Columbia River Project Water Use Plan
Kinbasket and Arrow Revegetation Management Plan

Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir

Implementation Year 5

Reference: CLBMON-11A

Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir

Study Period: 2012

Cooper Beauchesne and Associates Ltd.
Head Office
Box 646, 1799 Swayne Road
Errington, BC

July 2013

CLBMON 11A: Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir

Data Summary Report – Year 5 (2012)

A.J. MacInnis, V. Prigmore, R.A. Gill, and J.M. Cooper

Cooper Beauchesne and Associates Ltd.
Head Office
Box 646, 1799 Swayne Road
Errington, BC V0R 1V0
Tel: 250 954-1822
Contact: John Cooper
jcooper@cooperbeauchesne.com

Report prepared for:
BC Hydro
Environmental Risk Management
Columbia Water Licence Requirements
6911 Southpoint Dr,
Burnaby, BC V3N 4X8

Suggested Citation:

MacInnis A.J., V. Prigmore, and J.M. Cooper. 2012. Monitoring Program CLBMON-11A: Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir, Data Summary Report – Year 5 (2012). Unpublished report by Cooper Beauchesne and Associates Ltd., Errington, BC, for BC Hydro Generation, Environmental Risk Management, Columbia Water License Requirements, Burnaby, BC. v + 12 pp. + Appendices.

Cover photo: Site 15, Canoe Reach, Kinbasket Reservoir. Photo © A. Carson, Cooper Beauchesne and Associates Ltd.

EXECUTIVE SUMMARY

An 11-year wildlife effectiveness monitoring study of revegetation enhancements in the drawdown zone of Kinbasket Reservoir was initiated in 2008 (Year 1). The program is intended to assess the effectiveness of enhancing habitat to increase utilization of the drawdown zone by wildlife. In 2012 (Year 5), ungulate pellet group counts were completed following a recommendation in Year 3 to complete the pellet counts annually. The annual pellet group surveys ensure the plots are cleared and that the data collected is from a single year.

The pellet counts were completed on June 13 - 15, 2012 in Canoe Reach and June 19 – 20, 2012 in Bush Arm. Sampling was completed at the same sites and transects as in Years 3 and 4, following the same methods. It was not possible to sample one transect at site 121 due to flooding from high water levels in the Bush River.

There were 111 ungulate pellet groups observed in 480 stations. The number of pellet groups detected was higher than Year 4 but lower than in the three previous years of the project. There were more ungulate pellet groups detected in Bush Arm than in Canoe Reach. Only deer were observed in Canoe Reach and deer, moose and elk pellet groups were observed in Bush Arm. The highest relative abundance of ungulates was generally on local reference transects, above the drawdown zone.

It is not yet possible to draw any conclusion about the effectiveness of the revegetation program in increasing ungulate use of revegetated drawdown habitats. This is partly a result of the timing of the revegetation program in relation to the wildlife effectiveness monitoring program. The low numbers of pellet groups confirms that additional years of monitoring successfully revegetated sites are required to determine the effectiveness of the revegetation treatments in increasing ungulate use of drawdown zone habitats.

It is recommended that ungulate pellet group surveys continue on an annual basis for continuity of the data set and to ensure that pellet detections are from single years. The other major recommendation is for close coordination with the revegetation program to maintain existing monitoring sites.

ACKNOWLEDGEMENTS

Margo Dennis of BC Hydro administered this project and provided technical support. The project was managed by John Cooper. The field sampling for Year 5 was completed by Vicki Prigmore, Allan Carson, and James Bradley.

This report was prepared by Andrew MacInnis and Vicki Prigmore. The draft report was reviewed by John Cooper. Ryan Gill provided the mapping and GIS analysis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

The CLBMON-11A project is an 11-year monitoring program designed to determine the effectiveness of the CLBWORKS-1 revegetation program in improving wildlife habitat and increasing wildlife use of the Kinbasket Reservoir drawdown zone. The CLBWORKS-1 revegetation program is a multi-year program to enhance existing vegetation and establish additional, self-sustaining vegetation in the 741–754 m elevational band in the drawdown zone of the reservoir. Additional details on the background and intent of the CLBMON-11A wildlife effectiveness monitoring program are provided in the Year 3 technical report (CBA 2011a). While the full monitoring program was originally scheduled to continue in Year 5 of the project, the implementation of the Year 5 monitoring was postponed (BC Hydro 2012). However, following the completion of Year 3, it was recommended that ungulate pellet counts be completed on an annual basis (CBA 2011a). This was due to the need to clear the plots annually to ensure that ungulate detections are from single years only.

This report presents the results from the pellet counts completed in Year 5 (2012) of the CLBMON-11A monitoring program. It focuses on ungulate data collected in Year 5 of the project, with some comparisons to previous years, where feasible.

2 MONITORING OBJECTIVES AND HYPOTHESES

The monitoring objectives and hypotheses for CLBMON-11A were stated in the Terms of Reference for the project (BC Hydro 2008). In association with the revegetation program (CLBWORKS-1), the primary management question to be addressed by this monitoring program is:

- How effective is the revegetation program at enhancing and increasing the utilization of habitat in the drawdown zone by wildlife?

Specific management questions related to the monitoring of ungulates include:

- Are revegetation efforts negatively impacting wildlife in the drawdown zone?
- Which methods of revegetation are the most effective at enhancing and increasing utilization of the drawdown zone by wildlife?

Based on these management questions and objectives, the effectiveness monitoring program was designed to test the following management hypotheses as stated in the Terms of Reference (BC Hydro 2008):

<u>Ungulates</u>

H_{02}: Revegetation does not increase the utilization of habitat by ungulates in the drawdown zone.

H_{02A}: Revegetation does not increase the seasonal abundance (winter/spring) of ungulates in the drawdown zone.
H_{02B}: Revegetation does not increase the abundance (tonnes/hectare) of ungulate forage in the drawdown zone.
H_{02C}: Revegetation does not increase the amount of ungulate habitat in the drawdown zone.

H_{03}: Revegetation does not increase the area of extent of high value wildlife habitat for ungulates in the drawdown zone.

