

PHASE 5: BASELINE HEAVY METAL AND RADIONUCLIDE CONTAMINANTS IN CARIBOU LICHENS IN THE DEH CHO REGION, NWT.

INTRODUCTION

Many studies have utilized the natural capacity of lichens to function as biological receptors for atmospheric gases and particles to examine the movement and deposition of air-borne elements and pollutants in northwestern North America (Addison & Puckett, 1980; Puckett & Finegan, 1980; Furbish et al, 2000). The purpose of this phase of this project is to describe and monitor the “caribou lichen” communities (*Cetraria ericetorum*, *Cladina mitis*, *Cladina rangiferina*, *Cladina stellaris*, *Cladonia uncialis*, *Flavocetraria nivalis* and *Stereocaulon spp.* (Scotter, 1967; Thomas and Hervieux, 1986)) that currently exist within the Deh Cho Territory. These lichens are considered to be the most common lichens used by caribou during the winter months, and the abundance and health of these species can be used as an index of winter forage availability for caribou.

Lichen specimens will be collected from permanent sample plots to be established throughout the Deh Cho Territory. The specimens will be analyzed for the presence of heavy metals and radionuclides. In addition, species richness and abundance of the “caribou lichens” will be recorded in these permanent sample plots. This baseline data will allow for the establishment of a long term monitoring project that examines the health and availability of the most important of winter caribou forage species. This information will not only allow for the monitoring of contaminants in the environment, but will also aid in the management of caribou in the Deh Cho Territory by providing a coarse level assessment of forage availability across the a large geographical area and in time. made. Establishment of such an information baseline and continued monitoring will allow for a better understanding of air quality and the deposition of air-borne pollutants. This will allow for the determination of the potential effects of increased industrial development, such as oil and gas exploration, on caribou lichens and associated wildlife, such as caribou populations, as well as associated human health within the Deh Cho territory.

OBJECTIVES

The main objectives of this phase of the project will be:

1. To identify the species richness and abundance of caribou lichens at ten representative locations within the Deh Cho Territory.
2. To determine existing levels of heavy metals and radionuclides in caribou lichen species at ten representative locations within the Deh Cho Territory.
3. To establish the representative locations from this study as permanent sampling sites for continued monitoring of changes in species richness and abundance and contaminant levels.

METHODS

Ten representative locations within the Deh Cho Territory will be selected for the study based on a combination of potential areas of industrial development and traditional knowledge. In the Northwest Territories, caribou forage includes the terrestrial lichen species *Cetraria ericetorum*, *Cladina mitis*, *Cladina rangiferina*, *Cladina stellaris*, *Cladonia uncialis*, *Flavocetraria nivalis* and *Stereocaulon spp.* (Scotter, 1967; Thomas and Hervieux, 1986). Methodology will be modified from an established protocol developed for examining long-term responses of lichen communities to changes in air quality (McCune, 1994). At each location, a single 34.7 m radius circular plot (3782 m²) will be established. Within each plot, the presence and abundance of all caribou lichens will be recorded. Biomass data will not be collected since biomass collection work requires substantial amounts of time and effort and abundance estimations have been shown to correlate very well with biomass for lichens.

At each plot five voucher specimen of each identified caribou lichen species will be collected and numbered sequentially from 1 to 5. Voucher specimens will be as large as possible (approximately hand-sized) to ensure dry weight is a minimum of one gram. One specimen will be permanently stored for species verification by a lichen taxonomic specialist if required at a later date. The other four specimens will be utilized for contaminant analysis (three for immediate laboratory analysis as described below and one for future examination if needed).

