



Ministry of
Forests, Lands and
Natural Resource Operations

**PINK MOUNTAIN NORTHERN CARIBOU AND STONE'S
SHEEP UNGULATE WINTER RANGE (U-9-005) AND
WILDLIFE HABITAT AREA (9-146 TO 9-165 AND 9-172 TO
9-180) PROPOSAL RATIONALE**

Prepared By:

Colleen Arnison, RPBio
Ecosystem Biologist
Ministry of Forests, Lands and Natural Resource Operations (MFLNRO)
Northeast Region
Ecosystem Section
Rm. 400-10003-110 Avenue
Fort St. John, BC
V1J 6M7

February 2016

Table of Contents

Introduction.....	3
Biological Justification/Supporting Rationale	5
Expected Conservation Benefit	6
WHA and UWR selection	6
Key Habitat Requirements	8
Northern Caribou Winter Habitat	8
Stone’s Sheep Winter Habitat	8
Northern Caribou Calving Habitat	8
Forest Resource Impacts	8
Consistent with Established Objectives	9
Works Cited	11
Appendix 1.....	13
Appendix 2.....	17

Introduction

Ungulate Winter Range (UWR) and Wildlife Habitat Areas (WHA) are legal designations established under the *Government Actions Regulation (GAR)* of the *Forest and Range Practices Act (FRPA)* and are considered under the *Environmental Protection and Management Regulation (EPMR)* of the *Oil and Gas Activities Act (OGAA)*. These spatially defined areas are legally established for managing important wildlife habitat, such as Species at Risk, Identified Wildlife, or Category of Ungulates. Under *FRPA*, General Wildlife Measures provide associated measures of protection of habitats required by ungulates during the winter (UWRs), or vulnerable habitat elements (e.g., rutting, calving, and mineral licks – WHAs).

This UWR and WHA proposal is for Pink Mountain northern caribou (*Rangifer tarandus* pop. 15) and Stone's sheep (*Ovis dalli stonei*), as a secondary species. The UWRs encompasses 56,999 ha in area and the WHAs covers 107,182 ha in total. Each unit is consistent with existing policies and directives for the establishment of UWR and WHAs, including topographic and vegetative features, documented history of animal use and First Nation's knowledge. This proposal is located within the Fort St John, Fort Nelson and Mackenzie Timber Supply Area, within the Peace, Fort Nelson and Mackenzie Forest Districts, and overlaps with the Muskwa-Kechika Management Area (MKMA – see Figure 1).

This proposal describes the biological justification and supporting rationale, the expected benefit to northern caribou conservation, and an overview of the research conducted to determine each proposed unit and how this proposal is supported by existing objectives.