This report provides a summary of data from 2012 on ungulate habitat use and relative abundance. The differences between revegetation treatments, untreated controls and reference locations above the drawdown zone will be tested using spring/summer pellet counts. Specifically, the data collected can be used for addressing null hypotheses 2 and 2A.

3 METHODS

The project followed the same study design as in 2010 (CBA 2011a). The overall objective of the project is to monitor the effectiveness of revegetation treatments in enhancing wildlife habitat in the drawdown zone of the reservoir. The monitoring program was developed using a stratified random design to test the responses of the indicator species groups to revegetation treatments. Ungulate relative abundance is one of the indicators identified in the Terms of Reference (BC Hydro 2008).

3.1 Study Area

The study area for the project is Kinbasket Reservoir in eastern British Columbia (Figure 3-1). Specifically, effectiveness monitoring under CLBMON-11A is being conducted in the Canoe Reach and Bush Arm regions of the reservoir. For additional information on the study areas refer to CBA (2011a).

3.2 Study Sites

Sampling occurred at the same sites as in 2010 (sites 2, 8, 12, 15, and 25 in Canoe Reach and sites 83, 84, 87, 88, and 121 in Bush Arm) (Figure 3-2). With the exception of Site 121, these sites have been sampled in all years of the wildlife effectiveness monitoring program to date. Site 121 was added in 2010 at the request of BC Hydro so that sampling from a naturally revegetated area was included in the project. For additional information on the study sites and the rationale for their selection refer to CBA (2011a).

3.2.1 Transect Location and Layout

The transect locations and layout were identical to those used in 2010 (CBA 2011a). Sampling stations were permanently marked in 2010 with painted spikes and washers and the coordinates of each station were recorded using submeter resolution GPS (SX Blue II). Sampling stations were relocated using the same GPS unit and visual searches for the station marker. It was not possible to locate all station markers, as some appeared to have been completely buried under sediment or debris (Figure 3-3). If a marker was not found, the plot center was located using the submeter GPS and confirmed by measurement from located markers.

As in previous years of the program, the transects sampled at each site included a treatment transect located in an area of the drawdown zone that received a revegetation treatment, a control transect in an area of the drawdown zone that did not receive a vegetation treatment, and a local reference transect located immediately above the drawdown zone. Additional treatment transects were established at some sites where extensive or multiple revegetation treatments had been implemented. For additional details on transect selection and definition, refer to CBA (2011a, 2011b). Maps of the transects sampled in 2011 are provided in Appendix 1.

Each 140-m transect had 15 sampling stations located at intervals of 10 m. Ungulate pellet counts were conducted at all 15 sampling stations on each transect.

