BC hydro

FOR GENERATIONS

Report Title: *Peace River Wildlife Surveys – Summary Report Winter Baseline Inventory Surveys 2006*
Project: Peace River Site C Hydro Project
Prepared By: Keystone Wildlife Research Ltd.
Prepared for: BC Hydro

NOTE TO READER:

This is a report on a study commissioned toward the development of engineering, environmental and technical work conducted to further define the potential Site C project.

For environmental studies, the focus is on the development of an environmental and socio-economic baseline around the area of the potential Site C Project. Baseline studies are generally a survey of existing conditions within a project study area.

This report and other information may be used for future planning work or an environmental assessment or regulatory applications related to the potential Site C Project.

For additional information, contact:

Peace River Site C Hydro Project
P.O. Box 2218
Vancouver, B.C.
V6B 3W2
Toll-free: 1 877 217 0777
Fax: 604 623 4332
Email: sitec@bchydro.com

PEACE RIVER WILDLIFE SURVEYS – SUMMARY REPORT
Winter Baseline Inventory Surveys
2006

Prepared by:

Keystone Wildlife Research Ltd.

Prepared for:

BC Hydro

Field Work: 2005-2006
Report Finalized: 2009

Winter Baseline Inventory Surveys

Prepared for

BC Hydro
C/O Carol Lamont
Engineering – Generation Environment
E05 - 6911 Southpoint Drive
Burnaby, B.C. V3N 4X8

Prepared by

Keystone Wildlife Research Ltd.
#112, 9547 152 St.,
Surrey, BC
V3R 5Y5

EXECUTIVE SUMMARY

The study conducted was a baseline study, commissioned by BC Hydro toward the development of an environmental baseline around the area of the potential Site C Project. Baseline studies are preliminary to and not intended to be environmental effects assessment studies. Baseline studies are generally a survey of existing conditions within a project study area.

FURBEARERS

Winter snow tracking surveys were completed along the Peace River valley between Hudson's Hope and the British Columbia/Alberta border between February 18th and 26th 2006. Nineteen transects, totalling 41.4 km were completed, with the primary focus on habitat suitable for fisher (*Martes pennanti*) and marten (*Martes americana*). Fourteen large mustelid tracks (marten or fisher) were located, averaging about one track per 3 km surveyed. Seven camera stations were baited and monitored for over 30 days in suitable habitat where tracks had been observed, beginning on February 28. Marten were photographed at five of the seven stations. No fishers were photographed. Elk (*Cervus canadensis*), red squirrels (*Tamiasciurus hudsonicus*) and Gray Jays also triggered the cameras. Black bears (*Ursus americanus*) began disturbing stations in early April and all stations were removed by May 25, 2006.

UNGULATES

A stratified random block count that was completed in 1991 to estimate numbers of deer (*Odocoileus* spp.), elk (*Cervus canadensis*) and moose (*Alces americanus*) along the Peace River between the Moberly River and Hudson's Hope. This survey was repeated in 2006 and expanded to include areas downstream of the Moberly River, to quantify the regional population. Forty-seven blocks were defined in 2006, including 27 of the 29 blocks surveyed in 1991. Pre-stratification was completed on February 14, 2006 using a fixed wing aircraft and block counts were completed using a Bell Jet Ranger with 3 observers from February 15 to 18, 2006. The numbers of moose counted were similar to those reported for 1991 in all strata. Numbers of deer seen were similar to 1991 on north aspects and in the valley bottom, but substantially lower on south aspects. The numbers of elk were greater on south aspects and in the valley bottom. Snow depths (estimated from the air) were 15-20 cm, which is well below the average (50 cm). It would be advisable to repeat the census with more normal winter snow conditions to confirm the numbers of ungulates using each area.

BEAVER

An aerial census for beaver (*Castor canadensis*) was conducted to document lodge locations and estimate the population size upstream and downstream of the Moberly River. Aerial beaver lodge and food cache counts were completed along the Peace River by Keystone Wildlife Research on September 13 and 14, 2005. Observers noted the

presence of beaver caches and lodges and recorded their location using a GPS and a hardcopy map. The survey located 67 active and 60 inactive lodges between Moberly River and Hudson Hope. The results of the 2005 survey show that the beaver population has remained relatively stable over the last 15 years. The baseline inventory is adequate at this time. An additional survey should be completed to update numbers prior to any changes to water use planning and or hydroelectric development.

DISCLAIMER

This report was prepared exclusively for BC Hydro and Power Authority by Keystone Wildlife Research Ltd. The quality of information, conclusions and estimates contained herein is consistent with the level of effort expended and is based on:

i) information available at the time of preparation;

ii) data collected by Keystone Wildlife Research Ltd. and/or supplied by outside sources; and

iii) the assumptions, conditions and qualifications set forth in this report.

This report is intended to be used by BC Hydro and Power Authority only, subject to the terms and conditions of its contract with Keystone Wildlife Research Ltd. Any other use, or reliance on this report by any third party is at that party's sole risk.

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

Wildlife surveys along the Peace River Valley were conducted as a baseline study, commissioned by BC Hydro toward the development of an environmental baseline around the area of the potential Site C Project. Baseline studies are preliminary to and not intended to be environmental effects assessment studies. Baseline studies are generally surveys of existing conditions within a project study area. These studies may be used to inform future water use planning and or hydroelectric development.

The main objectives of the surveys are to:

- Document the occurrence and relative abundance (if possible) of fishers and other furbearers in the Peace Valley using snow tracking and photo inventory methods.
- Update 1991 census data for deer, moose and elk in the Peace Valley and adjacent slopes upstream of Moberly River,
- Census deer, moose and elk downstream of the Moberly River to quantify the regional population
- Census beaver colonies along the Peace River.

Marten (*Martes americana*) and fisher (*Martes pennanti*) are valued furbearers that are known to inhabit the Peace River Valley. Marten are provincially Yellow-listed (not at risk), while the fisher is Blue-listed (vulnerable, BC CDC 2006). The purpose of the winter 2006 surveys was to document the occurrence and relative abundance of fisher and other furbearers in the Peace Valley using snow tracking and photo inventory methods.

Several species of ungulates are abundant in the Peace River valley. An ungulate inventory using aerial survey methods was conducted to estimate numbers of deer, elk and moose along the Peace River in 1991. A repeat of the survey was completed in 2006 to monitor changes in ungulate numbers and distribution since 1991, and to survey areas from the Moberly River to Alberta.

Beaver are valued furbearers in the Peace region and a large population is resident in the Peace corridor. An aerial census for beaver was conducted to document lodge locations and estimate the population size within the study area.

2.0 STUDY AREA

The study area included the Peace River Valley in northeastern British Columbia, from the Peace Canyon Dam to the Alberta Border (Figure 1). The entire study area falls into the Boreal White and Black Spruce moist, warm variant (BWBSmw1) and the Peace Lowlands (PEL) ecosection. The study area included the valley bottom, river breaks and habitat within 500 m of the crest of the breaks on the plateau.

