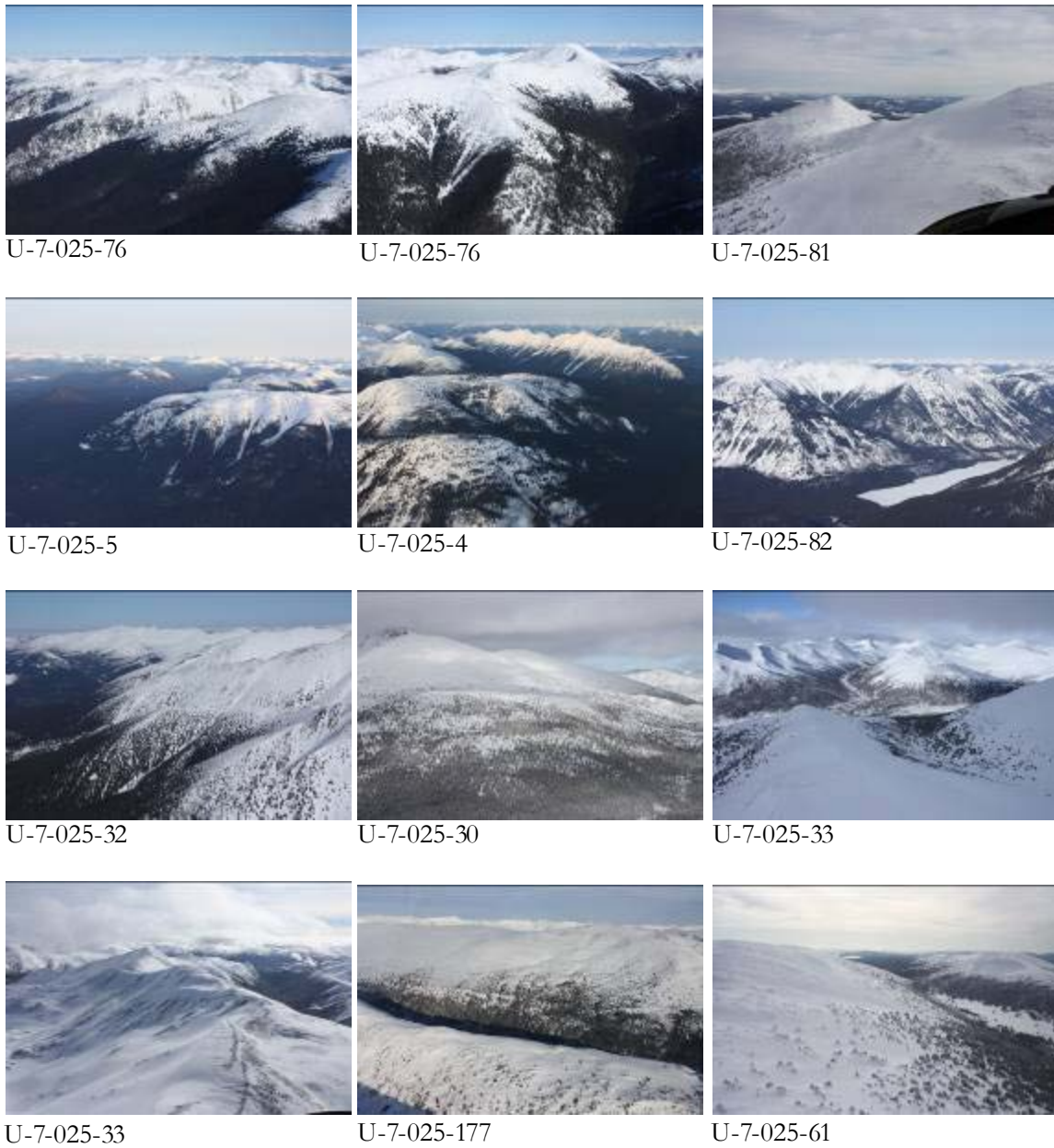


Figure 5. Pictures of candidate Ungulate Winter Ranges located in caribou recovery plan areas of the Fort St. James and Mackenzie Forest Districts, north-central British Columbia.

Table 7. Caribou and mountain goat use (weighted observations) of habitat within Ungulate Winter Range Types in the Mackenzie and Fort St. James Forest Districts, north-central British Columbia. See text for a description of weighted observations and habitat types.

Species or Habitat	Forest District	Ungulate Winter Range Type	Habitat Type												Total
			Alpine Tundra	Supalpine Parkland	Deciduous Early Seral	Spruce/Fir Young	Spruce/Fir Mature	Spruce/Fir Old	Pine Young	Pine Mature	Pine Old	Wetlands	Other	Unknown	
Caribou	Fort St. James	Selected UWR Candidate	5	16						1					22
		Rejected UWR Candidate													
		Parks													
		Non-UWR	109	102			10	35					7		266
		Total	114	119			10	36		2			7		289
	Mackenzie	Selected UWR Candidate	2990	2622			23	163		51	44		2		5897
		Rejected UWR Candidate	4	1869			5	11		26	8				1924
		Parks	2068	773			5	129		135					3111
		Non-UWR	1342	956	5		45	320		393	24	7	4		3096
		Total	6404	6221	6		77	622		606	76	7	8		14028
	Total		6518	6340	6		88	658		608	77	7	15		14317
Mountain Goat	Mackenzie	Selected UWR Candidate	419	161	1		7	21							609
		Rejected UWR Candidate					2	2		2					7
		Parks	4	1			3			2					10
		Non-UWR	151	66		3	18	5	12					6	261
	Total		573	229	1	3	29	28	12	4				6	886

while still capturing most of the use of high-elevation habitat by radio-collared caribou. The candidate areas were also found to function as goat habitat providing more general value as area managed for montane ungulates. With the uncertain effects of widespread tree mortality on low-elevation winter range caused by the recent epidemic of Mountain Pine Beetles, it seems imperative that the conservation of high-elevation winter range values be undertaken. Animals may depend on these higher elevation ranges until restoration of low-elevation winter range has occurred. Also, high-elevation winter range is essentially a focal element in the life history of woodland caribou; throughout the province, low-elevation winter range values are much reduced if these areas do not occur within migration distance of high-valued high-elevation winter range.

Furthermore, once the MPB-killed timber of low-elevations has been harvested, salvaged, or advanced beyond its useful fiber quality, more harvest pressure will be placed on higher-elevation forests – it'll become important to have clear direction on how to best manage the sustainability of these forests for use by caribou as well as use by the forest industry. We feel the candidate UWR area we identified will help in this pursuit.

General Wildlife Measures

The following general wildlife measures are consistent with the general direction for land use planning (BC Govt 2000) and caribou recovery planning (McNay et al. 2008) and were constructed to apply to herd-based groups of UWR polygons within the two forest districts of Mackenzie and Fort St. James.

Definitions

Operable area - represents the portion of provincial forests suitable for forestry activities and is the area considered in the calculation of available harvest volume in the timber supply review. It is commonly referred to as the timber harvesting land base (THLB) (Pedersen 2004).

Inoperable area - the portion of the land base that is not suitable for forest harvesting and is not considered part of the THLB.

Elevated Risk of Predation - areas where the risk of predation is increased due to the presence of moose and the corresponding draw of wolves providing predation pressure on moose populations and on caribou where ranges overlap. Elevated predation risk (for caribou) is present when a site is < 5 km from good moose range, and/or < 100 m from linear corridors such as roads or industrial trails. Good moose range is biogeoclimatic units (site series/plant association) identified in Table 8 or an area of a productive forest site series (i.e. site series numbers ≥ 01 for all biogeoclimatic units), is < 40 years old, and is < 1,200 m in elevation.

Herd-based groups – are UWR polygons in the Mackenzie forest district portion of the Chase (MC), Finlay (MF), Scott (MS), and Wolverine (MW) caribou herds and in the Fort St. James forest district portion of the Chase (FC) and Wolverine (FW) caribou herds.

Table 8. High value ecological units for moose habitat within the Mackenzie and Fort St. James Forests districts. Ratings were assigned by a panel of biologists (McNay et al. 2003).