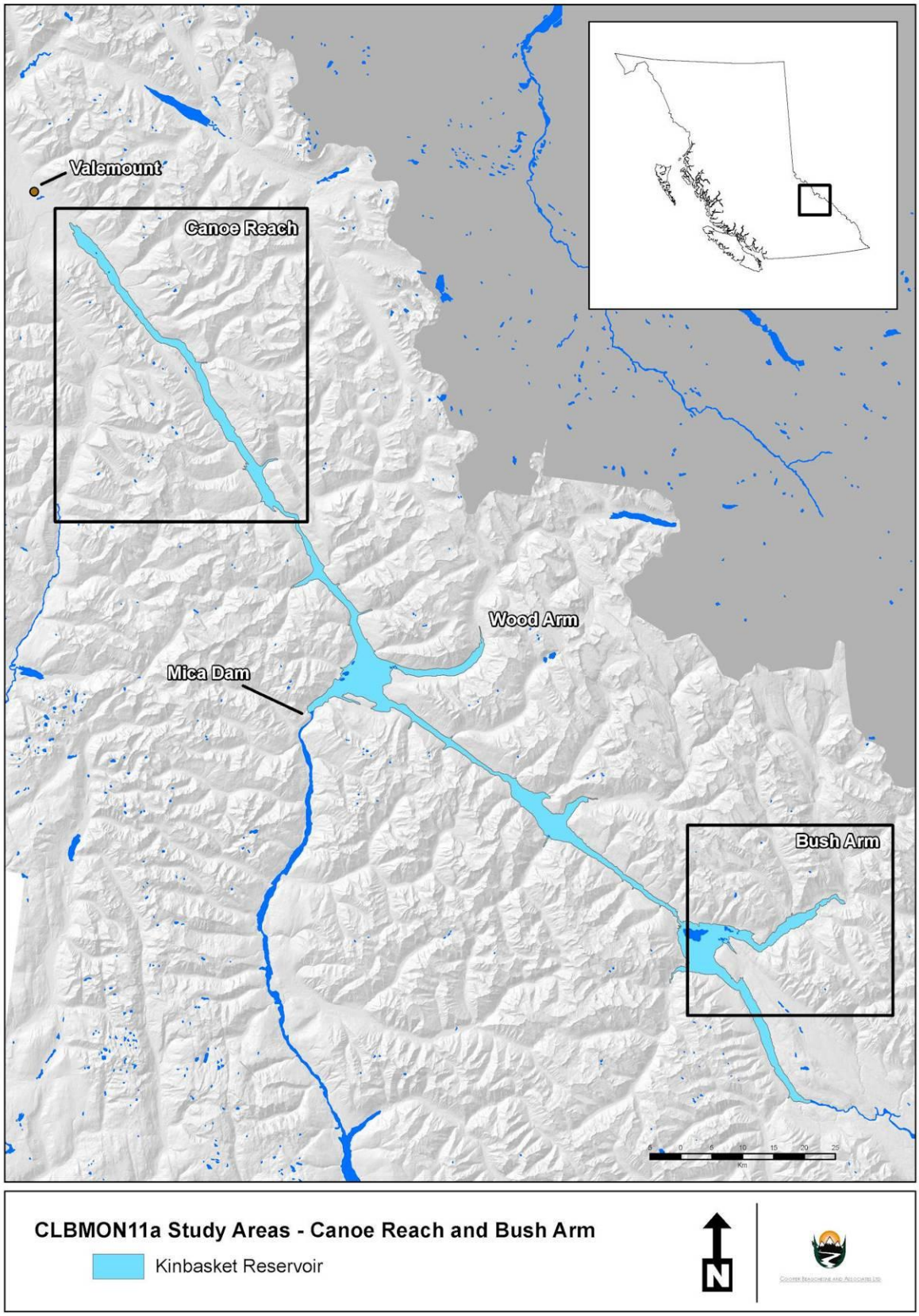


Figure 3-1: Kinbasket Reservoir overview

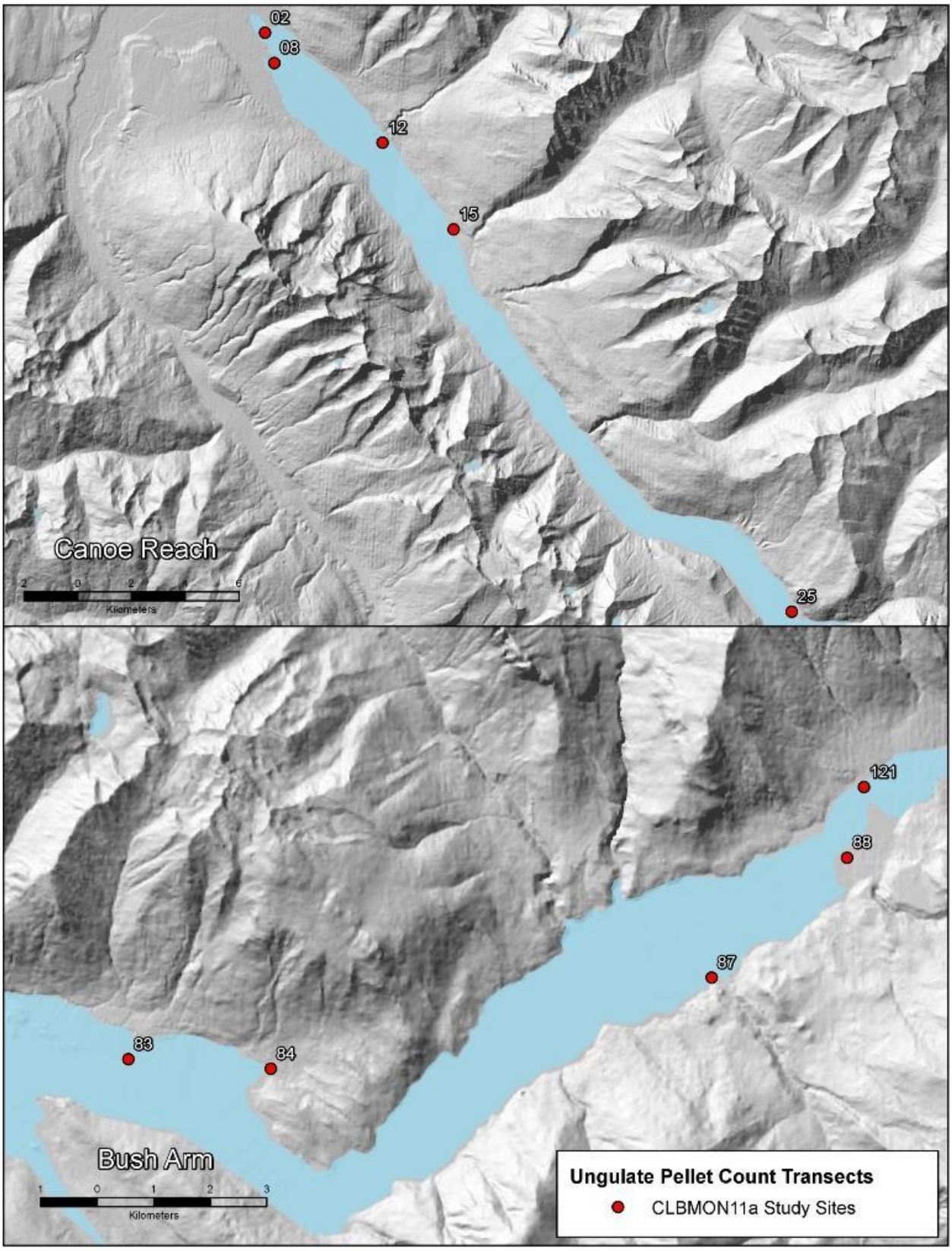


Figure 3-2: Location of study sites in Bush Arm and Canoe Reach of Kinbasket Reservoir

Figure 3-3: Partially buried station marker

3.3 Pellet Group Counts

A single replicate of a systematic fecal pellet group count survey (Neff 1968) was conducted at ten sites in Kinbasket Reservoir. Protocols were consistent with provincial standards (Resources Inventory Committee 1998). A circular 3.99-m radius (50 m^2) plot was surveyed at 15 permanent sampling stations on each transect.

Pellet groups were defined as 10 or more pellets in close proximity. Each pellet group was identified to species, recorded and cleared from the plot. Both white-tailed deer and mule deer are known to occur in the study area. Since it is virtually impossible to differentiate between deer species by their pellets (Shackleton 1999), all deer pellet groups were classified as “deer”. Scats from other species were also recorded when they could be reliably identified (e.g., bear, grouse). Total pellet group counts were summarized by transect type, site and region.

4 RESULTS

Ungulate pellet group counts were completed from June 13 – 15 (Canoe Reach) and June 19 – 20 June 19 – 20 (Bush Arm), 2012 (

Table 4-1). A total of 11 ungulate fecal pellet groups (moose, deer, elk) were counted in 480 survey plots on 32 transects, with a total survey area of 23,597.5 m^2. Surveys totalled 12,750 m^2 and 10,847.5 m^2 in Canoe Reach and Bush Arm, respectively. A summary of the data is provided in Appendix 2.

Flooding due to high water levels in the Bush River prevented surveys from being completed on one of the transects at Site 121. Also in Bush Arm, all plots on the site 88 treatment transect were covered with woody debris deposited at full pool in the previous season. Five of the fifteen plots in this site were completely covered with debris and the remaining ten were partly covered (10-95%).

Other than on a few transects, the number of pellet groups detected was low, with more pellet groups detected in Bush Arm than in Canoe Reach (86 vs. 29, Table 4-2). In Canoe Reach, deer were the only species detected, accounting for 27 pellet group detections with 25 of the detections from a single local reference transect. No moose or elk pellet groups were recorded in Canoe Reach in 2012 (Table 4-2). Pellet groups from deer, moose and elk were detected in Bush Arm, with elk being the most abundant.

