

Methodology for Field Assessments in the Project:  
Adaptive Management of Forestry Practices in Pine-Lichen Winter range for  
Northern Caribou in North Central British Columbia

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Prepared by: Todd Windle  
and  
Randy Sulyma  
Forest Floor Contracting Ltd.  
Box 271, Fort St. James, BC  
VOJ 1PO

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## Introduction

The goal of this adaptive environmental management project is to increase the understanding of forestry practices in pine-lichen woodlands that promote the maintenance of terrestrial lichens after harvesting. Pine-lichen woodlands, which comprise thick mats of reindeer lichen (*Cladina* spp.) provide valuable foraging areas for northern caribou during portions of the winter (Cichowski, 1993). Characteristics of pine-lichen woodlands include well-drained soils and a poor nutrient regime (Johnson, 1981; Rowe, 1984; Stevenson, 1991).

Common forestry practices on these sites use ground based harvesting systems to remove trees from the setting. These systems can include a feller buncher, skidder, or forwarder, a processor and a loader. When a skidder is used, the entire tree including the crowns are dragged to a landing where they are processed (prepared for delivery to the mill). This procedure is referred to as a “whole tree” harvesting. Correspondingly, when a forwarder is utilised, trees are processed at the stump (in the setting where they are felled) and only the finished log is taken to the landing to be loaded onto the truck. This method of harvesting is referred to as a “cut-to-length” system.

Silviculture practices utilised on these dry sites can involve slash re-alignment to aid in planting and to promote natural regeneration (referred to as scarification), or “raw” planting. Raw planting is planting the site as it was left after harvesting.

When considering all of the alternatives that can be applied to pine-lichen sites there are numerous combinations of treatment regimes that can be tested. We focused on assessing specific treatment effects of the conventional forestry practices that are currently used. Nine different treatment regimes were established to test a combination of harvesting, site preparation and regeneration methods (Table 1) (Sulyma & Wawryszyn, 2001). Variations in the combination of regimes implemented will occur at each site. At the 98-Mile site, which is the focus of the pre-treatment assessments in the Mackenzie portion of

**Table 1.** Summary of treatment regimes to be applied

Treatment Regime	Predicted Conditions for Lichen <sup>1</sup>	Harvesting Method	Harvesting Season	Site Preparation	Regen Method	Results of the Treatment
1	Best	Whole tree	Winter	None	Natural	Creating small amounts of debris with little disturbance to the lichen mats and providing a more open canopy cover during regeneration.
2	Good	Cut to length	Winter	None	Natural	Creating large amounts of debris with little disturbance to the lichen mats and providing a more open canopy cover during regeneration.
3	Moderate	Cut to length	Summer	None	Natural	Creating large amounts of debris with moderate disturbance to the lichen mats and providing a more open canopy cover during regeneration.
4	Moderate	Cut to length	Summer	None	Plant	Creating large amounts of debris with moderate disturbance to the lichen mats and providing a more closed canopy cover during regeneration.
5	Worst	Cut to length	Summer	Drag scarify	Natural	Creating large amounts of debris with very heavy disturbance to the lichen mats and providing a more open canopy cover during regeneration.
6	Good	Whole tree	Summer	None	Natural	Creating small amounts of debris with heavy disturbance to the lichen mats and providing a more open canopy cover during regeneration.
7	Moderate	Whole tree	Summer	None	Plant	Creating small amounts of debris with heavy disturbance to the lichen mats and providing a more closed canopy cover during regeneration.
8	Worst	Whole tree	Summer	Drag scarify	Natural	Creating small amounts of debris with very heavy disturbance to the lichen mats and providing a more open canopy cover during regeneration.
9	Worst	Whole tree	Summer	Drag scarify	Plant	Creating small amounts of debris with very heavy disturbance to the lichen mats and providing a more closed canopy cover during regeneration.

<sup>1</sup>This designation is based on the premise that no disturbance provides optimal conditions for lichen growth and regeneration.

the study area for 2001 (and the example site used within this document), six treatment regimes and a control area were established.

For each site, detailed monitoring will track changes in the forest floor cover vegetation, forest ground cover disturbance, levels of coarse woody debris (CWD) and tree regeneration. Pre-treatment conditions evaluated the summer prior to the implementation of treatment activities will be used as the basis for measuring change. This project will evaluate both short-term and long-term results. The short-term component involves monitoring for the first 30 years after harvesting, specifically the first five years after treatment activities. Indicators, such as changes in the forest floor vegetation community, soil disturbance, CWD accumulations and costs associated with the treatments will be measured. The long-term time frame involves monitoring of the lichen's response to changes in the forest overstorey and the growing medium over the rotation of the stand. This report outlines the methodology for data collection in this adaptive environmental management project for those variables expected to give a response in the short term.