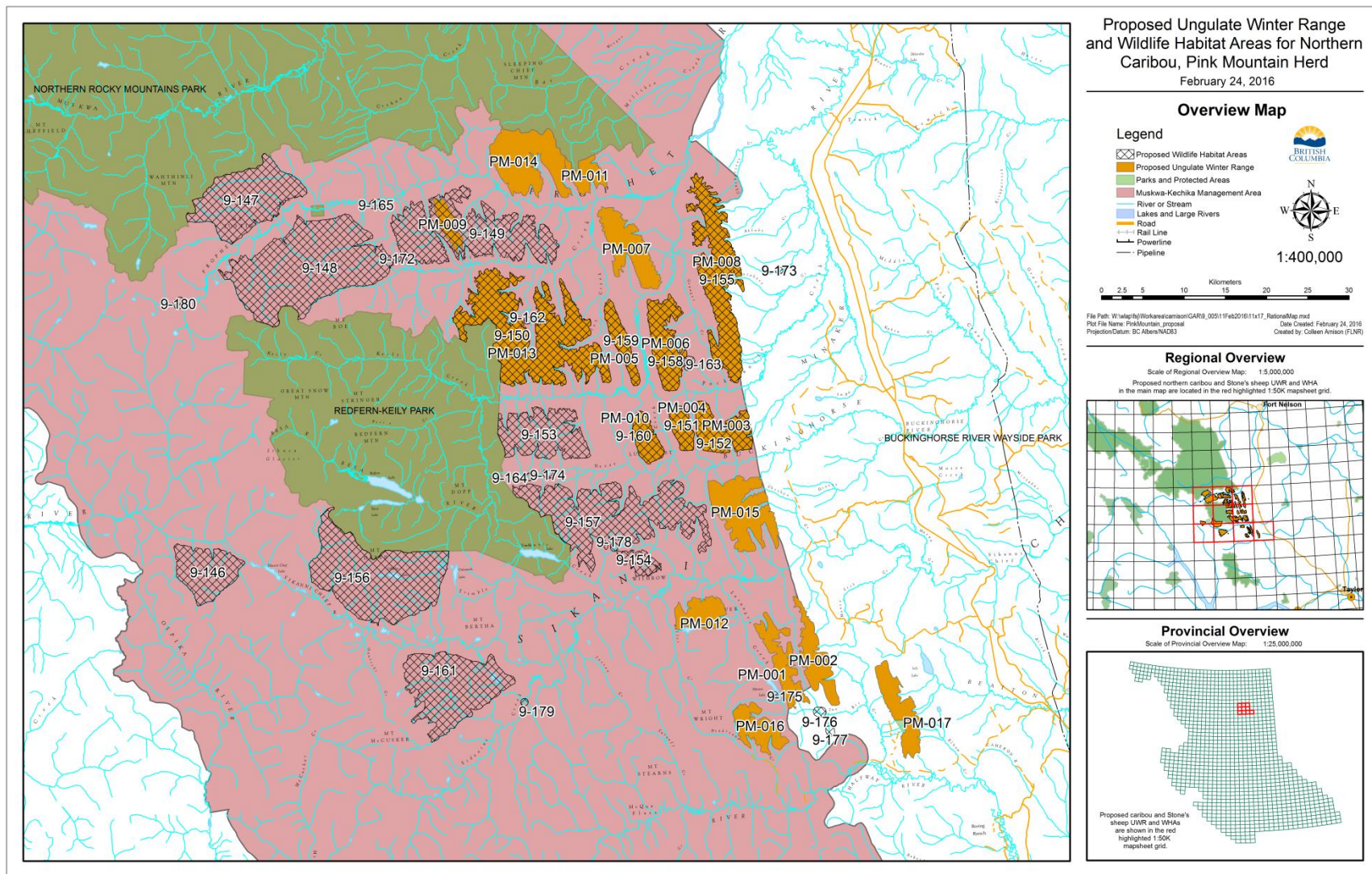


Figure 1: Location of Pink Mountain WHA and UWR proposal

Biological Justification/Supporting Rationale

Recent literature, regional data, and anecdotal evidence suggest that many caribou populations are either stable or declining in most of Canada¹⁻³. Woodland caribou in British Columbia (BC) are classified into mountain, northern or boreal ecotypes based on life history characteristics, behavior and ecological differences. Northern caribou (*Rangifer tarandus caribou* pop. 15 – hereafter referred to as caribou), the focus of this proposal, occupy mountain ranges in western and northern parts of BC with moderate snow depths. They make seasonal altitude migrations to forage on terrestrial lichens that are available in low elevation forests and on windswept alpine ridges². Northern mountain caribou that are currently designated in the Northern Mountain National Ecological Area (NMNEA) number approximately 11,000 individuals⁴, and their numbers have declined substantially since the early 1990s². Northern mountain herds are listed as Special Concern under the Federal *Species at Risk Act* (SARA 2005). Due to this, COSEWIC developed a management Plan for the Northern Mountain Population of Woodland caribou in Canada in 2012⁵. In BC, they are classified as blue-listed (special concern status), Vulnerable (S3) as of 2010 and assigned a priority ranking 2 on BC's Conservation Framework (scale is from 1-6, with 1 being the highest ranking) under goal 2 (to prevent species and ecosystems from becoming at risk). Furthermore, they are also considered vulnerable by local population risk status^{6,7}.

Currently there are 7 UWRs in the province that have been established as a conservation tool for northern caribou in the NMNEA⁸, however no UWRs have been established in the Fort Nelson Timber Supply Area and none have been established for the Pink Mountain herd, the target of this proposal. Pink Mountain herd has also been referred to as the Besa-Prophet, Sikanni Chief, Cypress River, Cameron-Chowade, and Beaton-Blueberry caribou herd².

The range of the Pink Mountain caribou herd is 957,542 ha centered between the Prophet River in the north and the Sikanni Chief River in the south. The western portion overlaps with the Muskwa-Kechika Management Area (MKMA). In 1996, the herd was estimated to be stable at 1,300 animals, but by 2002 the estimate declined to 850 animals. In late winter 2016, the MFLNRO NE Fish and Wildlife Section will be conducting an inventory on the herd and will have more information regarding their population status.

The federal government has documented that industrial development has reduce the Pink Mountain caribou herd range use on the east foothills and may be a future concern throughout the range⁵. Industrial development activities in the area includes forestry practices, oil and gas development (including associated well sites, LNG pipelines, pipeline right-of-ways, seismic lines, and resource roads), and wind development. Wind tenure proposals have become more feasible in the short- to mid-term due to the recent Northeast Transmission Line development. As well, the proposed ATCO transmission line would provide direct service to gas drilling operations in the area and has the potential to enable additional development including wind parks on the windswept eastern foothills deemed high value winter, calving and rutting areas. Industrial development fragments and alters caribou habitat, and creates more browse and young forests. This type of vegetation facilitates an increase in moose, deer and elk populations, which in turn attract more predators, such as wolves and bears. The increased presence of predators increases the risk to caribou through incidental predation⁵. Further, linear corridors, such as roads and seismic lines, can enhance predator movements into caribou habitat⁹.