In Bush Arm, elk pellet groups were observed at three of the five sites sampled in 2012 and represented the majority of detections from the site 83 reference transect and the site 88 control transect (Figure 4-1). Elk pellet groups were observed on all transects at site 88 and were the only species detected on the site 83 treatment transect and site 121. Moose pellet groups were the only species detected at site 84 and on the site 83 control transect. Moose pellet groups were also observed on the site 83 reference transect. Deer pellet groups were only detected on the site 83 reference transect and the site 88 control transect.

In Canoe Reach, the only pellet groups recorded in the drawdown zone were on the control transect at site 8 (Figure 4-1). The remaining pellet groups in Canoe Reach were only recorded from local reference transects. No ungulate pellet groups were recorded from the treatment transects in Canoe Reach. No pellet groups were observed at sites 12 and 15. The local reference transect at site 8 had the highest number of pellet group observations (Figure 4-1).

Table 4-1: Ungulate pellet group survey dates

Region	Site	Survey Date
Canoe Reach	2	June 15, 2012
	8	June 14, 2012
	12	June 14, 2012
	15	June 15, 2012
	25	June 13, 2012
Bush Arm	83	June 19, 2012
	84	June 19, 2012
	87	June 20, 2012
	88	June 20, 2012
	121	June 20, 2012

Table 4-2: Total ungulate fecal pellet groups by transect type and ungulate species, in Bush Arm and Canoe Reach

Ungulate Species	Bush Arm				Canoe Reach		
	Control	Treatment	Local Reference	Reference	Control	Treatment	Local Reference
Deer	2	0	3	0	2	0	27
Elk	26	6	34	1	0	0	0
Moose	1	1	8	0	0	0	0
Total	29	7	45	1	2	0	27

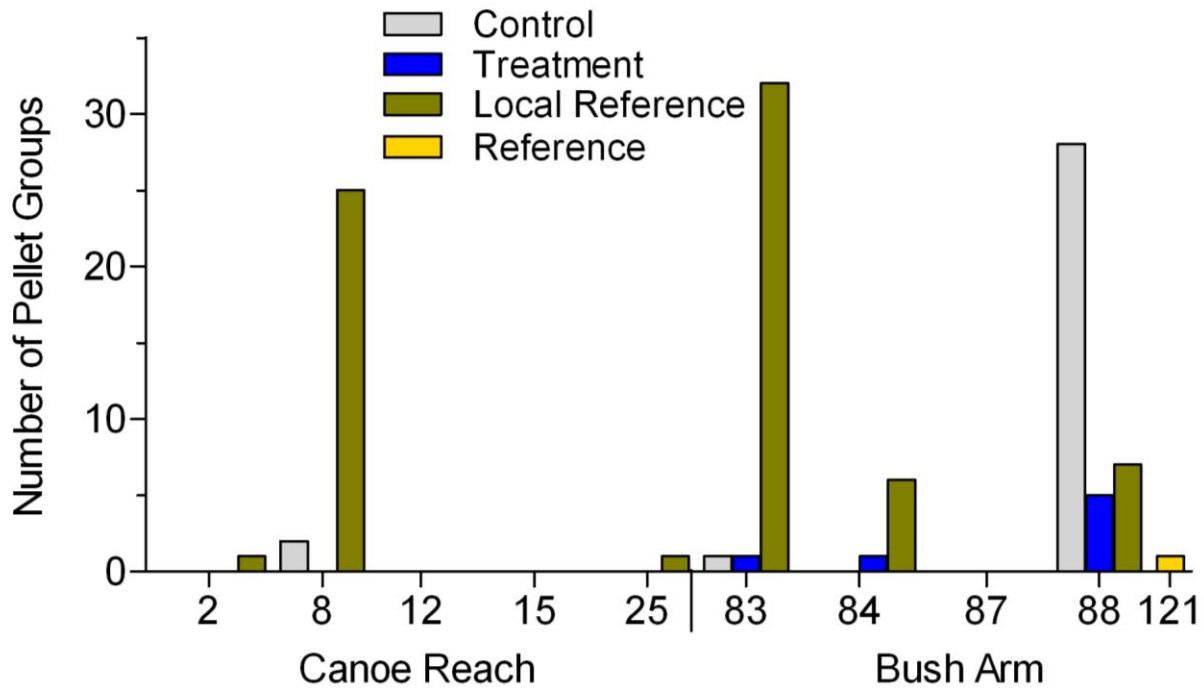


Figure 4-1: Number of pellet groups for all ungulate species by transect and site.

5 DISCUSSION

Ungulates select resources based on forage and mobility requirements, while minimizing predation risk (Kittle et al. 2008). A number of factors, including quality and quantity of forage, snow depth, and thermal and security cover, influence resource selection patterns by different ungulate species to varying degrees (Kittle et al. 2008, Hansen et al. 2009).

The systematic ungulate pellet group surveys used in this project are a non-invasive, cost effective means of obtaining an index of ungulate relative abundance (Neff 1968, Collins and Urness 1981, Resources Inventory Committee 1998). The annual pellet group surveys are complemented by periodic aerial winter ungulate surveys along the entire drawdown zone. In the context of the CLBMON-11A wildlife effectiveness monitoring program, these surveys provide information on the relative use of areas in and above the drawdown zone by ungulates and their distribution around the reservoir. The pellet count data will be used to test the following management hypotheses:

H_{O2}: Revegetation does not increase the utilization of habitats by ungulates in the drawdown zone.

H_{02A}: Revegetation does not increase the seasonal abundance (winter/spring) of ungulates in the drawdown zone.

In 2012, the frequency of pellet groups (0.23, 111 in 480 plots) was higher than in 2011 (0.11, 45 in 417 stations) but still lower than in most previous years (2008: 0.38, 136 in 360 plots; 2009: 0.53, 335 in 630 plots; 2010: 1.4, 692 in 495 plots) (CBA 2009, 2010, 2011a, 2011c). The high numbers of pellet groups recorded in 2009 and 2010 were primarily the result of large numbers of elk pellet groups encountered at some Bush Arm sites. The overall distribution of pellet groups in 2012 was also different from previous years with the majority of pellet group detection from only a few sites rather than a more even distribution. Additionally, for the first time, in 2012 moose were not detected in Canoe Reach.