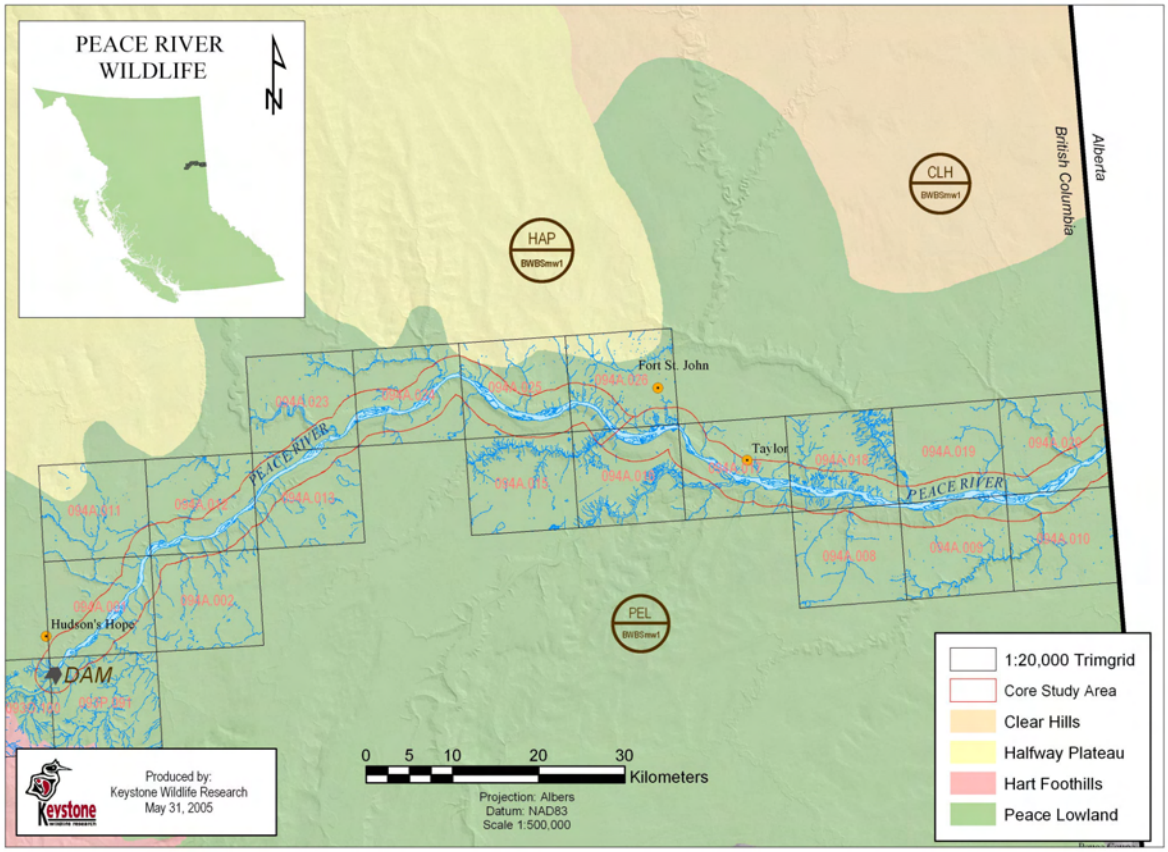

Figure 1. The core study area corridor along the Peace River.

3.0 MARTEN/FISHER SURVEYS

Furbearer surveys were undertaken primarily to document the occurrence and habitat associations of fishers. Fishers are thought to be more common in the Omineca-Peace region than in other parts of the Province, based mainly on regional harvests reported to the Provincial Fur Harvest Database between 1993 and 2001 (Weir 2003).

3.1 Methods

Snow tracking was used to identify sites being used by marten or fisher. Tracks cannot be used to reliably distinguish between marten and fisher, so camera stations were set up to confirm use by fishers.

Snow Tracking

Tracking sites were selected based on known habitat preferences of fisher and including young to mature trembling aspen *(Populus tremuloides),* balsam poplar *(Populus balsamifera)*, or white spruce *(Picea glauca)* stands, or mixed forest. Tracking surveys generally followed methodologies described in ***Inventory Methods for Medium-sized Territorial Carnivores: Coyote, Red Fox, Lynx, Bobcat, Wolverine, Fisher & Badger*** (RIC 1999). A tracking form (Appendix 1) was completed for any mustelid (weasel

family) or lynx (*Lynx canadensis*) track encountered. A ground inspection form (GIF; BC MELP and BC MoF 1998) was completed when a marten or fisher track was encountered. Habitat attributes recorded included elevation, slope, aspect, slope position, ecosystem unit (site series) and structural stage. Tracks of snowshoe hare, red squirrel, and coyote, which were abundant in many areas, were not recorded to save time and increase the area searched for the target species. Other uncommon species such as otter, mink and lynx were recorded when encountered.

Remote Cameras

Camera stations were selected based on typical fisher habitat (young to mature deciduous and mixed forest, or white spruce stands) and/or areas where fisher or marten tracks had been found during the tracking survey. Seven bait/camera stations were set up using Trailmaster Second Generation TM1550 Active Infrared Trail Monitors and Canon 35 mm cameras between Taylor and Hudson's Hope, British Columbia. The Trail Monitors consisted of an infrared beam transmitter and receiver, with the receiver attached to the camera via a cable. Cameras were set up in trembling aspen or balsam poplar forest stands on flat or gentle slopes.

Three trees were selected in a general north-south direction, with the middle tree being slightly off-set (10-15 cm) from the outside trees (Figure 2, 3, 4). This arrangement would pass the infrared beam 5-15 cm in front of the tree with the camera. Trees selected were large enough to mount the bait and equipment and also large enough that the trees would not move significantly during windy conditions. The infrared receiver was mounted facing north so that the sun did not interfere with receiving the beam.

When a fourth tree was available in front of the bait tree, the camera was set on this tree opposite the bait (Figure 3). When only three trees were available, the camera was set on the tree with the receiver facing the bait tree, giving a side view of the station (Figure 4). The cameras were mounted to the trees using screws and washers and the tripod provided. The camera was normally set up sideways to take a vertical photo of the tree. The beam transmitter and receiver were placed in trees approximately 2 m above ground to reduce the chances of interference from other non-target, terrestrial species (e.g. wolf, coyote, hare).

Figure 2. Typical bait and beam transmitter set-up.

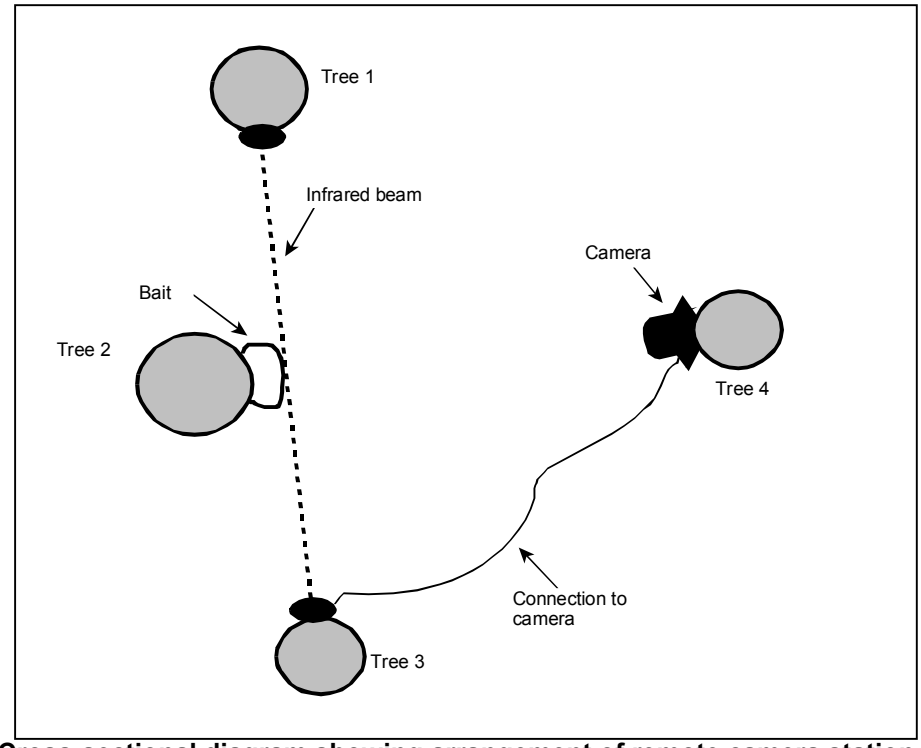

Figure 3. Cross-sectional diagram showing arrangement of remote camera station, four-tree configuration.

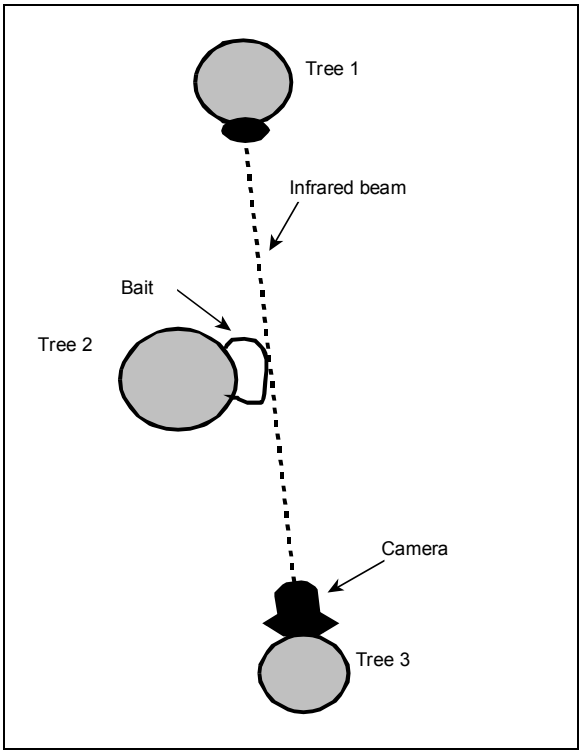

Figure 4. Cross-sectional diagram showing arrangement of remote camera station, three tree configuration.