Zone	Subzone/ Variant	Site Series		
		Number	Code	Name
BWBS	dk1	8 & 7 & 0	CC	Sw-Currant-Horsetail (SC); Sb-Lingonberry-Coltsfoot (BC); Willow Birch Floodplain (Wf)
BWBS	dk1	0	WF	Willow-Birch Floodplain
ESSF	mv3	0	WB	Willow-Birch-Sedge Wetland
ESSF	mv3	0	WF	Willow-Birch Floodplain
SBS	mk1	9a	CC	Sx-Horsetail: Fluvial Phase
SBS	mk1	9	SH	Sxw-Horsetail
SBS	mk1	0	WB	Willow-Bluejoint Floodplain
SBS	mk2	6	SH	Sx-Horsetail
SBS	wk2	6	SH	Sx-Horsetail
SBS	wk2	0	WS	Willow –Sedge Fen

Measures

Ensure that the combined UWR area within each of the herd-based polygon groupings does not exceed parameters listed in Table 9.

Fire management and the associated plans must be sensitive to the targets set for each herd area. All attempts must be made to contain wildfire if the outcomes of fire will exceed the parameters listed in Table 9.

Pest management and the associated plans must be sensitive to the targets set for each herd area. All attempts to control pests must be done in a manner so the outcomes do not exceed parameters listed in Table 9.

Planning and implementation of natural resource management activities (such as ecosystem restoration projects or range improvements for other ungulates or domestic livestock) must be sensitive to the targets set for each herd area. Activities must be done in a manner so the outcomes do not exceed the parameters listed in Table 9.

No forestry activities in the following UWR polygons: FC, FW, and MS.

Table 9. Parameters used to guide General Wildlife Measures (GWM) associated with candidate Ungulate Winter Ranges (Herd-based polygons) in the Chase, Finlay, Wolverine, and Scott caribou herd areas in the Mackenzie Forest District (MC, MF, MW, and MS respectively) and the Chase and Wolverine caribou herd areas in the Fort St. James Forest District (FC and FW respectively).

Herd-based Polygons	Provincial Forest designation and GWM measure		
	Inoperable	Operable	
	Elevated risk of predation	Elevated risk of predation	Forest < 140 years
MC, MF, FC, and FW	83%	83%	83%
MW	88%	88%	88%
MS	??	??	??

LITERATURE CITED

- Apps, C. D., and B. N. McLellan. 2006. Factors influencing the dispersion and fragmentation of endangered mountain caribou populations. *Biological Conservation* 130:84-97.
- BC Govt (British Columbia Government). 2000. Mackenzie land and resource management plan. Unpubl. Rept., BC Min of Sustainable Resource Management, Victoria, British Columbia, Canada. 379pp.
- Chesson, J. 1983. The estimation and analysis of preference and its relationship to foraging models. *Ecology* 64:1297-1304.
- DeLong, C. 2002. Natural disturbance units of the Prince George Forest Region: Guidance for sustainable forest management. Internal Rep., British Columbia Min. of Forests, Prince George, B.C. 38pp.
- Doucette, A. M. and R. S. McNay. 2003. Resource Selection Analysis of Caribou's Preference for Winter Range in the Chase Herd Study Area. Wildlife Infometrics Inc. Report No. 063. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada. 17 pp. plus appendices.
- Giguere L. and R. S. McNay. 2007. Abundance and distribution of woodland caribou in the Chase, Wolverine, and Scott recovery plan areas. Wildlife Infometrics Inc. Report No. 225. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada.
- Heard, D. C. and K. L. Vagt. 1998. Caribou in British Columbia: a 1996 status report. *Rangifer*, Special Issue No. 10:117-123.
- Johnson, C.J., Parker, K.L., and Heard, D.C. 2000. Feeding site selection by woodland caribou in northcentral British Columbia. *Rangifer* Special Issue No. 12: 159-172.

- McNay, R. S. and A. M. Doucette. 2003. Assessment of a Bayesian belief network describing caribou's preference for winter range in north-central British Columbia. Wildlife Infometrics Inc. Report No. 058. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada. 22pp.
- McNay, R. S. and R. Sulyma. 2003. Aerial Reconnaissance of Modeled Terrestrial Lichen Habitat Units in the Scott, Wolverine, and Chase Caribou Herds of North-Central British Columbia. Wildlife Infometrics Inc. Report No. 094. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada. 19pp.
- McNay, R.S., A. Carson, and R. Sulyma. 2008. Refinement and verification of a model to predict high-elevation winter range for woodland caribou in north-central British Columbia. Wildlife Infometrics Inc. Report No. 265. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada.
- McNay, R.S., Zimmerman, K.L., and Ellis, R. 2003. Caribou habitat assessment and supply estimator (CHASE): Using modeling and adaptive management to assist implementation of the Mackenzie LRMP in strategic and operational forestry planning. Rept. No. 55. Wildlife Infometrics Inc. Mackenzie, BC. 115pp.
- McNay, S., D. Heard, R. Sulyma, and R. Ellis. 2008. A recovery action plan for northern caribou herds in north-central British Columbia. FORREX Forest Research Extension Partnership, Kamloops, British Columbia. FORREX Series 22.
- McNay, R.S., B.G. Marcot, V. Brumovsky, and R. Ellis. 2006. A Bayesian approach to evaluating habitat suitability for woodland caribou in north-central British Columbia. Can. J. For. Res. 36:3117-3133.
- Meidinger, D. and J. Pojar. 1991. Ecosystems of British Columbia. Special Report Series 6. Research Branch, B.C. Ministry Forest, Victoria, B.C. 280pp plus appendices.
- Pedersen, L. 2004. Prince George Timber Supply Area: rationale for allowable annual cut (AAC) determination. BC Ministry of Forests. Victoria, BC. 42 pp plus appendices.
- Province of BC. 2003. Memorandum of understanding on establishment of ungulate winter ranges and related objectives. Province of BC. Victoria, BC. Available from <http://www.env.gov.bc.ca/wld/frpa/uwr/docs.html>.
- Rankin, M.L. and R.S. McNay. 2007. An Assessment of Modeled High-Elevation Winter Range in Woodland Caribou Herd Areas of North-Central British Columbia. Wildlife Infometrics Inc. Report No.224. Wildlife Infometrics Inc., Mackenzie British Columbia, Canada. 13pp.
- Schmidt K. and R. S. McNay. 2002. Wolverine, Chase, Finlay and Scott Caribou Herds Ungulate Winter Range (UWR) Final Report. Wildlife Infometrics Inc. Report No. 035. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada. 28 pp. plus appendices.

- Wang, T., A. Hamann, D.L. Spittlehouse, and S.N. Aitken. 2006. Development of scale-free climate data for western Canada for use in resource management. *International Journal of Climatology* 26:383-387.
- Wood, M. D. and E. L. Terry. 1999. Seasonal Movement and Habitat Selection by Woodland Caribou in the Omineca Mountains, North-Central British Columbia Phase 1: The Chase And Wolverine Herds (1991-1994). Peace/Williston Fish and Wildlife Compensation Program Report No. 201. 41pp. plus appendices.
- Zimmerman, K. L., R. S. McNay, L. Giguere, S. Walshe, G. A. Keddie, L. Wilson, K. Schmidt, P. E. Hengeveld, A. M. Doucette. 2002. Aerial-based census results for caribou and moose in the mackenzie timber supply area march 2002. Wildlife Infometrics Inc. Report No. 044. Wildlife Infometrics Inc., Mackenzie, British Columbia, Canada.

APPENDIX A. DETAILED LIST OF UNGULATE WINTER RANGE CANDIDATE AREAS LOCATED WITHIN RECOVERY PLANNING AREAS FOR 4 HERDS OF WOODLAND CARIBOU IN THE FORT. ST. JAMES AND MACKENZIE FOREST DISTRICTS IN NORTH-CENTRAL BRITISH COLUMBIA

Ungulate Winter Range (UWR) polygons were stratified by forest district, their type (constrained, selected, rejected, or GoatUWR), caribou herd recovery planning area (RPA), individual UWR polygon unit number, herd census unit number from McNay and Giguere (2008). UWRs were characterized by Universal Transverse Mercator (UTM) easting and northing, general elevation range (m asl), size (ha), and amount of Timber Harvesting Land Base (THLB).