The reason for the low number of ungulate detections in the 2012 surveys may be due to a deep winter snowpack, but no aerial surveys were conducted in March 2012 to confirm this. In previous years, ungulate observations during the late winter aerial surveys have corresponded with the results of the pellet group surveys, particularly for the Bush Arm elk herd (CBA 2011a). Factors such as snow depth and annual inundation level should be reviewed in future technical reports to determine if either factor has an influence on ungulate use of the drawdown zone.

The 2012 ungulate pellet group surveys were conducted approximately one month earlier than in 2011. The dense vegetation growth that may have affected pellet group detections in 2011 (CBA 2011c) was not an issue in 2012. High water levels in the Bush River prevented access to one of the transects at site 121 and could have potentially affected the number of pellet groups detected at the other transect on this site. Use of the site 88 treatment transect by ungulates was likely affected by the extensive coverage of woody debris deposited during full pool. The presence of woody debris would have reduced access to forage and resulted in poor footing, effectively excluding elk from this transect. Access to sites 87 and 88 was affected by washouts from the rivers that flow through these sites.

A discussion of the habitat requirements of moose, elk and deer and how the revegetation program would be expected to increase the use of drawdown zone habitats by these species is provided in CBA (2011a). Measurable increases in herb cover (sedge and grass treatments) and shrub cover (live stake and deciduous plug treatments) will likely have to occur before differences in ungulate use of the drawdown zone are observed. Most revegetation treatments completed to date have had poor or no success (Keefer et al. 2011).

The Year 5 pellet count data provide continuity in the ungulate data for future years of the wildlife effectiveness monitoring program. The results from Year 3 provided some indication that the revegetation program may be producing positive results for ungulates (CBA 2011a). However, it was considered too early to draw any conclusions about the effectiveness of the revegetation program (CBA 2011a). The relatively low numbers of pellet groups observed in 2012 confirm that additional years of monitoring on successfully revegetated sites will be required to determine if the revegetation treatments have been effective in increasing ungulate use of drawdown zone habitats.

As discussed in (CBA 2011a), the revegetation treatments were completed either just prior to or during the wildlife effectiveness monitoring program. Additionally, the success of the revegetation treatments was variable, with either complete failure in some locations (e.g., live stake treatment at Site 85 in Bush Arm), poor establishment of the revegetation treatment, or losses due to erosion and deposition in other locations (Keefer et al. 2011). Therefore most data collected to date is primarily baseline data. Coordination with the revegetation program (CLBWORKS-1) about future planting locations and replanting plans will also be required before the next effectiveness monitoring is initiated to avoid conflicts between the two studies and to confirm monitoring locations.

5.1 Recommendations

The ungulate pellet counts were continued during Year 5 of CLBMON-11A to address one of the recommendations in CBA (2011a). Based on the results and observations during Year 5, the following recommendations should be addressed in future years of the effectiveness monitoring program:

- Coordination with the revegetation program will be crucial for the success of the wildlife effectiveness monitoring program in future years to ensure that appropriate controls are maintained and for coordination of sampling sites. The number of sites with high potential for revegetation is limited and as additional revegetation treatments are completed it is becoming difficult to maintain effective control transects for wildlife monitoring at some of the sites. Crowding has occurred at sites 15, 84, 87, and 88 due to the large areas treated at these sites. This has affected transect placement, particularly for identifying appropriate locations for control transects.

- Ungulate pellet count data should continue to be collected every year, as the plots need to be cleared of pellets annually to ensure that pellets detected are only from a single year.

6 LITERATURE CITED

BC Hydro. 2008. Columbia River Project Water Use Plan, monitoring program Terms of Reference: CLBMON-11A wildlife effectiveness monitoring of revegetation in Kinbasket Reservoir. BC Hydro, Burnaby, BC.

BC Hydro. 2012. Columbia River Project Water Use Plan, Kinbasket & Arrow Reservoir Revegetation Management Plan, Annual Report: 2012. BC Hydro, Burnaby, BC.

Collins, W. B., and P. J. Urness. 1981. Habitat preferences of mule deer as rated by pellet-group distributions. The Journal of Wildlife Management 45:969–972.

Cooper Beauchesne and Associates Ltd (CBA). 2009. Monitoring program no. CLBMON-11A: Wildlife effectiveness monitoring of revegetation in Kinbasket Reservoir, Final Technical Report, Year 1 (2008). BC Hydro, Water License Requirements, Golden, BC.

Cooper Beauchesne and Associates Ltd (CBA). 2010. Monitoring program no. CLBMON-11A: Wildlife effectiveness monitoring of revegetation in Kinbasket Reservoir, Final Technical Report, Year 2 (2009). BC Hydro, Water License Requirements, Golden, BC.

Cooper Beauchesne and Associates Ltd (CBA). 2011a. Monitoring Program CLBMON-11A: Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir, Final Technical Report – Year 3 (2010). BC Hydro, Water License Requirements, Golden, BC.

Cooper Beauchesne and Associates Ltd (CBA). 2011b. Monitoring Protocols for CLBMON-11A: Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir (2010 Update). Cooper Beauchesne and Associates Ltd. for BC Hydro Water License Requirements.

Cooper Beauchesne and Associates Ltd (CBA). 2011c. Monitoring Program CLBMON- 11A: Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir, Data Summary Report – Year 4 (2011). BC Hydro Water Licence Requirements, Golden, BC.

Hansen, B. B., I. Herfindal, R. Aanes, B. E. Saether, and S. Henriksen. 2009. Functional response in habitat selection and the tradeoffs between foraging niche components in a large herbivore. Oikos 118:859–872.

Keefer, M. E., R. J. Moody, K. Dixon, and A. Kennedy. 2011. CLBWORKS-1 Kinbasket Reservoir Revegetation Program Physical Works Report – 2010. BC Hydro, Water License Requirements, Castlegar, BC.