### **Study Area**

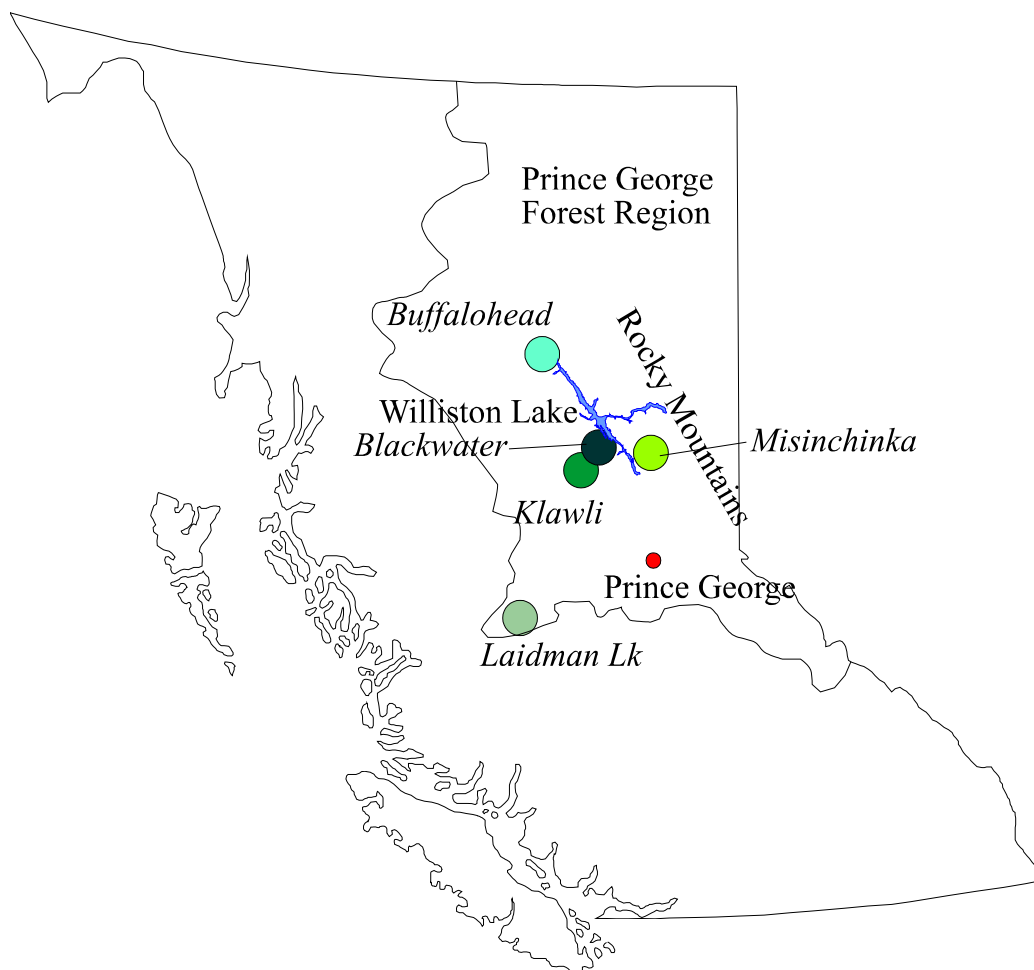
The study area for this project lies west of the Rocky Mountains in the Prince George Forest Region (Figure 1). Three sites will be established in the Laidman Resource Management Zone (RMZ) of the Vanderhoof Forest District and four sites in the Mackenzie Forest District (Table 2). The sites in the Mackenzie Forest District fall within the Blackwater, Klawli and Buffalohead RMZ's respectively, with one site still to be determined. In the summer of 2001 field activities were conducted on a single site at the 98-Mile site in the Blackwater RMZ.