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
Fort St. James	Selected_lt50	Chase	79	N/A (cha)	298677	6206477	1253 - 2021	485				334			
			80	C13	289061	6277466	1282 - 2148	185				104			
				C8	289061	6277466	1282 - 2148	2				2			
			85	C13	294219	6278682	1275 - 2024	21							
			88	C14	263215	6276970	1207 - 2032	152				7			
			89	C14	263215	6276970	1207 - 2032	8							
			90	W2a	342800	6197471	1340 - 2003	1				0			
			96	N/A (cha)	301317	6199280	1214 - 1608	72				64			
			97	N/A (cha)	298677	6206477	1253 - 2021	0							
			98	C6	312104	6222673	1216 - 1974	5							
			99	N/A (cha)	298677	6206477	1253 - 2021	20				9			
			100	C16	278419	6237376	1332 - 1751	3				2			
			101	C13	294219	6278682	1275 - 2024	1							
			102	C14	265902	6266828	1156 - 1968	47							
			103	C14	272010	6275693	1180 - 1947	0							
			104	C14	272010	6275693	1180 - 1947	0							
			105	C14	268257	6269602	1168 - 1850	9							
			106	C14	272010	6275693	1180 - 1947	2				0			
			107	C14	272010	6275693	1180 - 1947	5							
			108	C13	289061	6277466	1282 - 2148	260				204			
				C15	289061	6277466	1282 - 2148	156				48			
			109	C14	272010	6275693	1180 - 1947	122				15			
			110	C14	272010	6275693	1180 - 1947	117				0			
			111	C14	268257	6269602	1168 - 1850	216				57			
			112	C14	265902	6266828	1156 - 1968	138				23			
			113	C16	291772	6254563	1203 - 2100	264				37			
			114	C16	296326	6250165	1223 - 2077	375				156			
			115	C16	296088	6246107	1247 - 2067	451				162			
			116	C16	296088	6246107	1247 - 2067	154				59			
			117	C16	278419	6237376	1332 - 1751	1							
			118	C16	278419	6237376	1332 - 1751	11							
			119	C6	312104	6222673	1216 - 1974	9							
			120	N/A (cha)	298677	6206477	1253 - 2021	0							
			121	N/A (cha)	298677	6206477	1253 - 2021	24	3317				1286		
		Wolverine	81	W2b	354474	6170031	1146 - 2001	2							
			82	W2a	342800	6197471	1340 - 2003	0							
			83	W2a	342800	6197471	1340 - 2003	0							
			84	W2a	342800	6197471	1340 - 2003	0							
			86	W2a	342800	6197471	1340 - 2003	115				2			
			87	W2a	344005	6190709	1219 - 1906	369				148			
			90	W2a	342800	6197471	1340 - 2003	298				40			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
	Selected	Chase	91	W2a	338995	6193343	1194 - 1929	7							
			92	W2a	338995	6193343	1194 - 1929	82				31			
			93	W2a	338995	6193343	1194 - 1929	46				24			
			94	W2a	338995	6193343	1194 - 1929	2							
			95	W2a	342800	6197471	1340 - 2003	78				37			
			122	W2b	354474	6170031	1146 - 2001	158	1157	4475		34	317	1602	
			1	C16	287804	6234565	1194 - 1637	539				203			
			2	C16	297841	6238252	1197 - 1802	791				236			
			8	N/A (cha)	307503	6195848	1215 - 1796	531				139			
				N/A (wol)	307503	6195848	1215 - 1796	0				0			
			11	C13	294219	6278682	1275 - 2024	1901				789			
				C8	294219	6278682	1275 - 2024	254							
			19	N/A (cha)	301317	6199280	1214 - 1608	1369				554			
			20	C16	291028	6247985	1184 - 1760	996				248			
			21	C16	301015	6239745	1177 - 1822	802				80			
				C7	301015	6239745	1177 - 1822	10				1			
			24	C6	296346	6228319	1161 - 1664	523	7715			138	2387		
	Wolverine		3	W3a	367977	6163342	1207 - 1876	2793				1447			
			4	W2b	341701	6173180	1214 - 1789	551				182			
			5	W2b	339508	6175708	1210 - 1705	802				429			
			6	W2b	354474	6170031	1146 - 2001	524				210			
			7	W2b	354474	6170031	1146 - 2001	8077				2792			
				W3a	354474	6170031	1146 - 2001	3				3			
			8	N/A (cha)	307503	6195848	1215 - 1796	0				0			
				N/A (wol)	307503	6195848	1215 - 1796	700				274			
			9	W2a	344005	6190709	1219 - 1906	1140				330			
			10	W5	317743	6187327	1182 - 1871	1109				315			
			12	W3a	355921	6154497	1178 - 1476	515				384			
			13	W2b	323665	6156225	1198 - 1533	929				588			
			14	W2b	317888	6160204	1213 - 1876	819				285			
			15	W2b	315305	6167696	1231 - 1644	551				434			
			16	W5	309946	6177262	1226 - 1593	520				258			
			17	W5	320068	6179268	1185 - 1658	1393				333			
			18	W5	332706	6184795	1211 - 1475	957				749			
			22	W5	320658	6194202	1185 - 1749	855				252			
			23	W2b	338392	6161631	1175 - 1886	9893	32131	39847		4326	13591	15978	
	Park or UWR	Chase	26	C16	297841	6238252	1197 - 1802	4							
			27	C16	296326	6250165	1223 - 2077	180							
			28	C16	296326	6250165	1223 - 2077	77				0			
			29	C16	296088	6246107	1247 - 2067	259				0			
			30	C16	291772	6254563	1203 - 2100	2							
			31	C16	291772	6254563	1203 - 2100	270				4			
			32	C14	272010	6275693	1180 - 1947	35							
			33	C14	272010	6275693	1180 - 1947	560				1			
			34	C14	268257	6269602	1168 - 1850	23							
			35	C14	268257	6269602	1168 - 1850	347				6			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals				
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District		
			37	C14	263215	6276970	1207 - 2032	361	7034			1	72	434			
			38	C13	289061	6277466	1282 - 2148	519									
			40	C13	294219	6278682	1275 - 2024	4									
			45	N/A (cha)	301253	6204470	1221 - 1718	19									
			46	C6	304385	6201012	1184 - 1656	4									
				N/A (cha)	304385	6201012	1184 - 1656	440									
			65	C14	265902	6266828	1156 - 1968	457									
			66	C16	276712	6237053	1258 - 1751	616									
			67	C6	310591	6222958	1196 - 1911	663									
			71	C16	269859	6251150	1202 - 1676	663									
			72	C15	269569	6258244	1162 - 1938	740									
			73	C13	294219	6278682	1275 - 2024	124									
			74	N/A (cha)	298677	6206477	1253 - 2021	457									
			77	N/A (cha)	307503	6195848	1215 - 1796	30									
			78	C6	312104	6222673	1216 - 1974	5									
			123	N/A (cha)	301253	6204470	1221 - 1718	176									
	Wolverine		25	W2b	354474	6170031	1146 - 2001	41									0
			36	W5	317743	6187327	1182 - 1871	4									
			39	N/A (wol)	309949	6194340	1272 - 1663	0									
			41	N/A (wol)	309949	6194340	1272 - 1663	155									
			42	W2a	337082	6194689	1216 - 1397	17									
			43	W2a	348329	6188581	1250 - 1496	27									
			44	W2a	347558	6175551	1203 - 1445	24									
				W2b	347558	6175551	1203 - 1445	42									
			47	W5	317743	6187327	1182 - 1871	9									
			48	W2b	338392	6161631	1175 - 1886	228									
			49	W2b	338392	6161631	1175 - 1886	22									
			50	W2b	338392	6161631	1175 - 1886	236									
			51	W2b	317888	6160204	1213 - 1876	0									
			52	W2b	354474	6170031	1146 - 2001	7									
			53	W2b	354474	6170031	1146 - 2001	4									
			54	W2b	354474	6170031	1146 - 2001	118									
			55	W2b	317888	6160204	1213 - 1876	13									
			56	W2b	354474	6170031	1146 - 2001	0									
			57	W2b	354474	6170031	1146 - 2001	34									
			58	W5	317743	6187327	1182 - 1871	6									
			59	W2b	354474	6170031	1146 - 2001	159									
			60	W2b	354474	6170031	1146 - 2001	35									
			61	W2b	341701	6173180	1214 - 1789	0									
			62	W2b	354474	6170031	1146 - 2001	200									
			63	W2b	341701	6173180	1214 - 1789	7									
			64	W2b	354474	6170031	1146 - 2001	366									
			68	W2a	349467	6189512	1247 - 1785	260									
			69	W2a	344005	6190709	1219 - 1906	0									
			70	N/A (wol)	309949	6194340	1272 - 1663	231									
			75	W2a	344005	6190709	1219 - 1906	242									