The bait for all the stations was beaver obtained from local trappers. Each piece of meat was wrapped in 5 mm metal mesh and secured onto a tree with fencing staples. This size was used to help deter squirrels and avian scavengers (i.e. corvids). The bait was placed approximately 5-15 cm above where the beam would cross in front of the tree. Cameras were triggered when the infrared beam was broken. Three different scents where placed above the bait and with the bait. The scents used at all stations were a commercial canid lure (consisting of skunk scent), a fisher lure, and a marten lure mixed with raspberry jam and anise seed (Jones and Raphael 1993; Weir 2006). The scents were placed on the tree above the bait using a small stick to help disperse the smell via wind. The used stick was placed in the wire mesh with the meat bait.

The transmitters and receivers were attached to the trees using the provided adjustable straps, or duct tape if the tree was too large for the straps. The transmitters, receivers, camera tripod and cables were duct-taped around the tree for additional support when needed. If cables crossed from one tree to another, they were first wrapped around each tree as high as possible and then duct-taped in place. The station number was written in black marker on a note card and placed in a clear ziplock bag, then taped to the bait tree facing the camera (Figure 2).

The **pulses to miss (-P)** of the receivers (and consequently cameras) was set to record an event and take a photograph when the beam pulse was missed for a minimum of 0.25 seconds (-P 5).

The **delay function (cd)** for all receivers was set to take a photograph at a maximum of one photograph every 5 minutes (cd5.0). If the beam was broken again within 5 minutes after a photograph is taken (i.e. the same animal at the bait), the camera would not trigger again until 5 minutes had passed. The receiver continued to record events regardless of the time passed between the events. The **camera time zones (CTZ)** were set to take photographs 24 hours a day. Each camera had an automatic flash.

Once a station was set up, the transmitter and receiver were tested to ensure proper function of the data-logger (receiver) and then reset. The camera was then turned on and a test photo was taken to ensure the whole station was properly functioning.

3.2 Results

Snow Tracking

Fourteen separate fisher/marten tracks were found over 41.4 km traversed (Table 1; Figure 5), resulting in a track every 2957 m (Appendix 2). A track was assumed to indicate one individual. Since it is difficult to distinguish between marten and fisher tracks in snow unless tracking conditions are excellent, separation of the two species was rarely possible (RIC 1999). Eight tracks were encountered that were thought to be from fisher based on size and gait (Table 2).

Other species encountered included: lynx, otter, mink, and unknown weasel (Table 2). Red squirrels, snowshoe hare, coyote and wolf tracks were also observed but these non-target species were not recorded.

Table 1. Summary of fisher (MAPE) and marten (MAAM) tracking results in the Peace River Valley.

Number of days surveyed	Number of transects completed	Distance surveyed (km)	Number tracks encountered (MAPE or MAAM)
9	19	41.4	14

Table 2. Species track totals found during surveys.

Fisher	Marten	Lynx	River Otter	Mink	Unk. Weasel
8	6	1	1	3	8

Marten/fisher tracks were encountered in structural stages 4 (15-40 years) to 6 (80-140 years) forest), on slopes ranging from 0 to 35% slope, indicating their use of a variety of structural stages during the winter (Table 3). The ease of finding tracks increased after light snowfalls of one to two cm, conditions that occurred on four of the nine sample days. Light snow over a harder crust provided the best substrate for finding furbearer tracks. Many areas in the study area had little or no snow cover (i.e. south aspect slopes or white spruce-dominated canopies). North aspects and deciduous-dominated forest had more continuous snow cover and were the areas selected for track surveys.

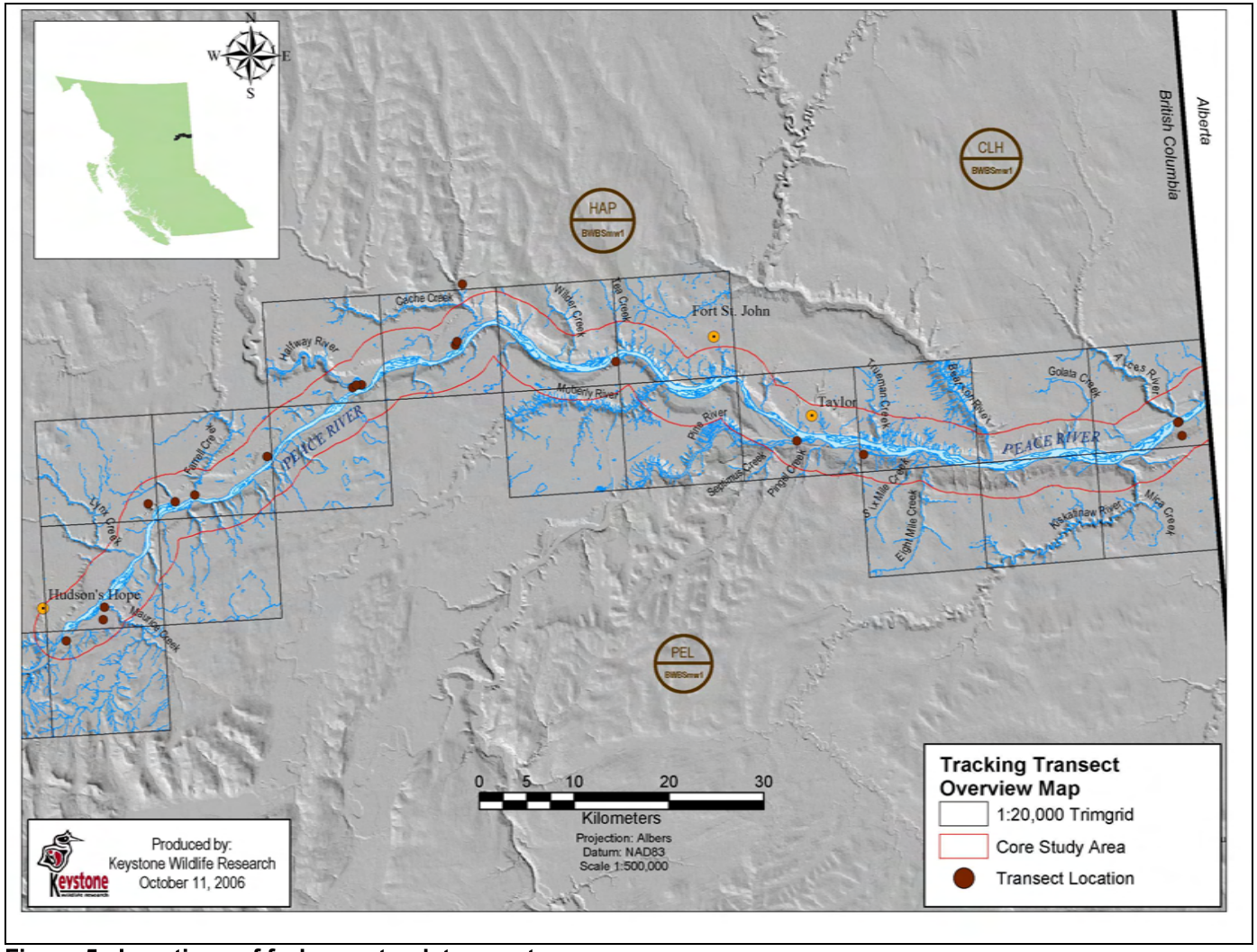

Figure 5. Locations of furbearer track transects.

Table 3. Site conditions at plots where marten/fisher tracks were found.

Plot	Date	Site Series *	Site Series Symbol*	Struct. Stage*	Slope Gradient	Aspect (degrees)	Meso Slope Position	Site Notes
WS2-1	Feb 19, 2006	$01	$ap	4	0	N/a	CREST	Fisher 27cm STRIDE 14cm STRADDLE HIND L 8cm W 5.5cm UTM 6078/62414
WS2-2	Feb 19, 2006	00	AS	4	35	270		Marten 37cm STRIDE 11cm STRADDLE HIND L 6.5cm W 5cm
WS4-3	Feb 20, 2006	$01	$ap	5	2	360	CREST	Marten STRADDLE 8.8cm STRIDE 13.5cm HIND W 5cm L 6.3cm TRAIL GOES UP TREE, SQUIRREL TRACKS ALONG SAME TRAIL PLOT #CD4-4 OLD TRACK 62075/5672 MARTEN 2X2 BOUND STRADDLE 49.5cm STRIDE 19.5 50/50 AT/SW - LOW SHRUBS
WS7-1	Feb 21, 2006	07	SH	6	0	N/a	LEVEL	FISHER W-6.5cm L 6.5cm STRADDLE 14.5cm STRIDE 23.5cm old track, snowed on and melted, maybe 2+ days old
WS7-5A	Feb 21, 2006	07	SH	3	0	N/a	LEVEL	FISHER W 6.5cm L 7.5cm STRIDE 33cm STRADDLE 11.5cm