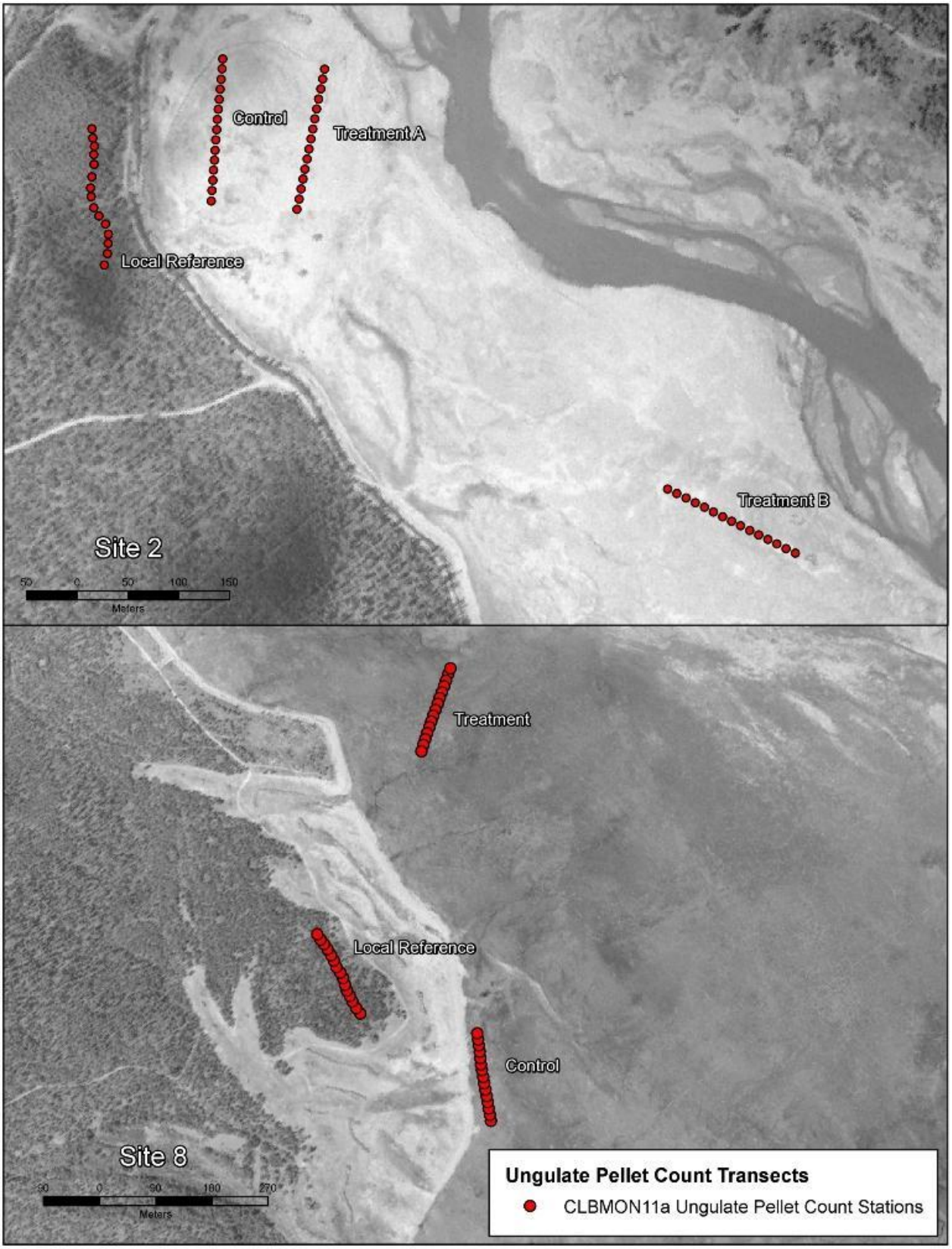
Kittle, A. M., J. M. Fryxell, G. E. Desy, and J. Hamr. 2008. The scale-dependent impact of wolf predation risk on resource selection by three sympatric ungulates. Oecologia 157:163–175.

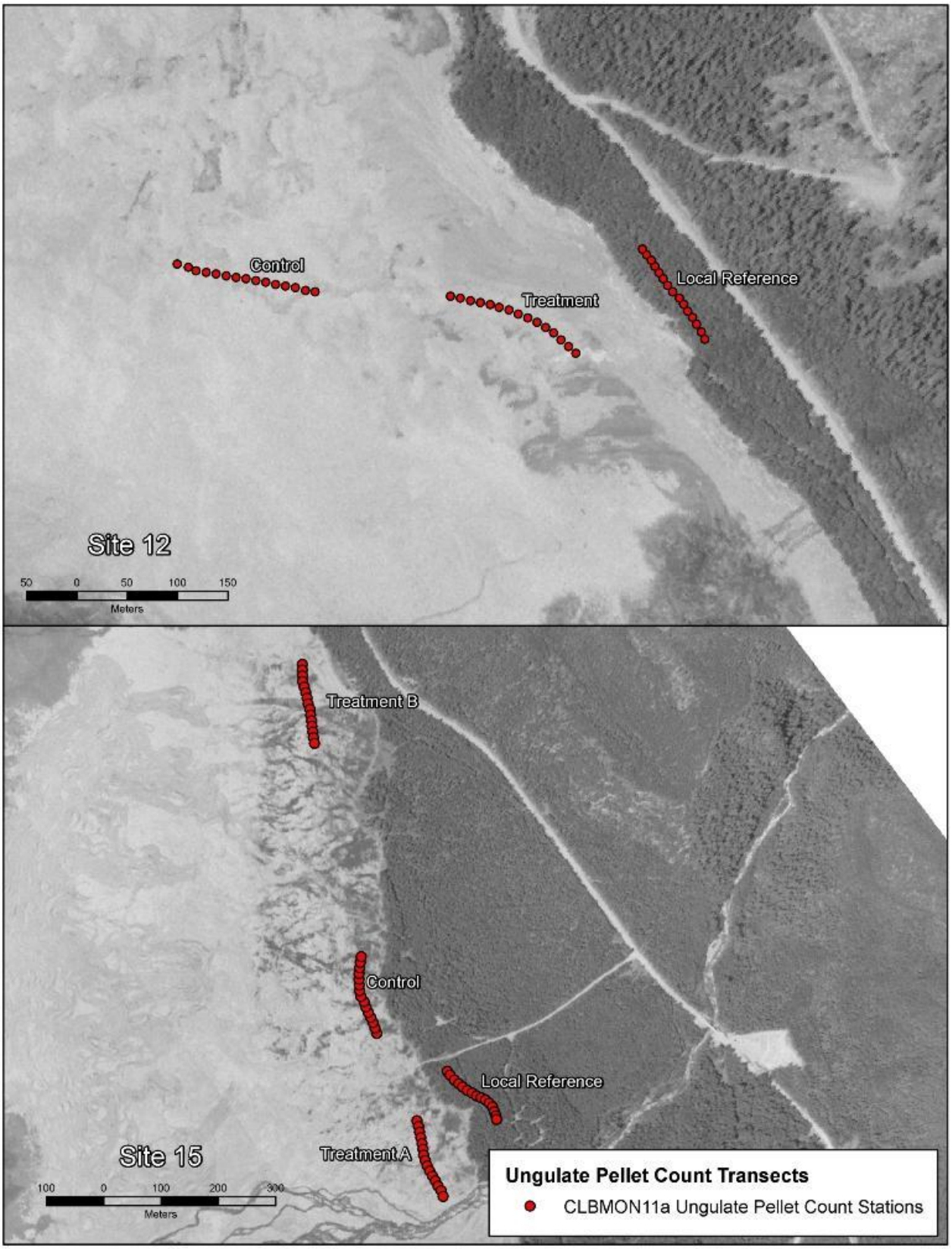
Neff, D. J. 1968. The pellet-group count technique for big game trend, census, and distribution: A review. The Journal of Wildlife Management 32:597–614.