Stone's sheep (*Ovis dalli stonei*), the secondary species in this proposal, are of high conservation concern provincially. Three-quarters of the global population of Stone's sheep occur in Northeast BC and they are considered a high-profile, valuable big game species and are rated the highest provincial ungulate species in terms of hunters willingness to pay¹⁰. They are currently yellow listed (S4) as of 2010. They prefer alpine tundra, grassland/shrub grasslands and meadows, as well as avalanche tracts. Many use the same ridge complexes in winter as the Pink Mountain caribou herd.

Expected Conservation Benefit

The expected benefit to the conservation of caribou and Stone's sheep from this proposal will be significant. Currently, 20% of the landbase of the Pink Mountain caribou herd range is formally protected under the *Park Act* (Provincial Parks), *Ecological Reserve Act* (Ecological Reserves) and *Environment and Land Use Act* (Protected Areas). These areas have various levels of protection depending on what act it falls under and the type of park; for example, Ecological Reserves are considered to be the most highly protected and least subject to human influence. WHAs and UWRs are considered designated units with varying levels of management, depending on the act or regulation the activity falls under and the established General Wildlife Measures outlined in the WHA/UWR legal order. If these UWR and WHAs are established, it would increase the level of management by 36% of the herd range (Table 1). When considering the area that caribou are known to use, based on 2001-2005 Pink Mountain caribou data, this area increases to 51% (Table 1).

Table 1: Formally protected area currently and proposed within the Pink Mountain caribou area

	Total Area (ha)	Current Protected Area	Proposed WHA (#)	Proposed UWR (#)	Potential Areas of Conservation (Proposed UWR/WHA and Protected Areas)
Pink Mountain Herd Boundary¹	957,542 ha	188,758 ha (19.71%)	103,290 ha (28)	56,999 ha (17)	36.45%
Caribou Usage Area²	668,159 ha	188,943 ha (17.80%)	105,851 ha (26)	46,813 ha (13)	51.13%

Note: all areas are in hectares (ha)

¹Pink Mountain Herd Boundary designated by MOE

²Caribou Usage Area is the minimum convex polygon (MCP) based on all collared Pink Mountain northern caribou data (2001-2005) using the *genmcp* tool in *Geospatial Modeling Environment*¹¹

This proposal will also contribute to the Conservation Framework goal for caribou and Stone's sheep, which is to prevent species and ecosystems from becoming at risk. By designating WHAs and UWRs to protect areas important to the survival of these species, the Province of BC will be contributing to the conservation framework's action of 'ecosystem and habitat protection' for caribou and Stone's sheep.

WHA and UWR selection

The proposal meets the requirements for caribou and Stone's sheep UWRs and caribou WHAs and is consistent with the habitat attributes and required evidence of use specific in the Identified Wildlife

Management Strategy species account⁷. The units of this proposal have been drafted over time from habitat models, regional biologist's expertise, and input from First Nations.

Initially, units were developed using a resource selection model based on GPS and VHF radio-telemetry from caribou collared in the Pink Mountain herd from 2001 to 2003 through a University of Northern British Columbia (UNBC) project. Refer to Gustine (2005)¹², Parker and Gustine (2007)¹³ and Parker and Walker (2007)¹⁴ for modeling methodology and results. Proposed UWR units that were found to also be used by Stone's sheep (through modeling, telemetry or aerial surveys – refer to Parker and Walker (2007)¹⁴) were identified as Stone's sheep winter habitat, as a secondary species. See Table 8 (Appendix 1) for more details.

During the initial development, low elevations units for winter range were identified, however the regional biologist conducting the consultation decided not to include them in the package. Consultation occurred in spring 2012; First Nations identified low elevation caribou winter range and calving area as important and the proposal was adapted to include those features.

In spring 2015, boundaries of the units were adjusted based on additional telemetry and survey information. This included caribou special landscape features that were identified from observations (Gustine and Walker, UNBC (2001-2005); Woods and Pate, Ministry of Environment (2008)) but never included in previous UWR/WHA proposals. Boundaries were digitized in ArcGIS 10.2¹⁵ using orthophotographs (2003) and Landsat Enhanced Thematic Mapper panchromatic images (2004) and buffered by 400 m to account for error in the digitization process and to correspond to the minimum 50 ha size for WHAs⁷.

Unfortunately, inventory work for the Pink Mountain herd has not been consistent over the years. Most often, surveys targeted specific ridges to find caribou, or specific wildlife management units, rather than a census of the entire Pink Mountain herd. This resulted in gaps in inventory for certain proposed areas. See Tables 5 to 8 in Appendix 1 for details on each related survey and the number of caribou and Stone's sheep sighted in each proposed unit during each survey, including incidental sightings. Additionally, in late winter 2016, the MFLNRO NE Fish and Wildlife Section will be conducting an inventory on the herd.