Mackenzie Forest District: This portion of the study falls within the Sub-Boreal Interior (Sbi) ecoprovince. The ecosections encountered in this portion of the study are the Babine Uplands, Manson Plateau, McGregor Plateau, Nechako Uplands and the Parsnip Trench. Five biogeoclimatic sub-zones are found throughout the Mackenzie portion of

the study. These are the Williston moist, cool sub-zone (wk1), the Mossvail moist cool sub-zone (mk1), the Willow wet cool sub-zone (wk1) and the Finlay-Peace wet cool sub-zone (wk2) of the Sub-Boreal Spruce zone (SBS *xx*). The Omineca moist, very cold sub-zone of the Englemann Spruce Sub-Alpine Fir zone (ESSF mv3) is also encountered (Medinger & Pojar, 1991).

Vanderhoof Forest District: This portion of the study falls within the Nazko Upland ecosection of the Central Interior (Cei) ecoprovince. Four biogeoclimatic sub-zones are encountered through this portion of the study area. They are the moist cold subzone of the Sub-Boreal Spruce zone (SBPSmc), the Babine moist cold and Kluskus moist cold subzones of the Sub-Boreal Spruce zone (SBSmc2 and SBSmc3), and the Nechako moist very cold subzone of the Englemann Spruce-Subalpine Fir zone (ESSFmv1) (Medinger & Pojar, 1991).

All sites chosen for this study show typical characteristics of pine-lichen woodlands found in western Canada including well-drained soils and a poor nutrient regime (Johnson, 1981; Rowe, 1984; Stevenson, 1991). The canopy cover at each site is dominated by lodgepole pine (*Pinus contorta* var. *latifolia*). Ground vegetation commonly found on the study sites include soopolallie (*Shepherdia canadensis*), lingonberry (*Vaccinium vitis-idea*), black huckleberry (*Vaccinium membranaceum*), dwarf blueberry (*Vaccinium caespitosum*), bunchberry (*Cornus canadensis*), kinnikinnick (*Arctostaphylos uva-ursi*), and twinflower (*Linnaea borealis*). Some of the terrestrial lichen found in the area where *Cladina mitis*, *Cladina rangiferina*, *Cladonia uncialis*, *Cladonia ecmocyna* and *Peltigera* spp.



**Figure 1.** Overview map of the project area.

**Table 2.** Site Location Information

RMZ	Forest District	Site	UTM (Zone 10)		BEC Zone
			Northing	Easting	
Blackwater	Mackenzie	98-Mile	6150200	473270	SBSmk2
Klawli	Mackenzie	Klawli	6149000	396400	ESSFmv3
Buffalohead	Mackenzie	Tsay Key	?	?	SBSmk2
?	Mackenzie	?	6107000	514000	SBS?
Laidman	Vanderhoof	Vhoof1	5890000	345000	SBS?
Laidman	Vanderhoof	Vhoof2	5890000	345000	SBS?
Laidman	Vanderhoof	Vhoof3	5890000	345000	SBS?

## Site Survey

For each treatment regime a 300-metre transect running east/west was established (Figure 2). A tight chain<sup>1</sup> was used to establish a 200-metre tie line to the POC of each transect. At the 98-mile site, the tie lines were fixed from the closest intersection of the on-block roads, at an angle of 45, 135 or 315 degrees. A marker pin was placed 30-metres from the POC of the tie line and at the POT-tie line.

All marker pins used for this project are 30-centimetre spikes with a washer and 1-metre of pink winter ribbon attached to aid in their location after logging. The two closest trees to each marker pin were painted pink below 20-centimetres with log marking paint. The trees were marked with metal tags stating the distance to the marker pin, the distance along the tie line or transect, and when necessary, the number of the stand plot centred on that pin. This process was repeated for every marker pin used throughout the layout procedure. All of the marker pins were placed as flush as possible into the ground to prevent removal during logging. After harvesting, the marker pins will be located and replaced with permanent 1.2-metre cedar stakes. The locations of the marker pins were also recorded using a geographical positioning system (GPS) unit.

Transects were tight chained from the POT-tie line for 300-metre with marker pins placed every 50-metres. A second tie line was established at the POT of each transect continuing in the same direction beyond the boundary of the treatment area. The POT of the tie lines that extend beyond the treatment area were marked with cedar stakes that were painted pink and marked with metal tags stating the distance and direction from the POT of the transect. Field maps at a scale of 1:20,000 were also created during the layout process. They showed the location of all reference trees, marker pins and quadrats.

Plot centres were established at 50-m intervals along the transect and used for forest stand evaluations and coarse woody debris surveys. Throughout the process care was taken to

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<sup>1</sup> Note: a list of required materials is listed in Appendix 1.