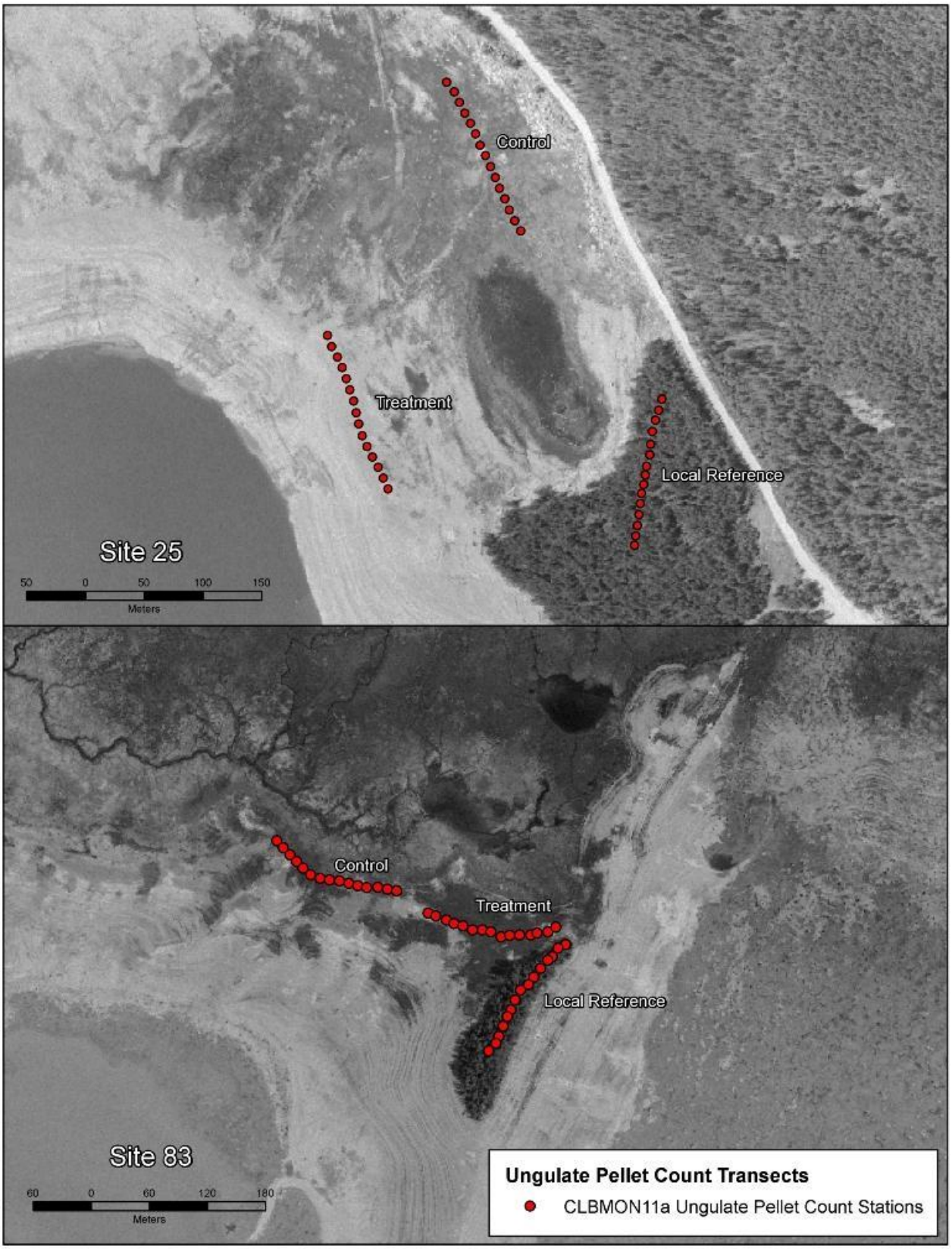
Resources Inventory Committee. 1998. Ground-based inventory methods for selected ungulates: Moose, elk and deer. Ministry of Environment, Lands and Parks.