Consultation in the fall of 2015 revealed concerns that the data collected to delineate UWR/WHA units may be out of date and no longer applicable in the low elevation areas due to the increase in industrial development in the last decade. This industrial development increase could have promoted landscape changes which may have caused a shift in habitat usage by caribou. Therefore, NE FLNR will defer the proposed low elevation designations (originally called units UWR PM-018, PM-019 and WHA 9-181) with the exception of one low elevation caribou special feature (WHA 9-173) outside of the MKMA until additional data is gathered that will assist in refining low elevation habitat designations. FLNR will deploy VHF and GPS collars on caribou in the Pink Mountain herd late winter 2016 to determine population metrics and habitat use, including low elevation usage in the area. Data collected over the next two years will inform refined low elevation habitat designations (e.g. UWR), if warranted, outside of the MKMA.

Key Habitat Requirements

Northern Caribou Winter Habitat

Winter habitat requirements for caribou include windswept alpine and sub-alpine areas that provide low snow depths, abundant terrestrial lichens and ground forage⁷. While caribou feed primarily on terrestrial lichens, arboreal lichens are also consumed, particularly during winters of high snow accumulations. Important sources of terrestrial lichen occur on wind-swept alpine and sub-alpine habitats and mature and old lodgepole pine (*Pinus contorta*) stands^{16–18}. Subalpine krummholz habitats can also provide expanded areas of lower snow depths, accessible forage, and lower predation risk^{19,20}. Also, caribou use mid- to high-elevation subalpine forests and lower to mid-elevation pine forests that provide abundant foraging habitat^{1,7}.

The Pink Mountain herd typically winters on windswept alpine/subalpine ridges and mid- to high-elevation forests along the eastern foothills of the Rocky Mountains^{12,13}. Different wintering areas were demonstrated by the herd; caribou wintering in the Pink Mountain region selected moderate and high elevations and avoided steep slopes, while caribou east of the mountains remained at low elevations. Both wintering strategies selected for spruce and sedge meadows and avoided shrubby areas, likely to minimize predation risk.

Stone's Sheep Winter Habitat

In the winter, Stone's sheep use rock or dry alpine areas, even though conifer forests are more abundant habitat available in the Pink Mountain area¹⁴. Stone's sheep have also been found to select steep slopes, south aspects, and convex topography (ridges and mountain tops) in winter, which tend to be areas with higher air temperatures, higher wind exposure, and lower snow depths. Burned areas are selected in early and late winter. Stone's sheep followed one of two wintering strategies: low elevation winter range (warmer temperatures on south and west slopes) or high elevation winter range (more wind exposure). Subalpine spruce was avoided, as were east aspects, north aspects, and conifer habitats (in late winter).

Northern Caribou Calving Habitat

Pink Mountain northern caribou have been found to use subalpine and alpine areas during the calving period (May 25 to June 14)²¹. Caribou generally trade-off forage quality and predation risk, and hence, calving in Pink Mountain occurred in areas that were higher and steeper with lower wolf risk and lower vegetation biomass than the surrounding landscape. Three main calving areas were described for the Pink Mountain area: North Prophet, Western High Country and Foothills^{12,13,21}. Survival rates for calves in the calving areas was similar, although calves that moved more than 1 km from their calving site were twice as likely to survive compared to calves that remained near the calving site, indicating the importance of protecting large areas surrounding calving sites.

Forest Resource Impacts

Timber supply impact assessments are based on spatial overlap of the UWR/WHA units with the timber harvesting land base (THLB) and associated management direction in the General Wildlife Measures. The numbers presented below for associated UWR/WHA THLB impacts are consistent with the policy direction that the THLB budget and resultant impacts of the UWR/WHA units are calculated using Timber

Supply Area 2 (TSA 2). The proposed UWR units encompasses 56,999 ha gross area, while the proposed WHAs encompasses 107,182 ha; however, some WHAs and UWR units overlap. The impact of UWRs on the mature THLB in the Fort St. John TSA 2 is approximately 862 ha with no impact in the Fort Nelson or Mackenzie TSA. In terms of the WHAs, there will be an impact of 2,919 ha in the Peace Forest District and no impact in Fort Nelson or Mackenzie Forest District. When a WHA and UWR unit overlaps, the UWR is taking the THLB hit. This proposal has no risk of exceeding the 1% mature THLB budget for the northeast region. The overlap with THLB for the proposed UWR and WHA units are summarized below (Tables 2 and 3), while each individual WHA and UWR unit's THLB impact is summarized in Appendix 2.

Table 2: Timber harvest landbase (THLB) impact for proposed caribou and Stone's sheep UWR units in the Fort St. John, Fort Nelson and Mackenzie Timber Supply Areas.