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			76	W2a	338995	6193343	1194 - 1929	559	3045	10079	54400	29	384	818	18399
Mackenzie	Selected_lt50	Chase	474	C7	321676	6242323	1191 - 2218	29							
			480	C3	358944	6262931	1135 - 2216	0							
			481	C3	358944	6262931	1135 - 2216	0							
			482	C3	358944	6262931	1135 - 2216	0							
			483	C3	358944	6262931	1135 - 2216	149							
				C4	358944	6262931	1135 - 2216	69							
			484	C3	358944	6262931	1135 - 2216	1				0			
			485	C3	358944	6262931	1135 - 2216	29				7			
			488	C4	369986	6233534	1378 - 2071	4							
			498	C4	384730	6232983	1383 - 2005	51				39			
			499	C4	384730	6232983	1383 - 2005	17				0			
			500	C1	392178	6253641	992 - 2126	1							
			501	C1	392178	6253641	992 - 2126	0							
			502	C1	392178	6253641	992 - 2126	0							
			503	C1	392178	6253641	992 - 2126	0							
			504	C1	392178	6253641	992 - 2126	26							
			505	C1	392178	6253641	992 - 2126	17							
			506	C1	392178	6253641	992 - 2126	9							
				C2	392178	6253641	992 - 2126	1							
			507	C1	392178	6253641	992 - 2126	24				17			
			508	C2	392178	6253641	992 - 2126	81				10			
			509	C1	392178	6253641	992 - 2126	84				7			
			510	C1	384011	6257821	1176 - 1766	209				2			
			511	C1	384011	6257821	1176 - 1766	0							
			512	C1	384011	6257821	1176 - 1766	50				15			
			513	C1	384011	6257821	1176 - 1766	116				14			
			514	C10	323229	6271125	1186 - 2322	38							
			548	C4	384730	6232983	1383 - 2005	0	1004				112		
		Finlay	486	N/A (fin)	395444	6392427	1177 - 2583	0							
			487	N/A (fin)	395444	6392427	1177 - 2583	10							
			515	N/A (fin)	395444	6392427	1177 - 2583	0							
			516	N/A (fin)	395444	6392427	1177 - 2583	62							
			517	N/A (fin)	366890	6429030	2101 - 2552	28							
			518	N/A (fin)	322731	6384632	1162 - 2249	0							
			519	N/A (fin)	322731	6384632	1162 - 2249	28							
			520	N/A (fin)	322731	6384632	1162 - 2249	13							
			521	N/A (fin)	322731	6384632	1162 - 2249	143							
			522	F14	326967	6357843	1260 - 2194	101							
			523	N/A (fin)	378801	6393567	1199 - 2320	1							
			524	N/A (fin)	378801	6393567	1199 - 2320	10							
			525	N/A (fin)	342819	6417633	1248 - 2103	66							
			526	F14	326967	6357843	1260 - 2194	422				3			
			527	F1	422048	6280881	1141 - 2261	281				39			
				F5	422048	6280881	1141 - 2261	88				32			
			528	N/A (fin)	395444	6392427	1177 - 2583	0							

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals						
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District				
			529	N/A (fin)	395444	6392427	1177 - 2583	1											
			530	N/A (fin)	395444	6392427	1177 - 2583	0											
			531	N/A (fin)	395444	6392427	1177 - 2583	1											
			532	N/A (fin)	395444	6392427	1177 - 2583	1											
			533	N/A (fin)	395444	6392427	1177 - 2583	50											
			534	N/A (fin)	395444	6392427	1177 - 2583	94											
			535	N/A (fin)	395444	6392427	1177 - 2583	22											
			536	N/A (fin)	395444	6392427	1177 - 2583	8											
			537	N/A (fin)	395444	6392427	1177 - 2583	18											
			538	N/A (fin)	395444	6392427	1177 - 2583	46											
			541	N/A (fin)	395444	6392427	1177 - 2583	71											
			543	N/A (fin)	322731	6384632	1162 - 2249	0											
			544	N/A (fin)	322731	6384632	1162 - 2249	13											
			545	N/A (fin)	322731	6384632	1162 - 2249	14		1591			74						
		Scott	460	N/A (sco)	418269	6176903	1168 - 2071	0											
			461	N/A (sco)	418269	6176903	1168 - 2071	15				10							
			463	N/A (sco)	418269	6176903	1168 - 2071	1											
			466	N/A (sco)	418269	6176903	1168 - 2071	22				20							
			467	N/A (sco)	418269	6176903	1168 - 2071	18											
			468	N/A (sco)	418269	6176903	1168 - 2071	5				1							
			469	N/A (sco)	418269	6176903	1168 - 2071	93				11							
			472	N/A (sco)	406568	6153471	1389 - 1888	0											
			494	N/A (sco)	406568	6153471	1389 - 1888	5				4							
			495	N/A (sco)	406568	6153471	1389 - 1888	0				0							
			496	N/A (sco)	406568	6153471	1389 - 1888	52				212							
	Wolverine	459	W1a	418269	6176903	1168 - 2071	6												
		460	W1a	418269	6176903	1168 - 2071	4												
		461	W1a	418269	6176903	1168 - 2071	6										0		
		462	W1b	390372	6197590	1184 - 1750	230										41		
		464	W1a	418269	6176903	1168 - 2071	3												
		465	W1a	418269	6176903	1168 - 2071	6												
		466	W1a	418269	6176903	1168 - 2071	37										0		
		468	W1a	418269	6176903	1168 - 2071	2												
		470	W1a	418269	6176903	1168 - 2071	71										5		
		471	W1a	418269	6176903	1168 - 2071	129										5		
		473	W1b	372157	6195384	1187 - 1929	2												
		475	W2b	361879	6174472	1173 - 2011	5										4		
		476	W2b	361879	6174472	1173 - 2011	0												
		477	W2b	361879	6174472	1173 - 2011	28												
		478	W1b	376556	6195849	1186 - 1723	37										22		
		479	W1b	376556	6195849	1186 - 1723	3										2		
		489	W1b	370490	6191551	1222 - 1686	6										1		
		490	W3a	383895	6166208	1224 - 1924	0												
		491	W3b	406568	6153471	1389 - 1888	12												
	492	W3b	406568	6153471	1389 - 1888	0	0												
	493	W3b	406568	6153471	1389 - 1888	0	0												