Plot	Date	Site Series *	Site Series Symbol*	Struct. Stage*	Slope Gradient	Aspect (degrees)	Meso Slope Position	Site Notes
WS16-5	Feb 25, 2006	05	SO	6	0	N/a	LEVEL	FISHER WALK L 5.5cm W 5.5cm STRADDLE 12cm STRIDE20cm track goes into open area across frozen water.
WS17-1	Feb 26, 2006	$01	$ap	5	0	N/a	LOWER	FISHER L 5.5cm W 7cm STRADDLE 10cm STRIDE 58cm OLD TRACK BEFORE LAST SNOW
WS17-2	Feb 26, 2006	$01	$ap		9	320	LOWER	FISHER OLD- SNOW COVERED STRADDLE 10CM/10CM STRIDE 51CM/57CM W 4/5CM L 6.5/7CM
WS17-3	Feb 26, 2006	03	SW	6	10	355	DEPRESSION	MARTEN 2X2 BOUND STRADDLE 10CM STRIDE 46CM W 4.5CM L 55. CM FISHER CD17-4 POLY27 STRIDE 17CM STRADDLE 13CM W 5.5CM L 6CM FOLLOWING UPSTREAM
WS17-7	Feb 26, 2006	$05	$ab		18	335	MIDSLOPE	MARTEN 2X2 BOUND FRESH TRACKS - OVERNIGHT STRADDLE 8.5cm STRIDE 59CM HIND W 4CM L 6.5CM FRONT W 3.5 L 6CM 1X2X1 RUN STRADDLE 8CM STRIDE 67CM

*see Appendix 4 for definitions.

Remote Cameras

Seven camera stations were set up (Table 4; Figure 6). The Taylor (Stn. 7), Hudson's Hope (Stn. 1) and Red Creek (Stn. 2) sites were accessed by road, and the remaining 4 sites (Stns 3-6) were accessed by helicopter.

Table 4. Locations and habitat attributes of camera stations.

Camera	Mapsheet	UTMx	UTMy	Polygon	Habitat	Structural stage
#1 - Hudson's Hope	93P.091	564400	6205500	49	$AMap	5
#2 - Red Creek	94A.024	607900	6241200	off mapped area	$AMap	4
#3 - Big island	94A.016	632300	6229100	3254	SH	6
#4 - Moberly	94A.016	628200	6229800	3347	SH	6
#5 - Pond	94A.026	624000	6232600	3917	$SHac	7
#6 - Little island	94A.025	618700	6231900	3804	SCab	5
#7 - Taylor (Pine R.)	94A.017	642800	6223400	2275	SH	6

The first cameras were set up on Feb. 28, 2006. The intent was to sample for the required 28 day period that was expected to "capture" all furbearers using the area. Sampling effort varied between stations, as some stations ran out of film due to intense marten or squirrel activity. Since film was expended on some cameras and the actual sample period could not be determined until after the data was analysed, it was decided to extend the sampling period into the spring season when bears became active. All of the cameras were collected by May 25, 3006. Total sampling effort was 216 camera/days in winter (Feb 28- March 31) and 245 days in spring (after March 31, Table 6).

No fishers were detected (Table 5) but marten were detected at five of the stations (Figure 7). Marten were photographed both at night and during the daylight hours. Some stations had the bait removed or camera dislodged by bears in April. The effectiveness of the spring sampling was likely limited due to disturbance by bears. One fisher was incidentally observed on the shoulder of Highway 29, near Flash Creek, on March 10, 2006.

Other wildlife, including elk, black bear, red squirrels and Gray Jays, were also attracted to the bait (Figure 6). Black bears in spring were a particular problem in that they usually ripped the bait off the tree. A summary of activity by station is presented in Appendix 3.

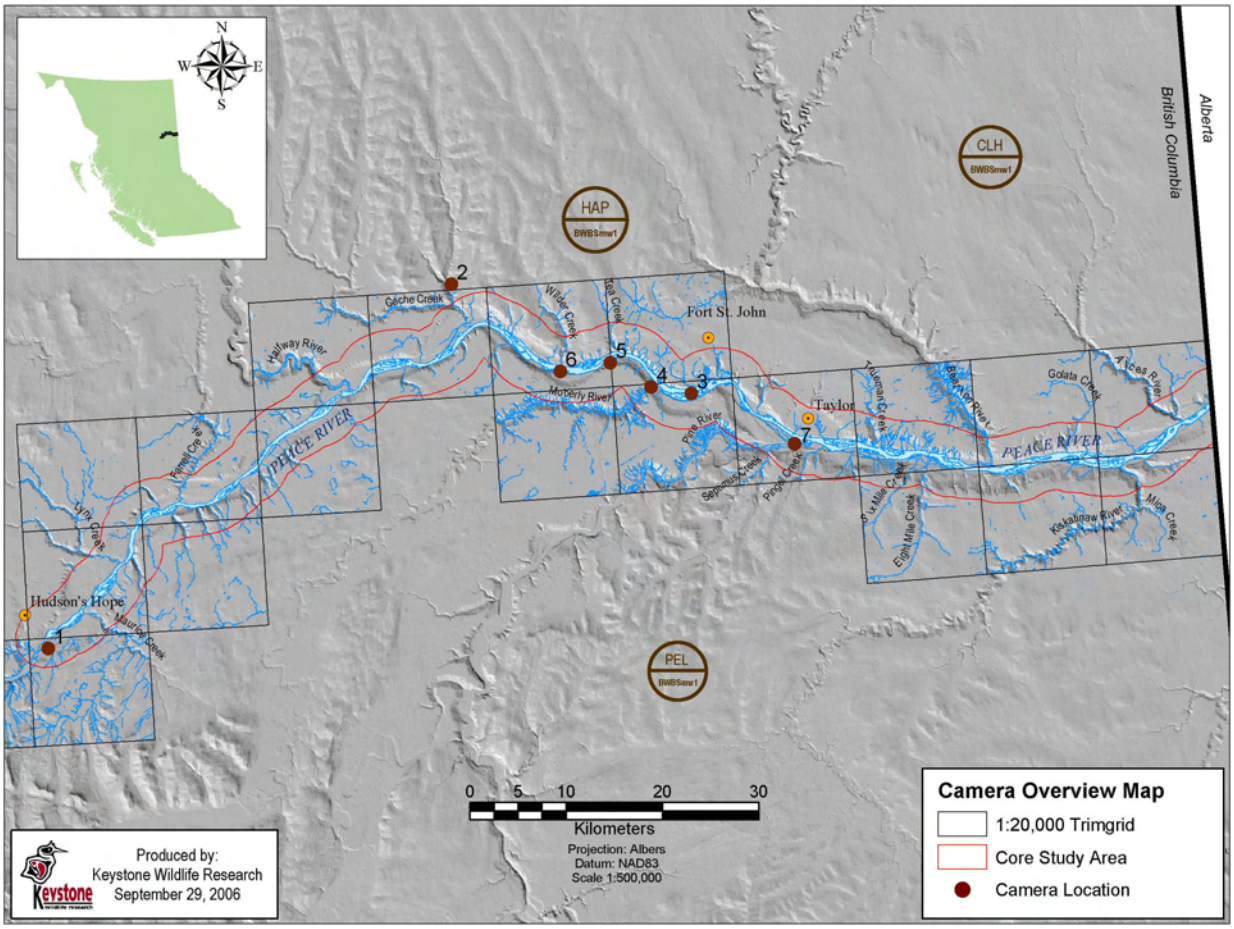

Figure 6. Locations of camera stations.

Table 5. Summary of remote camera results.

Unit	Species detected
#1 – Hudson's Hope	Marten
#2 – Red Creek	Marten, Elk, Black Bear
#3 – Big island	Red Squirrel, Elk
#4 – Moberly	Elk, Black Bear
#5 – Pond	Marten, Black Bear (ripped down bait)
#6 – Little island	Marten, Gray Jay, Elk
#7 – Taylor (Pine R).	Marten

Table 6. Summary of sampling effort.

Unit	Total sampling days*	Total Winter Sampling days (before Apr. 1)	Total Spring Sampling days (After Mar. 31)	Marten detected?
#1 – Hudson's Hope	88	29	59	Y
#2 – Red Creek	46	32	14	Y
#3 – Big Island	83	31	52	N
#4 – Moberly	62	31	31	N
#5 – Pond	43	31	12	Y
#6 – Little island	49	31	18	Y
#7 – Taylor (Pine R).	90	31	59	Y
Total	**461**	216	245	

*Total includes the day the camera was set up and the day the camera was removed or the last photo was taken.

Figure 7. A sample of the marten detected at different stations.

Figure 8. Other wildlife detected at the bait stations (black bear, elk, Gray Jay, red squirrel).

3.3 Discussion

Distinguishing fisher from marten tracks based on track size has recently been reported to be unreliable due to the extensive overlap between the species (RIC 1999). Although suspected fisher tracks were found, camera surveys at 7 sites suggested that only marten are present.