	UWR size (ha)	THLB Impact (ha)
Fort Nelson TSA	27,772	0
Mackenzie TSA	0	0
Fort St John TSA	29,227	862

Table 3: Timber harvest landbase (THLB) impact for proposed caribou WHA units in the Peace, Fort Nelson and Mackenzie Forest Districts.

	WHA size (ha)	THLB Impact (ha)
Fort Nelson Natural Resource District	50,693	0
Mackenzie Natural Resource District	3,892	0
Peace Natural Resource District	52,598	2,919

Consistent with Established Objectives

This WHA and UWR proposal for caribou and Stone's sheep is consistent with the following established objectives:

Management Plan for the Northern Mountain Population of Woodland Caribou (2012)⁵: This proposal meets the intent of objective 5 and 6 of the federal Management Plan. Specifically, objective 5 is to identify and assess the quality, quantity and distribution of important habitats specifically by (5.1) delineating key habitats (e.g., winter range, calving grounds, post-calving summer range, rutting range, etc.). Objective 6 is to manage and conserve important habitats to support healthy caribou herds by (6.1) conserving key habitats utilizing existing land designation tools and (6.2) manage human disturbances of caribou and their habitat including mechanized (e.g., off-road vehicles, snowmobiles) and non-mechanized access. This proposal will help implement the prescribed recovery actions from the Management Plan by designating important caribou habitat as WHAs and winter range as UWRs. The UWR/WHA designation will secure available high quality habitat and reduce the impact of industrial development activities within important caribou habitat.

Muskwa-Kechika Advisory Board Strategic Direction and Operational Business Plan (2015-2016)²²: One of the goals for the MKMA board is to ‘facilitate world class management of renewable and non-renewable resources that ensures the maintenance of conservation, ecological, wildlife, wilderness values’. This proposal would limit forestry practices in areas that are important for caribou and Stone’s sheep and therefore is in conjunction with the goals of the MKMA.

Land and Resource Management Plans were developed to guide direction on all aspects of land and resource management within the area. There are three LRMPs that this proposal overlaps with:

Fort Nelson LRMP (2007)²³: One general recommendation in the LRMP is to ‘identify critical ungulate winter habitats for consideration as Wildlife Habitat Areas’, which has already been completed for northern caribou and Stone’s sheep to prepare for this proposal. Further, two Resource Management Zones (RMZ) overlap with this proposal (1) Prophet RMZ, identified as special management with an objective to ‘manage to maintain forest attributes suitable for habitat for Stone’s sheep, elk, caribou, moose, and goats’ and to ‘manage access to avoid disturbance within ungulate winter habitat and minimize disturbance near winter habitat’. (2) Kula RMZ states to Identify and map important habitat elements of red and blue-listed and regionally significant species for consideration for Wildlife Habitat Areas. Both of these objectives will be met with the UWR/WHA designation, as it will secure available high quality habitat and reduce the impact of disturbance by managing access within important caribou habitat.

Fort St John LRMP (1997)²⁴: The general direction for the LRMP is to provide habitat requirements for rare, threatened, and regionally significant species, including caribou, at landscape and stand levels. Specifically, one of its recommendations is to ‘consider identifying and designating critical caribou habitat areas, on a priority basis, as wildlife habitat areas (WHAs)’. This recommendation will be met with this proposal, as UWR and WHAs will be legally designated in the area for northern caribou and Stone’s sheep. Further, the Besa-Halfway-Chowade RMZ (area that overlaps with this proposal) is designated for special management for fish and wildlife habitat, wilderness values, and backcountry recreation.

Mackenzie LRMP (2000)²⁵: An objective in the Caribou Management Strategy is to ‘manage and perpetuate caribou and caribou habitats within the Mackenzie LRMP area’. This should be completed by ‘... planning for the long term availability of suitable habitat to maintain viable caribou populations and by considering the establishment of Wildlife Habitat Areas through established processes’. Since WHAs will be legally established as a result of this proposal, this objective will be met. Furthermore, the Upper Akie area, which overlaps with this proposal, is considered a special wild land area where we need to ‘maintain habitat needs of all naturally occurring wildlife species and identify and map high value habitat features’.