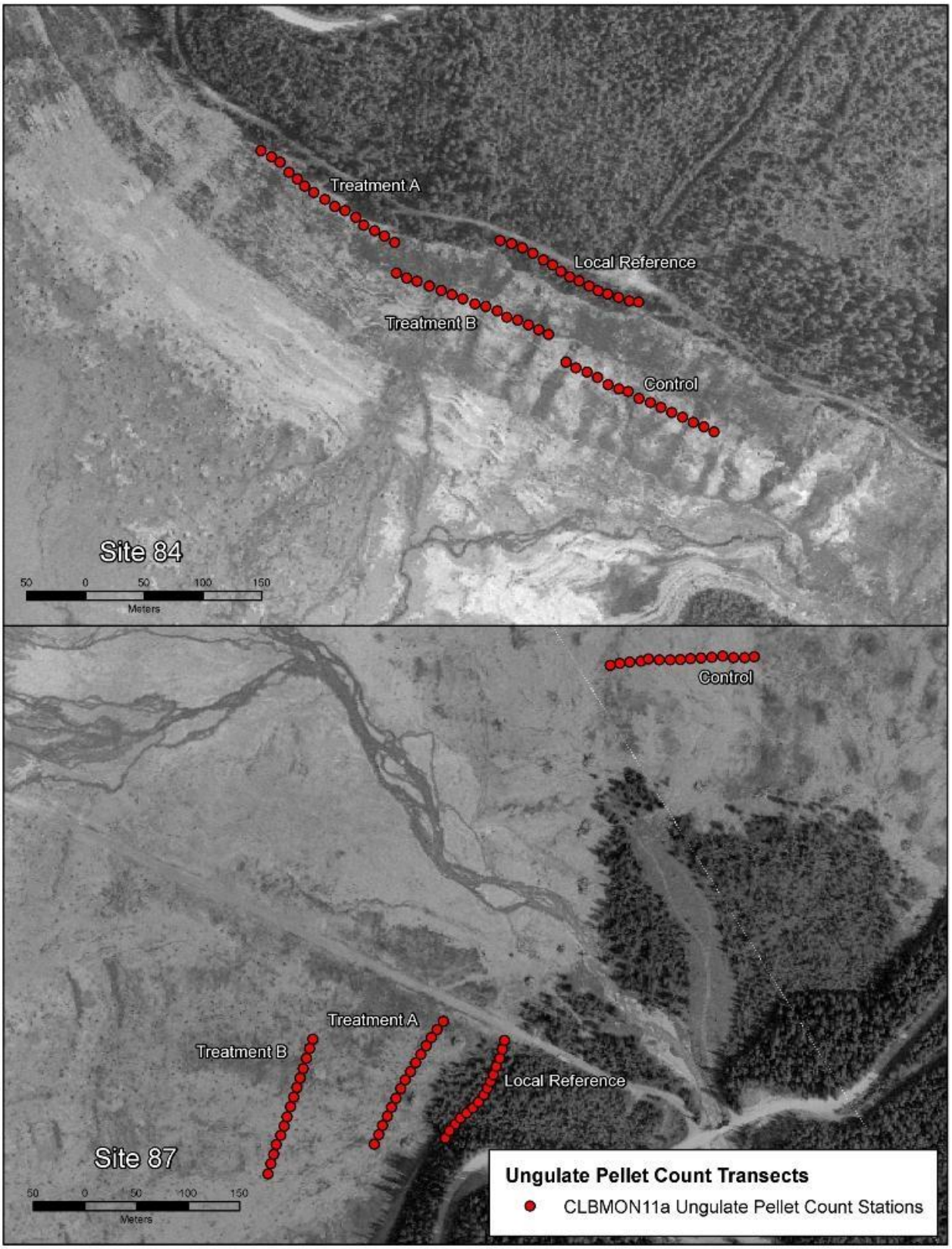
Shackleton, D. 1999. Hoofed mammals of British Columbia. UBC Press, Vancouver, BC.

Appendix 1. Sampling location maps.


Control
Treatment A
Local Reference
Treatment B
Site 2
50 0 50 100 150
Meters
Treatment
Local Reference
Control
Site 8
90 0 90 180 270
Meters
Ungulate Pellet Count Transects
CLBMON11a Ungulate Pellet Count Stations


Control
Treatment
Local Reference
Site 12
50 0 50 100 150
Meters
Treatment B
Control
Local Reference
Treatment A
Site 15
100 0 100 200 300
Meters
Ungulate Pellet Count Transects
CLBMON11a Ungulate Pellet Count Stations


Control
Treatment
Local Reference
Site 25
50 0 50 100 150
Meters
Control
Treatment
Local Reference
Site 83
60 0 60 120 180
Meters
Ungulate Pellet Count Transects
CLBMON11a Ungulate Pellet Count Stations


Treatment A
Local Reference
Treatment B
Control
Site 84
50 0 50 100 150
Meters
Control
Treatment A
Treatment B
Local Reference
Site 87
50 0 50 100 150
Meters
Ungulate Pellet Count Transects
CLBMON11a Ungulate Pellet Count Stations


Control
Treatment
Local Reference
Site 88
30 0 30 60 90
Meters
Reference Transect A
Reference Transect B
Site 121
75 0 75 150 225
Meters
Ungulate Pellet Count Transects
CLBMON11a Ungulate Pellet Count Stations

Appendix 2: Summary of ungulate pellet group count data, 2012

Region	Site	Transect	Deer	Moose	Elk	Total
Canoe Reach	2	Control	0	0	0	0
		Treatment A	0	0	0	0
		Treatment B	0	0	0	0
		Local Reference	1	0	0	1
	8	Control	2	0	0	2
		Treatment	0	0	0	0
		Local Reference	25	0	0	25
	12	Control	0	0	0	0
		Treatment	0	0	0	0
		Local Reference	0	0	0	0
	15	Control	0	0	0	0
		Treatment A	0	0	0	0
		Treatment B	0	0	0	0
		Local Reference	0	0	0	0
	25	Control	0	0	0	0
		Treatment	0	0	0	0
		Local Reference	1	0	0	1
Bush Arm	83	Control	0	1	0	1
		Treatment	0	0	1	1
		Local Reference	3	2	27	32
	84	Control	0	0	0	0
		Treatment A	0	0	0	0
		Treatment B	0	1	0	1
		Local Reference	0	6	0	6
	87	Control	0	0	0	0
		Treatment A	0	0	0	0
		Treatment B	0	0	0	0
		Local Reference	0	0	0	0
	88	Control	2	0	26	28
		Treatment	0	0	5	5
		Local Reference	0	0	7	7
	121	Reference A	0	0	1	1
		Reference B*	-	-	-	-

* – Transect flooded.