Large balsam poplars, which are rare on the landscape except in the main river valleys, are known to be a key reproductive and resting habitat for fisher. The Peace River corridor is considered to be excellent habitat for fisher based on the prevalence of the balsam poplar floodplains in the valley. Some successful telemetry and census studies have been undertaken in the Kistatinaw drainage near Dawson Creek (Rich Weir pers. comm.) and fishers have been reported in the Peace River area (Rob Woods pers comm). Therefore, the results of our surveys do not follow expectations.

In reviewing recently reported results of studies in the Kiskatinaw drainage (Weir 2005, 2006), we noted that over 50 stations were used to trap fisher within a 220 km^2 study area. Fisher were captured at only three of the 52 stations. Surprisingly, six individuals were captured at the same three stations with none at many nearby stations. This result varies from expectations, since all furbearers using a large area are expected to visit widely spaced bait stations if they are maintained over a reasonable period (28 days – RIC 1999; Zielinski and Kucera 1995). This suggests that fisher in the Peace Region are very specific in their response to bait and that they may be easily missed using standard survey techniques (few stations maintained over a long period).

In a recent census study using hair snagging and DNA analysis, approximately 10% of the over 200 hair samples were determined to be fisher (Rich Weir – pers. comm.). Preliminary findings suggest that fishers may be less abundant than previously estimated in the Peace Region.

3.4 Recommendations

Information from recent fisher studies in the Kiskatinaw drainage, southeast of the potential Site C project, indicated that fishers may be easily missed using standard survey techniques, such as few remote camera stations maintained over a long period (R. Weir, pers. comm.). A follow-up furbearer study is recommended as part of the future wildlife programs. A large number of hair snagging stations should be established and maintained from January to March 2009 in order to adequately census the Peace corridor for fisher and confirm expected habitat associations.

Approximately thirty, 20 km^2 grid cells should be established along the Peace River Corridor with one hair snagging station per grid cell. Each grid cell will be sampled over three sample periods. The final sample design should be developed in consultation with fisher expert Rich Weir.

Camera stations should also be established at or in proximity to hair snagging sample stations and/or areas where fisher or marten tracks were previously found during the tracking survey.

4.0 UNGULATE CENSUS

Ungulate surveys were completed in mid-winter to estimate the numbers of deer, moose and elk in the study area and compare them with earlier surveys.

4.1 Methods

The study area (Peace Canyon dam to the Alberta border) was divided into survey blocks. The survey blocks defined in 1991 were transferred to TRIM base maps. Some were adjusted in size due to changes in habitat quality (clearing for agricultural use) and some were eliminated due to lack of suitable habitat. Additional survey blocks were delineated in areas downstream of the Moberly River that were not surveyed in 1991.

A pre-stratification flight using a fixed-wing aircraft was conducted to stratify the blocks. The stratification was completed to classify each block as high, moderate or low abundance of each species, based on the current conditions (e.g. snow cover). Count surveys used a Bell Jet Ranger helicopter. Survey methods followed Unsworth *et al.* (1991) and ***Aerial-based Inventory Methods for Selected Ungulates: Bison, Mountain Goat, Mountain Sheep, Moose, Elk, Deer and Caribou*** (RIC 2002). Count data was analysed using Aerial Survey software (University of Idaho 2004). Count data collected in 1991 was not recorded in the same form (i.e. group sizes and vegetative cover were not recorded) but was re-analysed using the 2004 software to enable the closest possible comparisons. The University of Alaska model (Gasaway *et al.* 1986) was used to estimate the population size and confidence limits for each species in 1991.

4.2 Results

Twenty-nine survey blocks were defined in 1991: 6 in the valley bottom, upstream of the Moberly River, 14 on south aspect river breaks and 9 on north aspect breaks. Those same blocks were included in the census area for 2006 except blocks 12 and 14 (south aspects), were eliminated due to extensive clearing and development. Additional blocks were added downstream of the Moberly river, including nine new blocks on south aspects, seven on north aspects and four on the river valley bottom. The 2006 survey therefore included 21 south aspect blocks (stratum 1), six blocks in the Peace River valley bottom upstream of the Moberly River (stratum 2), 16 north aspect blocks (stratum 3) and four blocks in the Peace River valley bottom downstream of the Moberly River (stratum 4). Forty-seven blocks were defined in 2006 (Table 7, Figure 9).

Pre-stratification was completed on Feb 14, 2006 using a fixed wing aircraft and block counts were completed using a Bell Jet Ranger with 3 observers from February 15 to 18, 2006. Weather conditions were mainly cloudy with temperatures from -5 to -22^{o} C. Snow cover was above 90% in valleys and on north aspects. There was limited snow on south aspects except on level forested benches.

Strata 2 and 4 were expected to support similar numbers of animals but were separated in order to maintain a separate comparative sample for the area upstream and downstream of the Moberly River. Blocks were bounded by obvious geographical features and varied in size from 3 to 20 km^2. The largest blocks were along the river where a large portion was open water and gravel bars. All sample blocks were searched in less than one hour

of helicopter time. Nineteen blocks were counted including all 6 upstream of the Moberly River and 13 randomly selected from other strata using a computer random number table.

Table 7. Ungulate block counts completed along the Peace River in February 1991 and 2006.

Block #	Area (Ha)	Search Time (min)	# Moose		# Mule Deer		# Elk	
			2006	1991	2006	1991	2006	1991
Peace River valley bottom upstream of the Moberly River (Stratum 2)								
1	1072	25	6	14	3	5	0	0
2	1536	37	18	25	2	21	23	5
3	2075	48	11	35	53	33	56	0
4	1838	38	20	24	19	31	26	2
5	1505	40	3	10	7	13	0	0
6	1988	46	8	6	30	78	0	0
Subtotals		234	66	114	114	181	105	7
Peace River valley bottom downstream of the Moberly River (Stratum 4)								
32	1727	37	10		10		5	
33	2313	40	19		10		20	
Subtotals		77	29		20		25	
South aspect breaks (Stratum 1)								
11	746	24	25		70		0	
12	486			18		293		0
13	492	32	17	8	97	160	81	22
14	897			7		121		0
15	587			13		260		0
16	567	20	6		27	72	48	
17	423			4		248		0
18	408	28	7		99		16	
19	279			7		64		50
20	530			17				19
37	572	38	15		225		14	
41	675	22	11		84		0	
Subtotals		164	81	74	602	1332	159	91
North aspect breaks (Stratum 3)								
22	601			14		52		0
24	487			8		0		0
26	590	28	5	9	9	35	0	1
27	596	29	1		18		0	
28	613	26	3	8	1	9	0	0
48	779	21	3		11		0	
50	753	26	9		99		0	
Subtotals		130	21	39	138	96	0	1