Works Cited

1. Seip DR, Cichowski DB. Population ecology of caribou in British Columbia. *Rangifer Spec Issue*. 1996;(1990):73-80.
2. Heard DC, Vagt KL. Caribou in British Columbia: A 1996 status report. *Rangifer*. 1998;Special Is(1978):117-123.
3. Mcloughlin PD, Dzus E, Wynes B, Boutin S. Declines in population of woodland caribou. *J Wildl Manage*. 2003;67(4):755-761.
4. Cichowski D, Kinley T, Churchill B. *Caribou. Accounts and Measures for Managing Identified Wildlife*. Victoria; 2004.
5. Canada E. *Management Plan for the Northern Mountain Population of Woodland Caribou (Rangifer Tarandus Caribou) in Canada*. Ottawa: Environment Canada; 2012.
6. Thomas DC, Gray DR. *Update COSEWIC Status Report on the Woodland Caribou (Rangifer Tarandus) in Canada*.; 2002.
7. IWMS. *Accounts and Measures for Managing Identified Wildlife*. Victoria: Ministry of Environment; 2004.
8. B.C. Ministry of Environment. Approved ungulate winter ranges. 2015. <http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html>. Accessed May 1, 2015.
9. James ARC, Stuart-Smith AK. Distribution of caribou and wolves in relation to linear corridors. *J Wildl Manage*. 2000;64(1):154-159. doi:10.2307/3802985.
10. Demarchi RA, Hartwig CL. *Status of Thinhorn Sheep in British Columbia*.; 2004.
11. Beyer HL. Geospatial Modelling Environment (software). 2012. <http://www.spatial ecology.com/gme>.
12. Gustine DD. Plasticity in selection strategies of woodland caribou (*Rangifer tarandus caribou*) during winter and calving. 2005.
13. Parker KL, Gustine DD. *Winter Habitat Selection and Calving Strategies of Woodland Caribou in the Besa-Prophet*.; 2007.
14. Parker KL, Walker ABD. *Habitat Selection and Behavioural Strategies of Stone's Sheep in the Besa-Prophet. Part 2 of Project: An Ecosystem Approach to Habitat Capability Modeling and Cumulative Effects Management*. Prince George; 2007.
15. ESRI. ArcGIS Desktop: Release 10.2. 2014.
16. Hatler DF. *Studies of Radio-Collared Caribou in the Spatsizi Wilderness Park Area, British Columbia, 1980-1984*. Smithers, British Columbia; 1986.
17. Terry EL, Wood MD. Seasonal Movements and Habitat Selection by Woodland Caribou in the Wolverine Herd, North-central British Columbia Phase 2 : 1994-1997. 1999;(204):36.
18. Edmonds EJ. Population status, distribution, and movements of woodland caribou in west central Alberta. *Can J Zool*. 1988;66(4):817-826.
19. Cichowski DB. *Seasonal Movements, Habitat Use, and Winter Feeding Ecology of Woodland Caribou in West-Central British Columbia*.; 1993.
20. Seip DR. Factors limiting woodland caribou populations and their interrelationships with wolves and moose in southeastern British Columbia. *Can J Zool*. 1992;70:1494-1503.
21. Gustine DD, Parker KL, Lay RJ, Michael P, Heard DC. Calf Survival of Woodland Caribou in a Multi-Predator Ecosystem Calf Survival of Woodland Caribou in a Multi-Predator Ecosystem Sobrevivencia de Crais de Caribu de Bosque en un Ecosistema con Depredadores Múltiples. 2006:1-32.
22. Area Board of Directors M-KM. *Muskwa-Kechika Advisory Board Strategic Direction and Operational Business Plan, April 1, 2015 – March 31 2016*.; 2015.
23. Team L and RMP. *Fort Nelson Land and Resource Management Plan*.; 2007.
24. Group FSJLW. *Fort St. John Land and Resource Management Plan*. Fort St John, BC; 1997.
25. Table L. *Mackenzie Land and Resource Management Plan*.; 2000.
26. Walker ABD, Parker KL, Gillingham MP, Gustine DD, Lay RJ. Habitat selection by female Stone's sheep in relation to vegetation, topography, and risk of predation. *Ecoscience*. 2007;14(1):55-70. doi:10.2980/1195-6860(2007)14[55:HSBFSS]2.0.CO;2.
27. Walker ABD, Parker KL, Gillingham MP. Behaviour, habitat associations, and intrasexual differences of female Stone's sheep. *Can J Zool*. 2006;84(8):1187-1201. doi:10.1139/z06-109.
28. Walker ABD. *Habitat Selection and Behavioural Strategies of Stone's Sheep in Northern British Columbia*. 2005;(October).

29. Sittler KL, Parker KL, Gillingham MP. Resource separation by mountain ungulates on a landscape modified by fire. *J Wildl Manage*. 2015;79(4):591-604. doi:10.1002/jwmg.869.

Appendix 1

Table 5: Caribou observations in each proposed Ungulate Winter Range unit for each survey conducted by Northeast Fish and Wildlife in the Pink Mountain area. Incidental caribou sightings are included in the table below. NA = survey did not cover the proposed unit.