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			497	W1b	370490	6191551	1222 - 1686	151				91			
			539	W2b	361879	6174472	1173 - 2011	0							
			540	W2b	361879	6174472	1173 - 2011	16				0			
			542	W2b	361879	6174472	1173 - 2011	13							
			546	W2b	361879	6174472	1173 - 2011	0							
			547	W2b	361879	6174472	1173 - 2011	4	771	3578			172	424	
	Selected	Chase	1	C7	316702	6250442	1186 - 2186	671				0			
			2	C3	343367	6248108	1228 - 1724	693				88			
			7	C7	321676	6242323	1191 - 2218	757				2			
			8	C3	358944	6262931	1135 - 2216	21069				2244			
				C4	358944	6262931	1135 - 2216	72				10			
			9	C3	358944	6262931	1135 - 2216	812				67			
				C4	358944	6262931	1135 - 2216	17							
			13	C4	369986	6233534	1378 - 2071	8056				1976			
			14	C8	315351	6256535	1211 - 2161	1611							
			15	C8	312186	6253711	1254 - 2210	688							
			16	C8	311355	6261984	1251 - 2316	1294							
			17	C3	328505	6248490	1121 - 2192	169				75			
				C4	328505	6248490	1121 - 2192	78				36			
				C7	328505	6248490	1121 - 2192	14211				551			
			24	C1	397839	6263846	1233 - 1852	724				100			
			25	C11	332719	6306038	1166 - 1919	1277				134			
			26	F15	360284	6300486	1147 - 2100	2406				269			
			27	C10	305538	6293853	1181 - 2182	593				49			
			28	C10	320803	6297566	1519 - 2236	545							
			29	C10	326420	6295411	1237 - 2054	885				20			
			30	C11	340173	6301652	1155 - 2076	2152				145			
			41	W2a	356070	6198878	1191 - 2075	2409				389			
			42	C1	392178	6253641	992 - 2126	9729				1325			
			43	C1	391808	6264335	1194 - 2217	5828				346			
				C2	391808	6264335	1194 - 2217	17				2			
			44	C2	373088	6277555	1218 - 1791	582				134			
			56	C12	296024	6327871	1395 - 2171	172				7			
				C17	296024	6327871	1395 - 2171	343				1			
			57	C12	304109	6328840	1580 - 2375	842							
			65	C7	321309	6237080	1242 - 2142	699							
			66	C5	326076	6236063	1187 - 2198	917				9			
			68	C9	339746	6278636	1209 - 2270	24306				1272			
			69	C10	323229	6271125	1186 - 2322	5954				201			
				C3	323229	6271125	1186 - 2322	639				250			
				C8	323229	6271125	1186 - 2322	9440				267			
				C9	323229	6271125	1186 - 2322	22206				1534			
			70	C10	325551	6282850	1147 - 2269	146				18			
				C9	325551	6282850	1147 - 2269	10191				315			
			71	C9	349940	6281349	1229 - 2004	658				30			
			73	C13	278068	6313253	1249 - 1593	488				44			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
				C17	278068	6313253	1249 - 1593	27							
			74	C10	304262	6310768	1168 - 2186	11				1			
				C12	304262	6310768	1168 - 2186	1647				132			
			75	C12	297789	6312563	1232 - 2051	840				8			
			76	C11	315142	6321204	1233 - 2218	150				0			
				C12	315142	6321204	1233 - 2218	11114				234			
			78	C11	318357	6327927	1242 - 2228	149				5			
				C12	318357	6327927	1242 - 2228	3233				83			
			82	C11	342750	6326016	1110 - 2290	112				15			
				F15	342750	6326016	1110 - 2290	18499				349			
			83	C9	338204	6291458	1241 - 2044	1407				154			
			84	C10	312120	6298429	1170 - 2258	9769				220			
			85	C10	300718	6303067	1087 - 2233	1365				10			
			86	C11	333014	6316712	1079 - 2149	7445				655			
			87	C12	305174	6316485	1443 - 2262	1214							
			88	C10	320905	6308475	1137 - 2230	75				23			
				C11	320905	6308475	1137 - 2230	15358				314			
			107	C6	333073	6221220	1189 - 2162	989				33			
			108	W2a	341756	6210701	1229 - 2126	2052				275			
			113	C5	360427	6226024	1136 - 1937	1869				320			
			125	C4	341613	6228467	1155 - 2377	366				317			
				C5	341613	6228467	1155 - 2377	35572				2732			
			126	C4	384730	6232983	1383 - 2005	20560				3874			
			127	W1b	377992	6211344	1124 - 2166	10626				2368			
			129	W2a	346397	6201066	1219 - 2024	5966				852			
			131	W1b	384422	6201281	1185 - 2014	716	305481			127	25011		
Finlay			6	F1	426971	6265221	1158 - 2130	1462				194			
			26	F15	360284	6300486	1147 - 2100	1361				342			
			31	N/A (fin)	320832	6415307	1189 - 2098	2315				206			
			32	N/A (fin)	334351	6398916	1214 - 1740	545				58			
			33	N/A (fin)	332307	6398830	1201 - 1861	527				51			
			34	N/A (fin)	365052	6396510	1208 - 2039	591							
			35	N/A (fin)	346091	6396018	1245 - 1694	509				20			
			36	N/A (fin)	347494	6399963	1169 - 2105	2834				123			
			37	N/A (fin)	355600	6392727	1172 - 1969	1316							
			38	N/A (fin)	347310	6389268	1182 - 1896	828				10			
			39	N/A (fin)	345977	6386572	1210 - 1862	1002				108			
			40	N/A (fin)	339683	6398077	1186 - 2023	2428				392			
			45	N/A (fin)	333598	6426483	1243 - 2118	1079							
			46	N/A (fin)	328191	6424006	1199 - 2092	6416							
			47	N/A (fin)	321673	6427264	1232 - 2117	1246							
			48	N/A (fin)	316976	6420976	1226 - 1980	1569				107			
			49	N/A (fin)	307219	6413558	1433 - 2065	554							
			50	N/A (fin)	309304	6411696	1348 - 2218	900							
			51	N/A (fin)	315187	6401775	1245 - 2243	1118							
			52	N/A (fin)	322731	6384632	1162 - 2249	2797				210			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			53	N/A (fin)	322731	6384632	1162 - 2249	527				3			
			54	F14	327497	6354690	1336 - 2210	633				17			
			55	N/A (fin)	311380	6407101	1309 - 2238	1108							
			58	N/A (fin)	346033	6420855	1265 - 2057	887				9			
			59	N/A (fin)	351739	6422917	1264 - 2159	1200				171			
			60	N/A (fin)	357075	6419686	1192 - 2623	17421				83			
			61	N/A (fin)	316697	6394088	1222 - 2377	4911				68			
			62	F14	330267	6351103	1257 - 2235	860							
			63	F13	333485	6348815	1165 - 2120	17				6			
				F14	333485	6348815	1165 - 2120	2415				196			
			64	N/A (fin)	342819	6417633	1248 - 2103	847				10			
			67	F1	422048	6280881	1141 - 2261	13650				1908			
				F5	422048	6280881	1141 - 2261	70				19			
			72	F4	430869	6325814	1210 - 2166	4993							
			77	F15	352008	6324766	1211 - 2013	1524				8			
			79	F10	372501	6332378	1151 - 1942	1074				213			
			80	F14	348954	6329533	1229 - 2052	700				6			
				F15	348954	6329533	1229 - 2052	167							
			81	F13	353907	6328920	1219 - 1880	0				0			
				F14	353907	6328920	1219 - 1880	1046				80			
				F15	353907	6328920	1219 - 1880	14							
			82	F13	342750	6326016	1110 - 2290	7							
				F14	342750	6326016	1110 - 2290	18612				772			
				F15	342750	6326016	1110 - 2290	9598				57			
			89	N/A (fin)	347557	6414715	1132 - 1930	2058				41			
			90	N/A (fin)	340468	6411582	1206 - 1901	953				7			
			91	N/A (fin)	343788	6408622	1177 - 1931	1694				74			
			92	N/A (fin)	333197	6409287	1183 - 1976	3935				630			
			93	N/A (fin)	360574	6396213	1160 - 2048	1869							
			94	N/A (fin)	372887	6391355	1151 - 1822	2292							
			95	F12	358895	6377742	1177 - 1955	740				92			
			96	F12	348879	6374259	1188 - 1870	1342				264			
			97	F10	363333	6355873	1133 - 1806	791				137			
			98	F14	329986	6353942	1235 - 2144	985				10			
			99	F12	367583	6378825	1173 - 2203	19994				1133			
				N/A (fin)	367583	6378825	1173 - 2203	180				15			
			100	F13	338446	6358975	1167 - 1976	3336				478			
			101	N/A (fin)	378801	6393567	1199 - 2320	2703							
			102	F6	401354	6292071	1195 - 1870	559				40			
			103	F6	398670	6290645	1168 - 2066	1069				133			
			104	F6	396701	6296497	1068 - 2021	1535				287			
			105	F5	405911	6301831	1145 - 2157	1212				189			
				F7	405911	6301831	1145 - 2157	14				12			
			106	F3	429284	6312543	1133 - 2214	13							
				F4	429284	6312543	1133 - 2214	12843				843			
			109	F10	378167	6340574	1118 - 2000	2693				198			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
Scott	F	N/A (fin)		F9	378167	6340574	1118 - 2000	7				5			
			110	F9	388072	6333738	1106 - 2039	5835				773			
			111	F11	409039	6360251	1162 - 2170	1189							
			112	N/A (fin)	392450	6398373	1269 - 2281	760							
			114	F6	386227	6314089	1133 - 2259	9566				1390			
				F9	386227	6314089	1133 - 2259	1				1			
			115	F9	393734	6346560	1114 - 2333	20658				1626			
			116	N/A (fin)	395444	6392427	1177 - 2583	4131							
			117	N/A (fin)	395444	6392427	1177 - 2583	548							
			118	F11	395444	6392427	1177 - 2583	2							
				N/A (fin)	395444	6392427	1177 - 2583	7433							
			119	F5	427369	6295179	1130 - 2208	6303				620			
			120	F3	445080	6304063	1155 - 2667	13777							
			121	F3	437428	6319518	1125 - 2443	4948							
			122	F6	392846	6303849	1129 - 2141	4862				786			
			123	F3	440849	6304774	1183 - 2117	3410							
			124	F10	410362	6346087	1119 - 3015	27336				1994			
				F11	410362	6346087	1119 - 3015	45025				435			
				F12	410362	6346087	1119 - 3015	445				70			
				F3	410362	6346087	1119 - 3015	206							
				F4	410362	6346087	1119 - 3015	5915				9			
				F5	410362	6346087	1119 - 3015	22897				1976			
				F6	410362	6346087	1119 - 3015	231				91			
				F7	410362	6346087	1119 - 3015	41947				3279			
				F8	410362	6346087	1119 - 3015	46895							
				F9	410362	6346087	1119 - 3015	22781				1945			
				N/A (fin)	410362	6346087	1119 - 3015	266	473858				25032		
Scott	S	N/A (sco)	4	N/A (sco)	418269	6176903	1168 - 2071	554				117			
			18	S1a	461968	6199213	1201 - 2058	597				58			
			19	S1a	460681	6204645	1127 - 2291	2616				226			
			21	S1a	480811	6200195	1163 - 2124	906				32			
			128	N/A (sco)	406568	6153471	1389 - 1888	3096	7770			568	1002		
Wolverine	W	N/A (fin)	3	W1a	411306	6175903	1219 - 2047	1263				220			
			4	W1a	418269	6176903	1168 - 2071	10							
			5	W1a	418269	6176903	1168 - 2071	11706				2689			
			10	W3a	383895	6166208	1224 - 1924	650				114			
			11	W3a	383895	6166208	1224 - 1924	613				32			
			12	W1b	372157	6195384	1187 - 1929	1454				322			
			20	W1b	376556	6195849	1186 - 1723	595				205			
			22	W3a	406568	6153471	1389 - 1888	13							
				W3b	406568	6153471	1389 - 1888	2708				482			
			23	W3b	406568	6153471	1389 - 1888	739				158			
			41	W2a	356070	6198878	1191 - 2075	4443				711			
			127	W1b	377992	6211344	1124 - 2166	4150				514			
			128	W3b	406568	6153471	1389 - 1888	7589				1046			
			129	W2a	346397	6201066	1219 - 2024	3952				807			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			130	W2b	361879	6174472	1173 - 2011	5496				783			
			131	W1b	384422	6201281	1185 - 2014	2097				203			
			132	W3a	383895	6166208	1224 - 1924	2059				419			
			133	W3a	384113	6161285	1320 - 1848	595	50132	837241		66	8773	59817	
	Rejected	Chase	224	C2	381701	6278923	1196 - 1998	54				13			
			225	C1	379349	6250928	1234 - 1723	61				35			
				C4	379349	6250928	1234 - 1723	1071				535			
			226	F15	364921	6305340	1203 - 1621	236				129			
			227	C2	360444	6293160	1190 - 1739	39				25			
				F15	360444	6293160	1190 - 1739	874				350			
			228	C11	337493	6300288	1206 - 2056	771				252			
			229	F15	354523	6299087	1119 - 2041	1329				399			
			230	C4	386354	6232500	1162 - 1433	30				19			
			231	C4	386354	6232500	1162 - 1433	1				0			
			232	C4	386354	6232500	1162 - 1433	46				38			
			233	C4	386354	6232500	1162 - 1433	122				53			
			235	C5	365066	6217051	1131 - 1907	3264				911			
			261	C4	386354	6232500	1162 - 1433	31				21			
			262	C5	357073	6215269	1214 - 1565	548				288			
			263	C5	356446	6222367	1221 - 1620	599				460			
			264	C4	386354	6232500	1162 - 1433	17							
			265	C4	386354	6232500	1162 - 1433	49				30			
			266	C4	386354	6232500	1162 - 1433	261				85			
			267	C4	386354	6232500	1162 - 1433	80				13			
			269	C4	386354	6232500	1162 - 1433	4				3			
			270	C4	386354	6232500	1162 - 1433	37				10			
			271	C4	386354	6232500	1162 - 1433	170				106			
			272	C4	386354	6232500	1162 - 1433	91				61			
			273	C4	386354	6232500	1162 - 1433	4				2			
			274	C4	360983	6237583	1232 - 1614	1079				807			
			275	C4	352651	6238236	1212 - 1745	708				373			
			293	C2	381701	6278923	1196 - 1998	0							
			294	C2	381701	6278923	1196 - 1998	0							
			295	C4	386354	6232500	1162 - 1433	33				22			
			298	C4	386354	6232500	1162 - 1433	34				24			
			299	C4	386354	6232500	1162 - 1433	141				74			
			300	C4	386354	6232500	1162 - 1433	45				27			
			303	C4	386354	6232500	1162 - 1433	57				34			
			304	C4	386354	6232500	1162 - 1433	20				15			
			305	C4	386354	6232500	1162 - 1433	122				106			
				W1b	386354	6232500	1162 - 1433	26				26			
			306	C4	386354	6232500	1162 - 1433	88				87			
			307	C4	367949	6234489	1206 - 1411	39				36			
			308	C4	386354	6232500	1162 - 1433	255				211			
			309	C4	386354	6232500	1162 - 1433	26				4			
			310	C4	386354	6232500	1162 - 1433	151				83			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			311	C4	386354	6232500	1162 - 1433	86				29			
			313	C4	386354	6232500	1162 - 1433	290				249			
			314	C4	386354	6232500	1162 - 1433	481				298			
			315	C4	386354	6232500	1162 - 1433	24				11			
			316	C4	386354	6232500	1162 - 1433	61				29			
			317	C4	386354	6232500	1162 - 1433	93				77			
				W1b	386354	6232500	1162 - 1433	6				4			
			318	C4	386354	6232500	1162 - 1433	160				131			
			319	C4	386354	6232500	1162 - 1433	21				15			
			320	C4	386354	6232500	1162 - 1433	54				44			
			321	C4	386354	6232500	1162 - 1433	138				97			
			322	C4	386354	6232500	1162 - 1433	94				40			
			324	C4	386354	6232500	1162 - 1433	28				10			
			326	C4	367949	6234489	1206 - 1411	14				14			
			327	C4	367949	6234489	1206 - 1411	775				478			
			328	W1b	371001	6212514	1194 - 1702	863				305			
			329	C4	367949	6234489	1206 - 1411	42				2			
			330	C4	367949	6234489	1206 - 1411	51				21			
			331	C4	367949	6234489	1206 - 1411	7				6			
			332	C4	367949	6234489	1206 - 1411	12				7			
			333	C4	367949	6234489	1206 - 1411	37				16			
			335	C4	367949	6234489	1206 - 1411	18				12			
			336	C4	367949	6234489	1206 - 1411	119				81			
			337	C4	367949	6234489	1206 - 1411	5				0			
			338	C4	367949	6234489	1206 - 1411	1145				877			
			344	C10	290548	6297683	1248 - 1499	631				140			
			346	C2	381701	6278923	1196 - 1998	2814				588			
			350	W1b	386374	6214208	1188 - 1886	1598				712			
			351	W1b	389567	6212251	1217 - 1791	590				221			
			352	W1b	395729	6203929	1217 - 1701	310				256			
			358	C1	404207	6236687	1231 - 1963	5562				2435			
			361	W1b	393824	6212080	1203 - 1771	1740				421			
			362	C4	386354	6232500	1162 - 1433	873				632			
			363	C2	381701	6278923	1196 - 1998	4750				2024			
			364	C2	381701	6278923	1196 - 1998	291				14			
			365	C2	381701	6278923	1196 - 1998	1							
			369	C4	386354	6232500	1162 - 1433	255				170			
			370	C4	386354	6232500	1162 - 1433	143				121			
			371	C4	386354	6232500	1162 - 1433	70				52			
			372	C4	386354	6232500	1162 - 1433	132				126			
			373	C1	398676	6260916	1219 - 1806	570				136			
			376	W1b	390860	6204220	1183 - 1779	1029				230			
			377	W1b	369134	6203369	1223 - 1856	595				236			
			383	C4	386354	6232500	1162 - 1433	127				100			
			384	C2	381701	6278923	1196 - 1998	3							
			385	C2	381701	6278923	1196 - 1998	0	39321				17236		