Only caribou lichen species common to all ten sampling locations will be analyzed. Therefore, not all of the caribou lichen species listed above may be utilized. For each location, three samples of caribou lichens will be prepared for laboratory analyses. A similar amount of lichen material from each species will be combined into a single pooled sample and three pooled samples from each plot will be produced. In this manner, time and costs can be minimized in determining the presence and/or content of contaminants currently in caribou lichens within the Deh Cho territory. If contaminants are found at a particular location, the remaining voucher specimens can be used to determine the particular caribou lichen species the deposition is occurring in. Pooled samples will be sent for laboratory analyses for heavy metals and radionuclide. Heavy metals to be examined will include Cd, Pb, Hg, As. Radionuclides will include Cs-137, Cs-134, K-40, Pb-210, Po-210

Once the field work and laboratory analyses are completed, data will be summarized in report form. The report will include a description of the caribou lichen communities present at each of representative locations as well as the current level of naturally occurring elements and contaminants currently within caribou lichens in the Deh Cho territory.

REQUIRED PERSONNEL

Senior Researcher

A senior researcher will be required to examine the traditional knowledge information collected by the communications team and to use this information to develop a statistically valid study design. This individual will also be required to undertake the field sampling and training field assistants to help in the identification of lichens and collection procedures.

After the field data has been collected and shipped to the laboratories the senior researcher will be required to examine and interpret the results of the field data collection and laboratory analysis. This person must be familiar with statistical analysis, and be capable of producing a comprehensive final report that incorporates information from this project, as well as, information from previous and concurrent related projects. This person will be responsible for ensuring the final deliverables for this phase of the project are met and should attend community meeting surrounding the dissemination of the final results.

Field sampling crews

We propose to train two field assistants from the Deh Cho in lichen identification and field collection techniques. Once trained in proper field techniques the two field assistants will aid the Senior Research in the field work.

Communications Team

The communications team will be required through this phase of the project to maintain contact with the local communities and answer questions and concerns where required. It is hoped that most questions and concerns will be addressed in Phase 1.

The communications team will also be responsible for ensuring technology transfer and information dissemination as a result of the final report. Any information regarding level of contaminants and potential impacts to caribou forage will be important to disseminate to all peoples of the Deh Cho Territory, and this will be the role of the communications team. It is anticipated that several communities meetings may be required to discuss the final results of the project and the communications team will be responsible for organizing and chairing these meetings.

PHASE DELIVERABLES

1. Final report providing:

- An analysis of the baseline levels of heavy metals and radionuclides found in caribou lichens. The analysis should be broken out by geographic location if possible.
- Comparison of results with other previous or concurrent studies on caribou lichens and contaminants.
- An explanation of potential sources of any contaminants found.
- Analysis of potential risks to human health and to caribou forage availability.

2. GIS database showing location of the permanent assessment plots linking the lichen species diversity and abundance data. This information could be incorporated into the existing Boreal

Caribou Habitat and Land Use Planning in the Deh Cho, Northwest Territories as a course analysis of caribou forage availability across the Deh Cho Territory.

3. Proposed long term monitoring program. Based on the results of the baseline report the specific contaminants, locations and timing of future assessments will be determined. The long term monitoring program will be used to determine whether contaminant levels are increasing, decreasing or remaining the same over time.

BUDGET

Wages and Fees

Senior Researcher 17 days @ \$800/day \$ 13 600.00

Field sampling crews 20 days @ \$125/day \$ 2 500.00

Communications team 3 days @ \$1000/day \$ 3 000.00

Subtotal Wages and Fees \$ 19 100.00

Report Preparation, brochure publication etc. \$ 1 000.00

Travel and Accomodations

Plane, truck and snowmobile travel, camp costs, hotel costs, food \$ 5 000.00

Field Equipment

Whirlbags, GPS, data books, pencils, paper, knives, calipers \$ 500.00

Laboratory Costs

Enviro Test Laboratories (Edmonton, AB.)

Heavy metals 30 samples @ \$350/sample \$ 10 500.00

Radionuclides 30 samples @ \$300/sample \$ 9 000.00

Shipping \$ 200.00

Subtotal Laboratory Costs \$ 19 700.00

TOTAL \$ 45 300.00