UWR Unit	Name	Size (ha)	1994	1995	1998	1999	2000	2007	2008
PM-001	Marion East	2,333	0	0	NA	0	3	0	23
PM-002	Butler-two bit	2,500	0	0	3	0	21	0	50
PM-003	Buckinghorse 2	2,787	0	0	3	0	233	42	72
PM-004	Buckinghorse 1	1,125	17	0	NA	0	0	11	3
PM-005	Besa West	1,500	4	4	1	0	5	12	NA
PM-006	Besa East	3,198	0	32	1	14	0	21	0
PM-007	Unnamed	3,396	7	5	NA	0	0	26	NA
PM-008	Klingzut-pocketknife	7,403	0	48	3	2	0	12	94
PM-009	NA	972	NA	NA	NA	NA	NA	NA	NA
PM-010	Luckhurst Mnt	1,490	6	0	NA	0	0	0	NA
PM-011	NA	1,306	NA	NA	NA	NA	NA	NA	NA
PM-012	NA	1,938	NA	NA	NA	NA	NA	NA	NA
PM-013	NA	12,434	11	NA	NA	NA	10	NA	NA
PM-014	Prophet North	5,285	0	NA	NA	0	0	9	NA
PM-015	Chicken Creek	4,679	5	0	NA	2	16	25	NA
PM-016	Headstone Creek	2,098	0	0	NA	0	33	34	NA
PM-017	Pink Mountain	2,557	NA	30	3	8	12	0	NA

Table 6: Caribou observations in each proposed Wildlife Habitat Area unit for each survey conducted by Northeast Fish and Wildlife in the Pink Mountain area. Incidental caribou sightings are included in the table below. NA = survey did not cover the proposed unit.

WHA Unit	Name	Size (ha)	1994	1995	1998	1999	2000	2007	2008	2014
9-146	NA	3,892	NA	NA	NA	NA	NA	NA	NA	NA
9-147	NA	7,710	NA	NA	NA	NA	NA	NA	NA	NA
9-148	NA	15,363	2	NA	NA	NA	NA	4	NA	NA
9-149	Richards Creek	10,390	NA	NA	NA	1	NA	2	NA	NA
9-150	Townscey Creek	12,463	11	NA	NA	NA	10	NA	NA	NA
9-151	Buckinghorse 1	1,125	17	NA	NA	NA	NA	11	3	NA
9-152	Buckinghorse 2	2,787	NA	NA	3	NA	233	42	72	NA
9-153	Neves-Keily	5,069	33	NA	NA	NA	2	NA	NA	NA
9-154	Mt Withrow	956	17	NA	NA	NA	NA	NA	NA	NA
9-155	Pocketknife	7,403	NA	48	3	2	NA	12	94	NA
9-156	NA	12,589	NA	NA	NA	NA	NA	NA	NA	NA
9-157	Neves-Trimble	11,623	6	NA	2	NA	6	1	NA	NA
9-158	Besa East	3,198	NA	32	1	14	NA	21	NA	NA
9-159	Besa West	1,500	4	4	1	NA	5	12	NA	NA
9-160	Hurst	1,490	6	NA	NA	NA	NA	NA	NA	NA
9-161	NA	8,313	NA	NA	NA	NA	NA	NA	NA	3

Table 7: Summary of information sources used to determine movement patterns and habitat use of Pink Mountain caribou to support the proposed caribou UWRs

Reference	Source Type	Year	Description and Recommendations
BC MOE (unpubl. data)	Winter aerial inventory	1993	Aerial survey conducted between the Halfway and Prophet Rivers, 1432 caribou were observed
BC MOE (unpubl. data)	Winter aerial inventory	1994	Aerial survey conducted Jan 31 to Feb 3 between the Prophet and Halfway Rivers, 264 caribou were observed
BC MOE (unpubl. data)	Winter aerial inventory	1995	Aerial survey conducted Feb 15-16 between the Prophet and Halfway Rivers, 333 caribou were observed
BC MOE (unpubl. data)	Telemetry study	1998-2002	MOE monitored 35 VHF-collared caribou in the area
BC MOE (unpubl. data)	Late winter aerial inventory	1999	Stratified block aerial surveys covering management units (MUs) 7-42 (Mar 23, 24, 28), 7-43 (Feb 19, 22, Mar 29), 7-57 (Mar 11, 12, 15, 28), 7-58 (Mar 9, 28) between Prophet and Halfway Rivers. 87 caribou were observed in MU 7-42, 29 in MU 7-43, 29 in MU 7-57, and 44 in MU 7-58.
BC MOE (unpubl. data)	Late winter aerial inventory	2000	Aerial surveys in March covering MU 7-42, MU 7-43, MU 7-57, MU 7-58 between Prophet and Halfway Rivers. 25 caribou (including 2 with collars) were observed in MU 7-43, 377 were observed in MU 7-42, MU 7-57, and MU 7-58 (including 12 with collars)
Gustine (2005), Parker and Gustine (2007), Gustine et al. (2006a), Gustine et al. (2006b), Gustine and Parker (2008)	GPS telemetry study (with associated aerial surveys)	2001-2005	UNBC project to investigate winter habitat use and calving strategies, GPS radio-collaring study from 2001-2003 (n=48, but only 4 functioning) and 2004 (n=15). Locations were collected until 2005
BC MOE (unpubl. data) Thiessen (2008)	Late winter aerial inventory	2007	Aerial survey of alpine/subalpine ridges targeting Stone's sheep in MUs 7-35, 7-36, 7-42, 7-43, 7-50, 7-51, 7-57. Total of 2014 caribou observed, including 266 caribou in the proposed UWR areas
BC MOE (unpubl. data) Goddard (2009)	Winter reconnaissance-level flight	2008	Aerial survey of potential UWR blocks, 242 caribou observed