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
Finlay			204	F13	345798	6340127	1190 - 1660	183				111			
				F14	345798	6340127	1190 - 1660	763				258			
			205	F13	347947	6342139	1189 - 1684	578				314			
			206	F13	352072	6338040	1240 - 1553	588				339			
			207	F10	369247	6336550	1190 - 1716	570				329			
			208	F10	371393	6343966	1178 - 1890	838				213			
			209	F10	374754	6345865	1244 - 1850	560				199			
			210	F12	344774	6371416	1212 - 1644	626				343			
			211	F12	362123	6371802	1190 - 1659	587				392			
			213	F12	355331	6382404	1195 - 2036	965				197			
			214	N/A (fin)	341823	6384012	1175 - 1900	824				168			
			215	F12	354929	6374144	1183 - 1735	744				487			
			216	N/A (fin)	337670	6381105	1200 - 1650	523				343			
			217	F10	365855	6358741	1182 - 1948	889				262			
			218	N/A (fin)	330234	6398734	1188 - 1850	777				442			
			219	N/A (fin)	329222	6405537	1164 - 1962	1003				342			
			220	N/A (fin)	333302	6388981	1216 - 1645	612				268			
			226	C2	364921	6305340	1203 - 1621	14				2			
				F15	364921	6305340	1203 - 1621	313				240			
			292	F6	408804	6275388	1188 - 1734	684				210			
			339	F5	407245	6295541	1186 - 1904	656				235			
				F6	407245	6295541	1186 - 1904	6				5			
			340	F6	403776	6284773	1197 - 1998	1740				568			
			341	F5	410238	6290163	1165 - 1716	838				492			
			342	F10	374165	6339855	1158 - 1923	1189				334			
			343	F9	378455	6326038	1041 - 2022	1723				422			
			347	F10	375544	6351052	1184 - 1803	1018				490			
			348	F10	377845	6357055	1177 - 1975	2199				831			
			349	N/A (fin)	336141	6392979	1198 - 2024	2498				696			
			366	F1	425689	6238011	1195 - 1586	918				335			
			367	F1	431826	6248904	1218 - 1954	1087	26513	308	10175				
Scott			221	N/A (sco)	448533	6130849	1227 - 1545	1862				627			
			237	N/A (sco)	403585	6153031	1215 - 1489	4				4			
			238	N/A (sco)	403585	6153031	1215 - 1489	4				3			
			242	N/A (sco)	403585	6153031	1215 - 1489	51				7			
			243	N/A (sco)	403585	6153031	1215 - 1489	86				33			
			276	N/A (sco)	403585	6153031	1215 - 1489	0							
			277	N/A (sco)	403585	6153031	1215 - 1489	0							
			278	N/A (sco)	403585	6153031	1215 - 1489	0							
			280	N/A (sco)	403585	6153031	1215 - 1489	6				2			
			281	N/A (sco)	403585	6153031	1215 - 1489	139				66			
			282	N/A (sco)	403585	6153031	1215 - 1489	0				0			
			283	N/A (sco)	403585	6153031	1215 - 1489	1				1			
			284	N/A (sco)	403585	6153031	1215 - 1489	3				0			
			285	N/A (sco)	403585	6153031	1215 - 1489	102				43			
			286	N/A (sco)	403585	6153031	1215 - 1489	23	12						