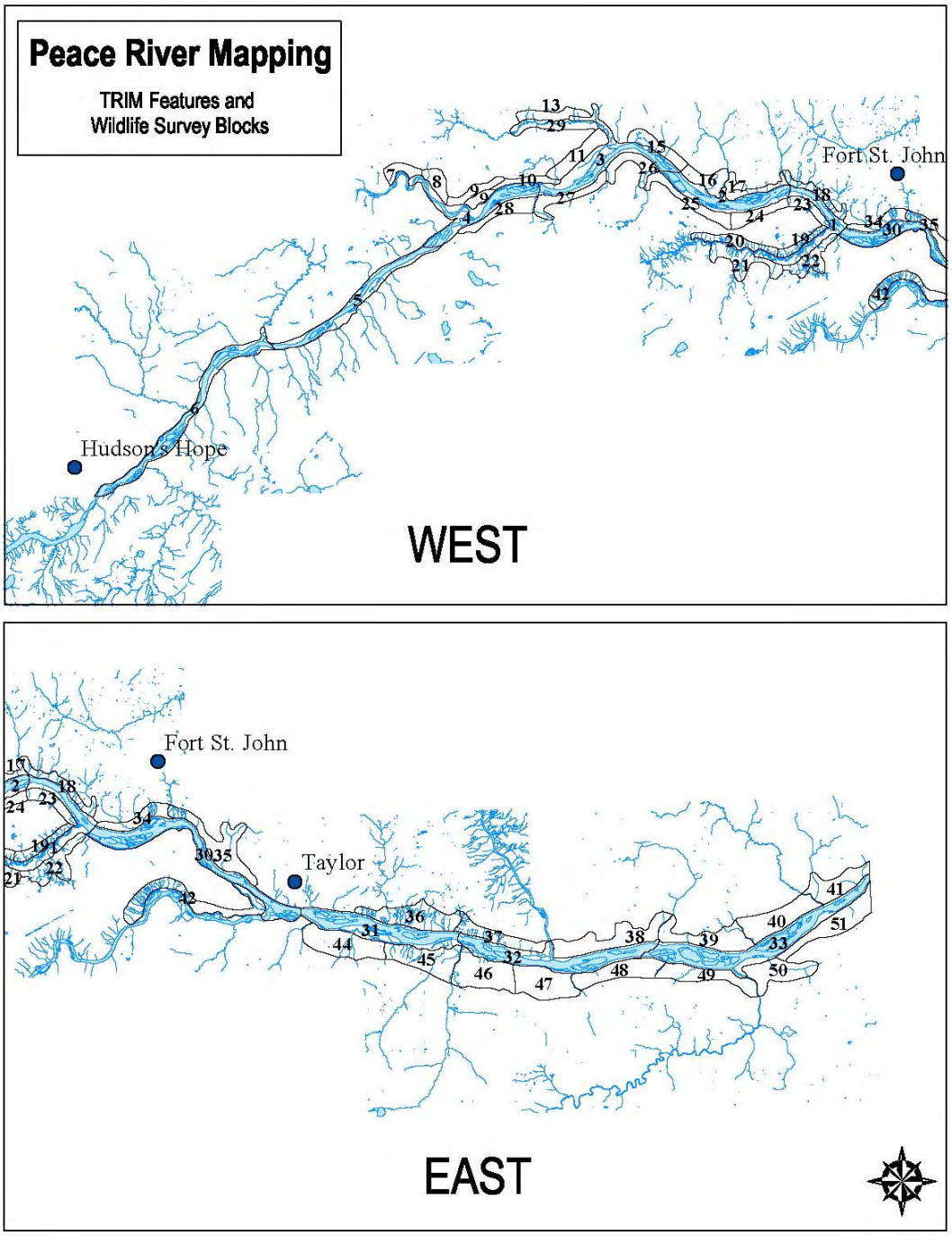

Figure 9. Blocks defined to census deer, moose and elk along the Peace River in February 2006.

The numbers of moose counted were similar to 1991 in all strata (Table 7). Numbers of deer seen were similar on north aspects and in the valley bottom but substantially lower on south aspects than in 1991. Numbers of elk were greater on south aspects and in the valley bottom and they occurred mainly in a few large groups (Table 7). Few (10) white-tailed deer were observed and population size was not estimated. Snow depths were 15-20 cm, well below average (50 cm; Simpson 1991). Ungulates were widely dispersed in many locations on the plateau and in agricultural areas. These areas are not considered critical winter range. It is expected that with more normal snow depths, counts would be two to three times greater than what was observed, particularly for mule deer and elk.

Population estimates incorporate sampling variability as well as small sightability corrections generated by the University of Idaho software (2004). Numbers of moose and mule deer in the valley bottom upstream of the Moberly River were similar to 1991 but there was a large (10x) increase in the number of elk (Table 8). Similar numbers were noted for all three species downstream of the Moberly River along the Peace River mainstem. The number of blocks included on north and south aspect breaks was 1/3 greater in 2006 so the population estimates are not directly comparable.

Table 8. Computer-generated ungulate population estimates along the Peace River in 1991 and 2006, generated from survey results, sampling variability and sightability corrections.

Strata	# blocks	Year	# Moose	# Mule Deer	# Elk
Valley bottom upstream of the Moberly River	6	1991	118±16	243±79	8±3
	6	2006	115±69	197±48	119±13
Valley bottom downstream of the Moberly River	not surveyed	1991			
	4	2006	66±29	64±24	53±36
South Aspect Breaks	14	1991	135±36	2340±267	159±97
	21	2006	396±124	3663±1214	595±419
North Aspect Breaks	9	1991	90±19	284±152	3±3
	16	2006	205±193	615±484	0
Totals	29	1991	343±43	2867±317	170±97
	47	2006	782±241	4539±1308	767±461

± 90% confidence interval, 1991 results approximated using re-analysis of old data

4.3 Discussion

The estimated numbers of mule deer, moose and elk were similar on the breaks between 1991 and 2006. It is clear that the south aspect breaks support the highest numbers of all three species and in a normal winter, with deeper snow on the plateau, we expect that the 2006 estimates would be much higher. The surveys in 1991 were done under more normal conditions (snow depths > 50 cm; Simpson 1991) when ungulates would have been more concentrated on the breaks. The variability of the counts and wide confidence limits also reflect the dispersed distribution of the animals. Regional populations of mule deer and elk have increased since 1991 and moose populations have remained fairly stable (J. Elliot - pers. comm.). These survey data and associated population estimates support that conclusion.

4.4 Recommendations

It would be advisable to repeat the census with more normal winter snow conditions to confirm the numbers of ungulates using each area.

5.0 BEAVER SURVEYS

Beaver are valued furbearers in the Peace region and a large population is resident in the Peace corridor. An aerial census for beaver was conducted to document lodge locations and estimate the population size within the study area.

5.1 Introduction

Beaver lodge and food cache counts along the Peace River were completed by Keystone Wildlife Research on September 13 and 14, 2005 to augment previous surveys completed by Blood in 1976 (Blood 1979) and Simpson in 1990 (Simpson 1991). Beaver surveys generally involve low level aerial reconnaissance to determine the number of visible lodges, dams and food caches.

Blood (1979) surveyed the Peace River from the Moberly River to Hudson Hope on November 26, 1976 and reported that beavers were abundant in the study area, particularly in back channels. Beaver sign was noted on all creeks, with bank dens built where banks were low and stable. Typical lodges were only seen in a few quiet backchannels. Blood noted that population estimation was hindered by the predominance of bank dens, which are difficult to detect from the air. In addition, many colonies along the Peace River do not establish food caches (the usual indicator of an active den), presumably because they can continue to feed all winter unhindered by ice formation. Both limitations may have reduced the number of colonies counted by Blood (1979) since they would be missed or presumed inactive (no visible cache). During the aerial survey, Blood (1979) observed 18 active colonies, 11 probably active colonies and 16 old colonies. Based on the limitations, the number of beavers expected to be present was adjusted to 30-40 active colonies by Blood (1979). This was equivalent to 150 to 200 animals, assuming 5 beavers occupy each colony (Denny 1952). It was noted that despite the adjustments these figures are probably conservative (Blood 1979).

Simpson (1991) completed an aerial survey to locate beaver lodges and food caches from the Moberly River to Hudson Hope on October 11, 1990. A boat survey was also

completed between Halfway River and Wilder Creek on October 12 and 13 to locate bank colonies not visible from the air.

Seventy-five active lodges and 27 inactive lodges were located during the October surveys. The boat survey confirmed these numbers and resulted in no additional dens counted. Inactive lodges were re-checked in November resulting in a corrected count of 76 active and 26 inactive lodges. Using the same figure as Blood (1979), (5 beavers per colony) the population estimate from this survey was approximately 380 beavers.

5.2 Methods

A food cache count was completed to verify the expected population of beavers. Methods used followed ***Inventory Methods for Beaver and Muskrat*** (RIC 1998). A helicopter was used to fly survey transects along the Peace River. Observers noted the presence of beaver caches and lodges and recorded their location using a GPS and a hardcopy map.

5.3 Results

Surveys conducted by Keystone Wildlife Research Ltd. on September 13, 2005 located 67 active and 60 inactive lodges between the Moberly River and Hudson Hope (Figures 10, 11, 12). Assuming 5 beavers per colony, these counts result in a population estimate of 335 beavers. Follow-up surveys completed by Simpson in November of 1990 resulted in the change of only one colony from inactive to active, so repeat surveys were not done later in the fall of 2005.

A survey was also conducted downstream from the Moberly River to the Alberta border on September 13, 2005. This survey recorded 75 active and 50 inactive lodges.

The results in Simpson (1991) show that the beaver population in 1990 was close to double that estimated in 1976 (Table 9). The results of the 2005 survey show that the beaver population has remained relatively stable over the last 15 years. The increase in the number of old/abandoned lodges suggests disused sites persist in the now stable river environment. The adjacency of many old inactive lodges to active lodges supports this.

Table 9. Summary of beaver lodge counts, between Moberly River and Hudson Hope, completed between 1976 and 2005.

Survey	Active Colonies	Inactive Colonies	Population estimate
Blood (Nov. 1976)	18	27	150-200
Simpson (Oct. 1990)	76	26	380
Keystone (Sept. 2005)	67	60	335

5.4 Recommendations

The beaver population appears to have stabilized along the Peace River mainstem. An additional survey should be completed to document current numbers if and when significant development or habitat alteration is undertaken in the valley.

Figure 10. Large lodge and cache, aerial view.

Figure 11. Lodge and cache on the banks of the Peace River.