Table 8: Summary of information sources used to determine movement patterns and habitat use of Stone's sheep used to develop proposed Stone's sheep UWRs

Reference	Source Type	Year	Description and Recommendations
BC MOE (unpubl. data)	Winter aerial inventory	1994	Aerial survey conducted Jan 31 to Feb 3 between the Halfway and Prophet Rivers, 1016 Stone's sheep were observed
BC MOE (unpubl. data)	Late winter aerial inventory	2002	Aerial surveys in March covering the east slopes of the Rocky Mountains; 2494 Stone's sheep were observed
Parker and Walker (2007) ¹⁴ , Walker et al. (2007) ²⁶ , Walker et al. (2006) ²⁷ , Walker (2005) ²⁸ , Sittler and Parker (2015) ²⁹	GPS telemetry study (with associated aerial surveys)	2001-2003	UNBC project to investigate habitat use and lambing strategies of Stone's sheep. GPS radio-collaring study from 2001 – 2003 (n= 36 ewes, only 33 functioning); developed surface models of high use areas
BC MOE (unpubl. data)	Late winter aerial inventory	2007	Aerial survey conducted March 6-27 of alpine/subalpine ridges targeting Stone's sheep in Mus 7-35, 7-36, 7-42, 7-43, 7-50, 7-51, 7-57
BC MOE (unpubl. data)	Winter aerial inventory	2012	Aerial survey conducted Jan 16 to Mar 1 along east slopes of the Rocky Mountains, 1176 Stone's sheep were observed

Appendix 2

Timber Harvesting Land Base Impact for Pink Mountain WHA/UWR Northern Caribou and Stone's Sheep Proposal

Total THLB Impact

	UWR (ha)	WHA (ha)	Total (ha)
Fort Nelson TSA/Natural Resource District	0	0	0
Mackenzie TSA/Natural Resource District	0	0	0
Fort St John TSA2/Peace Natural Resource District	862	2,919	3,591

Note: UWR is taking the hit when there is an overlap of UWR and WHAs

UWR Impact

UWR UNIT No	Size (Hectares)	THLB (ha)		
		Fort Nelson	Mackenzie	FSJ
PM-001	2,333	NA	NA	26.85
PM-002	2,500	NA	NA	111.97
PM-003	2,787	NA	NA	25.72
PM-004	1,125	NA	NA	0.00
PM-005	1,500	0	NA	1.25
PM-006	3,198	0	NA	47.84
PM-007	3,396	0	NA	NA
PM-008	7,403	0	NA	98.83
PM-009	972	0	NA	NA
PM-010	1,490	NA	NA	6.78
PM-011	1,306	0	NA	NA
PM-012	1,938	NA	NA	169.79
PM-013	12,434	0	NA	9.98
PM-014	5,285	0	NA	NA
PM-015	4,679	NA	NA	334.15
PM-016	2,098	NA	NA	0.00
PM-017	2,557	NA	NA	29.16
TOTAL	56,999	0	NA	862

WHA Impact

919WHA TAG	Size (Hectares)	THLB (ha)		
		Fort Nelson	Mackenzie	FSJ
9-146	3,892	NA	0	NA
9-147	7,710	0	NA	NA
9-148	15,363	0	NA	NA
9-149	10,390	0	NA	NA
9-150	12,463	0	NA	9.98
9-151	1,125	NA	NA	0.00
9-152	2,787	NA	NA	25.72
9-153	5,069	NA	NA	4.44
9-154	956	NA	NA	12.43
9-155	7,403	0	NA	98.83
9-156	12,589	NA	NA	459.54
9-157	11,623	NA	NA	200.01
9-158	3,198	0	NA	47.84
9-159	1,500	0	NA	1.25
9-160	1,490	NA	NA	6.78
9-161	8,313	NA	NA	1,867.22
9-162	61	0	NA	NA
9-163	178	NA	NA	48.67
9-164	70	NA	NA	0.00
9-165	155	0	NA	NA
9-172	81	0	NA	NA
9-173	60	NA	NA	12.49
9-174	105	NA	NA	0.00
9-175	87	NA	NA	14.53
9-176	154	NA	NA	12.41
9-177	111	NA	NA	35.27
9-178	76	NA	NA	28.27
9-179	66	NA	NA	32.99
9-180	137	0	NA	NA
Total	107,182	0	0	2,919