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			287	N/A (sco)	417248	6134882	1255 - 1521	391				223			
			288	N/A (sco)	415881	6129917	1227 - 1509	144				94			
			289	N/A (sco)	438769	6145751	1238 - 1591	636				252			
			291	N/A (sco)	454096	6141915	1177 - 1497	609				269			
			296	N/A (sco)	442143	6152472	1185 - 1848	6782				3026			
			297	N/A (sco)	442143	6152472	1185 - 1848	614				432			
			302	N/A (sco)	411281	6140619	1261 - 1456	177				68			
			354	S1a	469835	6205344	1121 - 2088	818				188			
			359	S1a	456373	6202044	1194 - 1950	2394				714			
			378	N/A (sco)	403585	6153031	1215 - 1489	0							
			380	N/A (sco)	403585	6153031	1215 - 1489	773				240			
			382	N/A (sco)	403585	6153031	1215 - 1489	354		15973		242		6546	
Wolverine			222	W1a	429123	6163622	1219 - 1645	1693				624			
				W3b	429123	6163622	1219 - 1645	50				28			
			236	W1b	395729	6203929	1217 - 1701	7							
			239	W3b	403585	6153031	1215 - 1489	4							
			240	W3b	403585	6153031	1215 - 1489	0							
			241	W3b	403585	6153031	1215 - 1489	0							
			243	W3b	403585	6153031	1215 - 1489	40				29			
			244	W3b	403585	6153031	1215 - 1489	638				400			
			247	W3b	403585	6153031	1215 - 1489	192				59			
			248	W3b	403585	6153031	1215 - 1489	37				32			
			249	W3a	403585	6153031	1215 - 1489	70				45			
				W3b	403585	6153031	1215 - 1489	1805				1128			
			250	W3b	403585	6153031	1215 - 1489	27				15			
			251	W3b	403585	6153031	1215 - 1489	1				1			
			252	W3b	403585	6153031	1215 - 1489	99				7			
			253	W3b	403585	6153031	1215 - 1489	22				2			
			254	W3a	403585	6153031	1215 - 1489	0				0			
				W3b	403585	6153031	1215 - 1489	334				160			
			255	W3b	403585	6153031	1215 - 1489	1				1			
			256	W3a	397771	6167821	1202 - 1595	697				384			
			258	W3b	406186	6163555	1250 - 1610	1421				947			
			259	W3a	376394	6164516	1233 - 1884	682				348			
			260	W3a	387397	6154983	1250 - 1753	1720				566			
				W3b	387397	6154983	1250 - 1753	604				410			
			287	N/A (wol)	417248	6134882	1255 - 1521	462				325			
			288	N/A (wol)	415881	6129917	1227 - 1509	436				302			
			302	N/A (wol)	411281	6140619	1261 - 1456	226				115			
				W3b	411281	6140619	1261 - 1456	303				212			
				W4	411281	6140619	1261 - 1456	3				2			
			325	W1a	429987	6171944	1219 - 1734	1752				423			
			352	W1b	395729	6203929	1217 - 1701	147				51			
			353	W1b	395729	6203929	1217 - 1701	0							
			355	W3b	418336	6163864	1194 - 1552	686				401			
			360	W3a	371363	6165923	1227 - 1887	2436				537			

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals													
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District											
			374	W3b	403585	6153031	1215 - 1489	0				2379														
			375	W3b	403585	6153031	1215 - 1489	3690																		
			376	W1b	390860	6204220	1183 - 1779	991																		
			377	W1b	369134	6203369	1223 - 1856	856																		
			381	W3b	403585	6153031	1215 - 1489	0																		
			382	W3b	403585	6153031	1215 - 1489	356								22489	104296	195	10742	44700						
	Park or UWR	Chase	134	C1	409770	6231335	1391 - 1497	0				0														
			136	C11	325510	6302320	1257 - 1284	0																		
			137	C10	325510	6302320	1257 - 1284	0																		
				C11	325510	6302320	1257 - 1284	0																		
			138	C1	384293	6263191	987 - 1962	4																		
			139	C1	384293	6263191	987 - 1962	1																		
			140	C1	384293	6263191	987 - 1962	1																		
			141	C1	384293	6263191	987 - 1962	41																		
			142	C1	384293	6263191	987 - 1962	5																		
			143	C1	384293	6263191	987 - 1962	2266									0									
				C2	384293	6263191	987 - 1962	193									0									
			144	C1	383467	6259718	1168 - 1767	3																		
			145	C1	383467	6259718	1168 - 1767	2																		
			147	C1	383467	6259718	1168 - 1767	570																		
			154	C2	380128	6273007	1184 - 1979	760																		
			156	C2	380128	6273007	1184 - 1979	1515									0									
			159	C2	374393	6274427	1221 - 1804	734									1									
			160	C3	366732	6261543	1233 - 2046	4751									8									
			245	C1	409770	6231335	1391 - 1497	13																		
			356	C1	409770	6231335	1391 - 1497	13																		
			386	C3	366732	6261543	1233 - 2046	2																		
			387	C3	366732	6261543	1233 - 2046	21																		
			388	C3	366732	6261543	1233 - 2046	37																		
			389	C3	366732	6261543	1233 - 2046	37																		
			390	C3	373882	6264169	1187 - 1818	536																		
			391	C3	370713	6264798	1202 - 1912	699																		
			410	F15	330743	6335824	1237 - 2182	249									1									
			422	C3	366732	6261543	1233 - 2046	3																		
				C4	366732	6261543	1233 - 2046	9									12464	10								
				Finlay	135	N/A (fin)	376792	6397076									1181 - 2320	24								
					146	N/A (fin)	376792	6397076									1181 - 2320	9								
					157	N/A (fin)	376792	6397076									1181 - 2320	76								
					158	N/A (fin)	382020	6413795									1118 - 2927	49220								
					162	F14	327304	6347732									1655 - 2030	8								
	163	N/A (fin)			369348	6427102	1257 - 2550	695																		
	164	N/A (fin)			360754	6416340	1225 - 2611	120																		
	165	N/A (fin)			360754	6416340	1225 - 2611	154																		
	166	N/A (fin)			360754	6416340	1225 - 2611	87																		
	167	N/A (fin)			360754	6416340	1225 - 2611	81																		
	168	N/A (fin)			376792	6397076	1181 - 2320	126																		