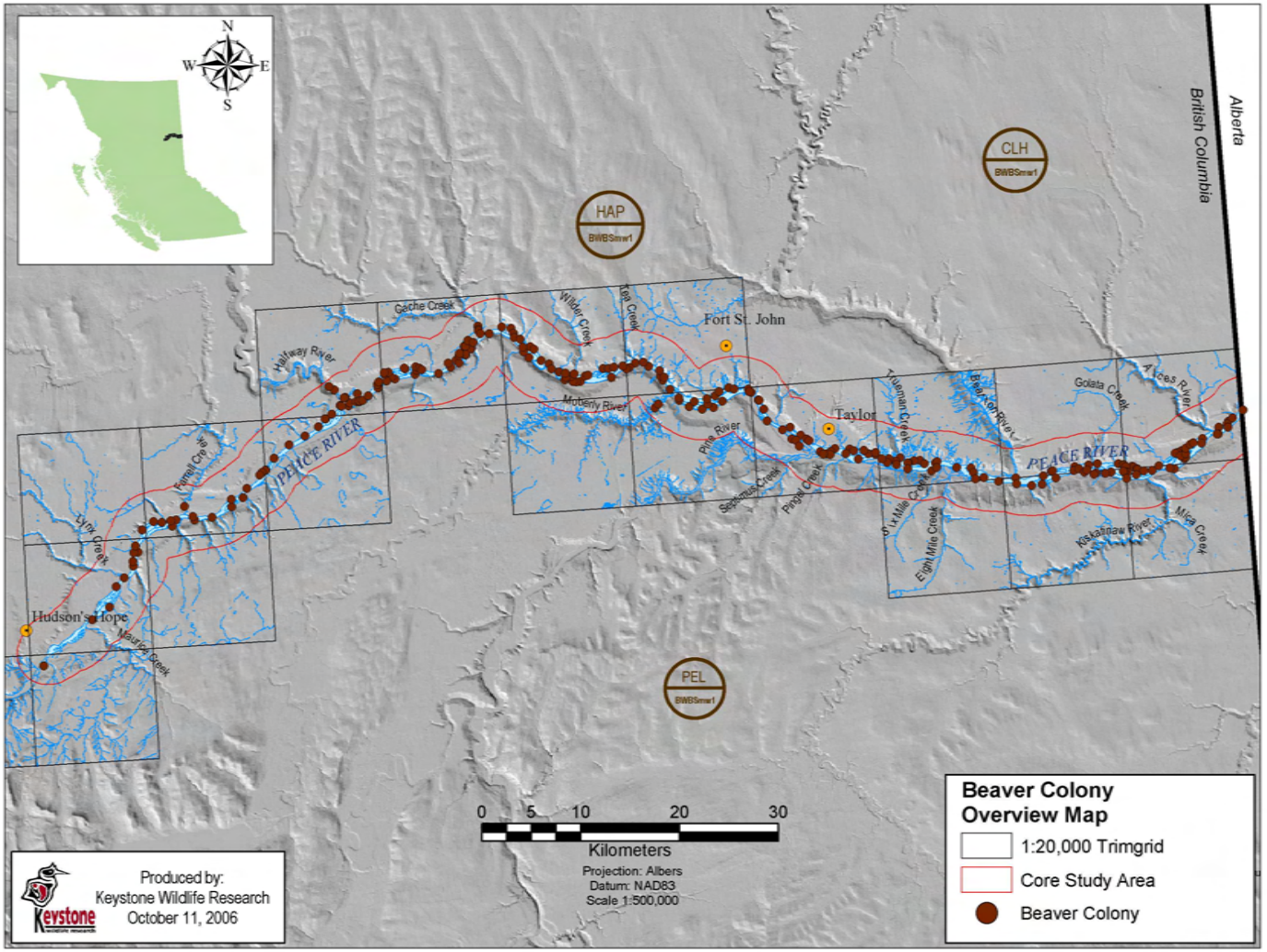

Figure 12. Locations of beaver colonies observed during the survey.

6.0 REFERENCES

BC Ministry of Environment, Lands, and Parks, and BC Ministry of Forests. 1998. Field Manual for Describing Terrestrial Ecosystems. Land Management Handbook No. 25. http://www.for.gov.bc.ca/ric/Pubs/teEcolo/fmdte/deif.htm

Blood, D.A. 1979. Peace River Site C Hydroelectric Development Environmental and Socioeconomic Assessment: Wildlife Sub-Report. Prepared for BC Hydro & Power Authority. 82pp plus appendices.

Denny, R. N. 1952. A Summary of North American Beaver Management, 1946-1948. Colo. Game and Fish Dep. Rep. No. 28. 64pp.

Gasaway, W.C. S.D. DuBois, D.J. Reed and S.J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biol. Papers of the Univ. of Alaska 22. 108 pp.

Jones, L. L., and M. G. Raphael. 1993. Inexpensive Camera Systems for Forest Service Detecting Martens, Fishers, and other Animals: Guidelines for Use and Standardization. USDA Forest Service Gen. Tech. Rept. PNW-GTR-306.

Resources Inventory Committee (RIC). 2002. Aerial-based Inventory Methods for Selected Ungulates: Bison, Mountain Goat, Mountain Sheep, Moose, Elk, Deer and Caribou. Version 2.0. Standards for Components of British Columbia's Biodiversity No. 32. 91 pp.

Resources Inventory Committee (RIC). 1998. Inventory Methods for Beaver and Muskrat. Standards for Components of British Columbia’s Biodiversity #22. Version 2.0. Province of British Columbia, Resources Inventory Committee.

Resources Inventory Committee (RIC). 1999. Inventory Methods for Medium-sized Territorial Carnivores: Coyote, Red Fox, Lynx, Bobcat, Wolverine, Fisher & Badger. Standards for Components of British Columbia's Biodiversity No. 25. Version 2.0. Province of British Columbia, Resources Inventory Committee.

Simpson, K. 1991. Peace River Site C Hydroelectric Development: Environmental Assessment, Consumptive Wildlife Resources. Rept. to BC Hydro. 45 pp.

Unsworth, J.W., F.A. Leban, E. Garton and J.R. Pope. 1991. Elk Sightability Surveys. Revised edition. Idaho Dept. of Fish and Game, Boise, ID. 42 pp.

Dr. Garton's Population Links and Software for Download. 2004
http://www.cnrhome.uidaho.edu/fishwild/Garton/tools
University of Idaho, Department of Fish and Wildlife Resources, Moscow, ID

Weir, R. 2003. Status of the Fisher in British Columbia. Wildlife Bulletin No B-105. BC Ministry of Water, Land and Air Protection and BC Ministry of Sustainable Resource Management.

Weir, R. 2005. Fisher Ecology in the BWBS: Inventory and Research. Year end report to Louisiana-Pacific Canada and Ministry of Environment. 10pp.

Weir, R. 2006. Fisher Ecology in the BWBS: Inventory and Research. Year end report to Louisiana-Pacific Canada and Ministry of Environment. 15pp.

Personal Communications

J. Elliot. Wildlife Biologist, BC Ministry of Environment, Peace Region

R. Weir, Biologist. Artemis Consulting, Armstrong, BC.

R. Woods. Wildlife Biologist, BC Ministry of Environment, Peace Region

Appendices

Appendix 1. Snow tracking datasheet.

BCHY Snow Tracking Data Sheet	Surveyors	year	month	day	CC	
Mapsheet	Transect	Start Bearing	0 6		Wind	
Drainage Peace River	days since snow	page of	Temp.	°C	Precip	
start UTMx	UTMy	Stop UTM x	UTM y			

plot no	Poly no.	m from start	Activ. type		Sign type	sign #	Vis Y/N	sink depth cm		snow depth cm	species code	comments (change bearing)

Appendix 2. General location and tracking results for fisher (MAPE) and marten (MAAM) in 2006.

Date	Location	Transect #.	Distance (m)	MAAM/MAPE tracks
Feb 18	South Peace Marten Tree	CD1	1350	0
Feb 19	Red Creek	CD2	3800	2
Feb 19	Bear Flat pit	CD3	1000	0
Feb 19	Bear Flat island	KS1	1300	0
Feb 20	W. Urice Crk (H Hope)	CD4	2100	2
Feb 20	Urice Crk (H Hope)	KS2	3000	1
Feb 20	Farrell Crk Top Breaks	CD5	2200	0
Feb 21	Taylor (E of bridge)	CD6	3500	0
Feb 21	Taylor Park	CD7	1700	2
Feb 22	Farrell Creek	CD8	3400	0
Feb 22	1st gully W of Farrell Crk	CD9	2500	0
Feb 23	Halfway River -Eastside	CD10	2100	0
Feb 23	Halfway S side of Hwy	CD11	400	0
Feb 24	Blackfoot Park (E Side)	CD12	1500	0
Feb 24	Blackfoot Park (W Side)	CD13	2500	0
Feb 24	S of Blackfoot Park	CD14	1800	0
Feb 25	Halfway River (N of Hwy)	CD15	950	0
Feb 25	14km W of Halfway River	CD16	3800	1
Feb 26	H Hope S side from bridge	CD17	2500	6
9 days		**19**	**41400**	**14**
			m/animal	**2957.1**

Appendix 3. Summary of activity by camera station.