Figure 2 <insert map of study area>

avoid stepping on the south side of the transect over a one metre strip where vegetation plots were to be established.

### **Forest Stand Evaluation**

Fixed radius plots were set up at each of the six marker pins from 0+050 to 0+300 metres along the transect. The plots were centred 30-centimetres to the north of the marker pins as to avoid disturbing them. Each tree in the plot was marked with a ribbon and given a number. The height, diameter at breast height (DBH), counted age and tree species were recorded for each tree. The DBH was measured in centimetres with a diameter tape in accordance with Husch *et al.* (1982). The height of each tree was measured using a Haglof, Vertex hypsometer and the age was determined using an increment borer (Husch *et al.*, 1982). For trees with a DBH less than 4-centimetres, a simple tally was kept separating the trees according to species and whether they were greater than or equal to 1.3-metres or less than 1.3-metres in height. Vegetation and soil overviews were also conducted at each stand plot to allow a biogeoclimatic ecosystem classification assessment (DeLong *et al.*, 1993).

### **Understorey Vegetation Evaluation**

Understorey vegetation cover was evaluated using both ocular estimates and photo imaging of 0.71 X 0.71 metre quadrats. To ensure broad coverage of the study area, each transect was divided into three 100-metre sections with 14 randomly selected quadrats established in each section. The quadrats were established along the south edge of each transect. Marker pins with a washer and 1-metre of pink winter ribbon were placed at each quadrat labelling the transect number, quadrat number, and distance of the quadrat along the transect. For each quadrat, ocular estimates were made of the vegetation cover to the species level before they were photographed.

A 28-mm lens was used on a manual single-lens-reflex camera mounted on a tripod with a horizontal boom. A photo card was placed beside the quadrat frame in each picture stating the site, treatment regime, quadrat number and distance of the quadrat along the transect. When a large tree was encountered inside the quadrat that inhibited photographs, only ocular estimates were made. When the placement of the quadrat frame went directly through a tree, the frame was dismantled and smaller pieces were used to build the quadrat up to the edge of the tree. Ocular estimates and photos were then taken. If a small tree was encountered inside the quadrat, it was pushed aside and photos were taken. The photographs were scanned using a flatbed scanner and the areas of specific vegetation types (i.e. feather moss and reindeer lichens) were determined using the software package SigmaScan Pro 5.0 (SPS Science Inc., 1999). This information will be used to measure changes in the percent cover of vegetation types in subsequent years.

### **Coarse Woody Debris (CWD) Evaluation**

Course woody debris was evaluated using the procedure from the “Field Manual for Describing Terrestrial Ecosystems” (Anonymous, 1998). Three CWD plots, each consisting of two, 24-metre sub-transects, were conducted for each treatment regime. Each plot had a randomly chosen POC from one of the six stand plot centres along the main transect. The information gathered for each piece of CWD was combined to give insight into the percent of ground cover, the volume, the condition and the suitability as habitat for wildlife. Similar information was measured for each pile of CWD found on the sub-transect. Piles were not encountered during the pre-treatment surveys, however, they are expected to be common after harvesting.

### **Soil and Forest Floor Cover Disturbance Evaluation**

A walk through assessment of the sites indicated that very little soil disturbance currently exists. Therefore, it was determined that only post harvest soil and forest floor cover disturbance will be measured. Disturbance will be measured using the survey methods

detailed in the “Soil Conservation Surveys Guidebook” (BC Ministry of Forests, 1997). The guidebook categorises the soil disturbance types using the means and/or effect of the disturbance. An additional category of disturbance termed mixing will be added for this study. This category is intended to provide a way of noting if any of the treatment regimes result in heavy mixing of organic and mineral soil layers. The mixing of these layers is expected to provide a habitat that is favourable for herb growth that will effectively reduce lichen development.

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## Appendix 1: List of Materials

Compass	7.98-metre plot cord
12" common nails (86 per treatment regime)	Tree diameter tape
Washers (86 per treatment regime)	Increment borer
Pink winter ribbon	Vertex
Yellow poly ribbon	Clinometer
Permanent black marker	Callipers
Pink log marking paint	Tape measure/loggers tape
Metal tags and ball point pen	Photo card
Tight chain	SLR camera
Hatchet	28 mm wide angle lens
GPS unit	Tripod with a horizontal boom
48" cedar stakes	Data sheets and pencil
0.5-metre squared quadrat frame	Flatbed scanner
35-cm quadrat frame pieces	SigmaScan Pro 5.0 software