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			169	N/A (fin)	360754	6416340	1225 - 2611	153							
			170	N/A (fin)	360754	6416340	1225 - 2611	124							
			171	N/A (fin)	360754	6416340	1225 - 2611	501							
			172	N/A (fin)	360754	6416340	1225 - 2611	255							
			173	N/A (fin)	360754	6416340	1225 - 2611	69							
			174	N/A (fin)	360754	6416340	1225 - 2611	177							
			175	N/A (fin)	360754	6416340	1225 - 2611	1018							
			176	N/A (fin)	360754	6416340	1225 - 2611	2198							
			177	N/A (fin)	341899	6418379	1269 - 2086	41							
			178	N/A (fin)	371033	6393994	1259 - 1822	12							
			179	N/A (fin)	392792	6400832	1409 - 2284	209							
			180	N/A (fin)	371033	6393994	1259 - 1822	101							
			181	N/A (fin)	371033	6393994	1259 - 1822	15							
			182	N/A (fin)	371033	6393994	1259 - 1822	32							
			183	N/A (fin)	360754	6416340	1225 - 2611	392							
			184	N/A (fin)	361134	6398415	1264 - 2039	29							
			185	N/A (fin)	362772	6398968	1177 - 2047	287							
			186	N/A (fin)	362772	6398968	1177 - 2047	48							
			187	N/A (fin)	371914	6403236	1156 - 2498	3734							
			188	N/A (fin)	376792	6397076	1181 - 2320	3224							
			190	N/A (fin)	392792	6400832	1409 - 2284	24							
			191	N/A (fin)	360754	6416340	1225 - 2611	0							
			192	N/A (fin)	360754	6416340	1225 - 2611	29							
			193	F14	325995	6358033	1690 - 2187	0							
			194	F14	325995	6358033	1690 - 2187	13							
			195	F8	432384	6360697	1595 - 2971	0							
			196	F8	432384	6360697	1595 - 2971	1							
			197	N/A (fin)	351888	6424265	1305 - 2144	0							
			198	F8	432384	6360697	1595 - 2971	0							
			199	F8	432384	6360697	1595 - 2971	0							
			200	F8	432384	6360697	1595 - 2971	0							
			201	N/A (fin)	382020	6413795	1118 - 2927	0							
			202	F8	432384	6360697	1595 - 2971	0							
			203	N/A (fin)	351888	6424265	1305 - 2144	0							
			212	N/A (fin)	382020	6413795	1118 - 2927	34							
			223	N/A (fin)	382020	6413795	1118 - 2927	2720							
			234	N/A (fin)	382020	6413795	1118 - 2927	0							
			246	N/A (fin)	382020	6413795	1118 - 2927	294							
			257	F8	432384	6360697	1595 - 2971	0							
			268	F8	432384	6360697	1595 - 2971	0							
			279	F8	432384	6360697	1595 - 2971	0							
			290	F8	432384	6360697	1595 - 2971	0							
			301	F8	432384	6360697	1595 - 2971	9							
			312	F8	432384	6360697	1595 - 2971	0							
			323	F8	432384	6360697	1595 - 2971	1							
			334	F8	432384	6360697	1595 - 2971	2							

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals		
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District
			345	F8	432384	6360697	1595 - 2971	0							
			357	N/A (fin)	397382	6411901	1221 - 2728	6041							
			368	F8	432384	6360697	1595 - 2971	1							
			379	F8	432384	6360697	1595 - 2971	3							
			400	F14	330743	6335824	1237 - 2182	1							
			401	N/A (fin)	360754	6416340	1225 - 2611	2							
			402	N/A (fin)	360754	6416340	1225 - 2611	2							
			403	N/A (fin)	341899	6418379	1269 - 2086	16							
			405	N/A (fin)	351888	6424265	1305 - 2144	0				0			
			406	N/A (fin)	361134	6398415	1264 - 2039	5							
			407	F14	330743	6335824	1237 - 2182	9							
			408	F14	330743	6335824	1237 - 2182	0							
			409	F14	330743	6335824	1237 - 2182	0							
			410	F14	330743	6335824	1237 - 2182	8							
			411	F13	353081	6335856	1234 - 1303	10							
			412	F14	330743	6335824	1237 - 2182	9							
			413	F14	330743	6335824	1237 - 2182	10							
			414	F14	330743	6335824	1237 - 2182	13							
			421	F4	424354	6320263	1144 - 2180	904				0			
			423	F14	327304	6347732	1655 - 2030	0							
			424	F14	327566	6349108	2016 - 2233	0							
			425	F14	327566	6349108	2016 - 2233	11							
			426	N/A (fin)	376792	6397076	1181 - 2320	0							
			427	F14	325995	6358033	1690 - 2187	10							
			428	F14	325995	6358033	1690 - 2187	2							
			429	F14	325995	6358033	1690 - 2187	1							
			430	N/A (fin)	324369	6379883	1232 - 2191	119							
			431	N/A (fin)	324369	6379883	1232 - 2191	970				58			
			432	N/A (fin)	360754	6416340	1225 - 2611	1							
			433	N/A (fin)	360754	6416340	1225 - 2611	0							
			434	N/A (fin)	360754	6416340	1225 - 2611	1							
			435	N/A (fin)	360754	6416340	1225 - 2611	3							
			436	N/A (fin)	360754	6416340	1225 - 2611	24							
			437	N/A (fin)	376792	6397076	1181 - 2320	0							
			438	N/A (fin)	360754	6416340	1225 - 2611	11							
			439	N/A (fin)	360754	6416340	1225 - 2611	115							
			440	N/A (fin)	360754	6416340	1225 - 2611	0							
			441	N/A (fin)	360754	6416340	1225 - 2611	12							
			442	N/A (fin)	360754	6416340	1225 - 2611	129							
			443	N/A (fin)	351888	6424265	1305 - 2144	0							
			444	N/A (fin)	351888	6424265	1305 - 2144	0							
			445	N/A (fin)	351888	6424265	1305 - 2144	6							
			446	N/A (fin)	351888	6424265	1305 - 2144	0							
			447	N/A (fin)	351888	6424265	1305 - 2144	28							
			448	N/A (fin)	376792	6397076	1181 - 2320	10							
			449	N/A (fin)	351888	6424265	1305 - 2144	2							

Forest District	UWR Type	Herd RPA	UWR Unit	Herd Census Unit	UWR Coordinates		Elevation Range	UWR Unit Size (ha)	UWR Totals			UWR THLB	THLB Totals						
					UTM Easting	UTM Northing			By District, Type, and Herd	By District and Type	By District		By District, Type, and Herd	By District and Type	By District				
			450	N/A (fin)	371033	6393994	1259 - 1822	0											
			451	N/A (fin)	346628	6422360	1603 - 2059	54											
			452	N/A (fin)	371033	6393994	1259 - 1822	0											
			453	N/A (fin)	371033	6393994	1259 - 1822	0											
			454	N/A (fin)	371033	6393994	1259 - 1822	0											
			455	N/A (fin)	371033	6393994	1259 - 1822	2											
			456	N/A (fin)	371033	6393994	1259 - 1822	11											
			457	N/A (fin)	362772	6398968	1177 - 2047	0											
			458	N/A (fin)	362772	6398968	1177 - 2047	20								74928	59		
			Scott	161	N/A (sco)	414299	6191887	1093 - 2109								56	56	14	14
			Wolverine	148	W3a	384395	6169922	1102 - 1878								4			
				149	W3a	384395	6169922	1102 - 1878								4			
				150	W3a	384395	6169922	1102 - 1878								148			
				151	W3a	384395	6169922	1102 - 1878								20			
				152	W3a	384395	6169922	1102 - 1878								32			
				153	W3a	384395	6169922	1102 - 1878								1137			
				155	W1a	414299	6191887	1093 - 2109								2400	37		
				161	W1a	414299	6191887	1093 - 2109								22290	0		
				189	W1b	371384	6189235	1179 - 1790								649	0		
				392	W2a	349726	6190359	1754 - 1780								0			
				393	W1b	378819	6193152	1205 - 1782								1	1		
				394	W2a	349726	6190359	1754 - 1780								0			
				395	W2a	349726	6190359	1754 - 1780								0			
				396	W1b	390177	6193958	1193 - 1910								15	3		
				397	W1b	390177	6193958	1193 - 1910								3			
				398	W1b	390177	6193958	1193 - 1910								58			
				399	W1b	390177	6193958	1193 - 1910								903			
				404	W1b	378819	6193152	1205 - 1782								20	1		
				415	W1b	374123	6191889	1249 - 1936								379			
				416	W1b	395068	6200653	1258 - 1701								83			
				417	W1b	393681	6200292	1201 - 1735								153	1		
				418	W3a	386074	6178030	1213 - 1966								1524			
				419	W3a	379049	6177365	1203 - 1782								1699			
				420	W1b	378819	6193152	1205 - 1782								814	32335	119783	1064899