CAMERA	EVENT	DATE D/M/Y	TIME	SPECIES	NOTES
1		28/2/2006	15:55		camera set, event recorder not working
1		8/3/2006	7:17	Marten	
1		8/3/2006	11:01	Marten	
1		8/3/2006	11:06	Marten	
1		8/3/2006	11:14	Marten	
1		8/3/2006	11:22	Marten	
1		8/3/2006	11:26	Marten	
1		8/3/2006	11:34	Marten	
1		8/3/2006	11:51	Marten	
1		8/3/2006	11:58	Marten	
1		8/3/2006	12:03	Marten	
1		8/3/2006	12:09	Marten	
1		8/3/2006	12:17	Marten	
1		8/3/2006	12:19	Marten	
1		8/3/2006	12:23	Marten	
1		8/3/2006	12:29	Marten	
1		8/3/2006	12:24	Marten	
1		8/3/2006	12:39	Marten	
1		8/3/2006	12:53	Marten	
1		8/3/2006	12:57	Marten	
1		8/3/2006	21:48	Marten	
1		8/3/2006	21:53	Marten	
1		8/3/2006	21:58	Marten	
1		8/3/2006	22:03	Marten	end film
1		11/3/2006	12:09		film replaced
1	4	13/03/2006	8:55	Marten	
1	8	13/03/2006	9:08	Marten	
1	9	13/03/2006	9:18	Marten	
1	17	22/03/2006	1:55	Marten	
1	22	22/03/2006	2:08	Marten	
1	37	24/03/2006	18:40	Marten	
1	39	24/03/2006	11:32	Marten	
1	46	3/4/2006	21:31	Marten	
1	50	3/4/2006	21:36	Marten	
1		14/04/2006			camera removed
2		28/2/2006			camera set
2	4	8/3/2006	23:11	Marten	
2	19	24/03/2006	0:26	Marten	snowing
2	20	26/03/2006	21:49	Marten	
2	22	4/4/2006	20:30	Elk	
2		14/4/2006			end of sample period
3		1/3/2006			camera set
3	2	5/3/2006	23:33	Elk?	partial picture of hairy flank to left
3	4	11/3/2006	9:35	Red squirrel	
3	12	24/03/2006	7:57	Red squirrel	

CAMERA	EVENT	DATE D/M/Y	TIME	SPECIES	NOTES
3	19	24/03/2006	8:03	Red squirrel	
3	20	25/03/2006	7:34	Red squirrel	
3	21	29/03/2006	6:51	Elk	
3	35	30/03/2006	7:56	Red squirrel	
3	36	31/03/2006	7:21	Red squirrel	
3	37	31/03/2006	7:26	Red squirrel	
3	39	31/03/2006	9:50	Red squirrel	
3	40	31/03/2006	10:00	Red squirrel	
3	41	1/4/2006	8:27	Red squirrel	
3	43	2/4/2006	7:07	Red squirrel	
3	44	3/4/2006	9:49	Red squirrel	
3	46	4/4/2006	7:51	Red squirrel	
3	49	4/4/2006	8:19	Red squirrel	
3	53	5/4/2006	8:49	Red squirrel	
3	54	9/4/2006	19:18	Red squirrel	
3	79	18/04/2006	6:32	Red squirrel	
3	80	20/04/2006	6:53	Red squirrel	
3	82	11/5/2006	7:47	Red squirrel	
3	83	11/5/2006	7:57	Red squirrel	
3	84	22/05/2006	14:52		camera came down
4		1/3/2006			camera set
4	18	6/4/2006	12:04	Elk	
4	27	6/4/2006	12:10	Elk	
4	50	19/04/2006	4:26	Elk	
4	52	20/04/2006	8:02	Elk	
4	58	20/04/2006	8:07	Elk	
4	69	1/5/2006	13:41	Black bear - knocked camera out of alignment, removed bait	
4	76	1/5/2006	15:58	Black bear	bait gone
5		1/3/2006			camera set
5	2	4/3/2006	7:30	Marten	
5	8	4/3/2006	7:36	Marten	
5	9	4/3/2006	7:48	Marten	
5	20	9/4/2006	21:17	Black bear - took bait	
5	27	9/4/2006	23:13	Black bear	bait gone
5		10/4/2006			camera re-set
5	79	11/4/2006	21:00	Marten	
5	80	11/4/2006	21:06	Marten	
5	88	11/4/2006	21:12	Marten	
5	90	13/04/2006	21:59	Black bear - took bait	
5	97	13/04/2006	22:29	Black bear	
5	103	13/04/2006	22:36	Black bear	
5	107	13/04/2006	22:57	Black bear	bait gone
6		1/3/2006			camera set
6	2	5/3/2006	8:27	Gray Jay	
6	8	5/3/2006	15:41	Gray Jay	
6	13	5/3/2006	13:15	Gray Jay	

CAMERA	EVENT	DATE D/M/Y	TIME	SPECIES	NOTES
6	24	8/3/2006	15:14	Gray Jay	
6	29	9/32006	13:02	Gray Jay	
6	30	10/3/2006	5:35	Marten	
6	45	12/3/2006	1:36	Marten	
6	88	14/03/2006	14:08	Gray Jay	
6	441	18/04/2006	16:37	Elk	
6	443	24/04/2006	18:50		camera dislodged
7		1/3/2006			camera set
7	3	13/03/2006	6:20	Marten	
7	8	22/03/2006	21:34	Marten	
7	17	22/03/2006	22:51	Marten	
7	40	24/03/2006	8:32	Marten	
7	44	22/04/2006	1:19	Marten	
7		29/5/2006			camera removed

Appendix 4. Site series and structural stage definitions.

Ecosystem units mapped in the study area (excludes non-vegetated and anthropogenic units).

Map Code	Site Series #	Ecosystem Name
AM	01	SwAt - Step moss
AM: ap	$01	$At - Creamy peavine (seral association)
AMy: ap	$01	$At - Creamy peavine, moist (seral association)
AMk: ap	$01	$At - Creamy peavine, cool aspect (seral association)
AMw: ap	$01	$At - Creamy peavine, warm aspect (seral association)
AS	00	SwAt – Soopolallie
BL	04	Sb - Lingonberry - Coltsfoot
BL: al	$04	$At - Labrador tea (seral association)
BT	08	Sb - Labrador tea – Sphagnum
Fm02	09	ActSw - Red-osier dogwood
LL	02	Pl - Lingonberry - Velvet-leaved blueberry
LL: ak	$02	$At - Kinnikinnick (seral association)
SC	06	Sw - Currant – Bluebells
SC: ab	$05	$At – Black Twinberry (seral association)
SC: ep	$05	$Ep – red-osier dogwood (seral association)
SE	00	Sedge Wetland
SH	07	Sw - Currant – Horsetail
SH: ac	$07	$Ac – Cow parsnip (seral association)
SH: ep	$07	$Ep – Ep-Dogwood (seral association)
SO	05	Sw - Currant - Oak fern
SW	03	Sw - Wildrye – Peavine
SW: as	$03	$At - Soopolallie (seral association)
TS	10	Tamarack - Sedge – Fen
WH	00	Willow – Horsetail – Sedge – Riparian Wetland
WS	00	Willow – Sedge – Wetland
WW	00	Fuzzy-spiked Wildrye - Wolf willow

Structural stage definitions (RIC 1998a).

Structural Stage	Definition
1	Sparse/bryoid (< 20 yrs since major disturbance unless disclimax ecosystem)
1a	Sparse (less than 10% vegetation cover)
1b	Bryoid (bryophyte and lichen-dominated communities (>50% of total vegetation cover))
2	Herb (< 20 yrs old unless disclimax)
2a	Forb-dominated (dominated by non-graminoid herbs)
2b	Graminoid-dominated (dominated by grasses, sedges, reeds and rushes)
2d	Dwarf Shrub (dominated by dwarf woody species)
3	Shrub (shrubs <10 m tall, < 20 yrs old for forested sites)
3a	Low Shrub (shrubs < 2 m tall)
3b	Tall Shrub (shrubs 2-10 m tall)
4	Pole /Sapling (trees > 10 m tall & usually < 40 yrs old)
5	Young Forest (trees > 10 m tall & 40-80 yrs old)
6	Mature Forest (trees > 10 m tall; 80-140 yrs old)
7	Old Forest (trees > 10 m tall; >140 yrs old)