



## **PLAIN LANGUAGE SUMMARY**

**Evaluation of approaches to depicting First Nations,  
Inupiat and Inuvialuit environmental information in GIS  
format: Options for the handling of spatial information in  
the Arctic Borderlands Ecological Knowledge Co-op  
database**

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## **Introduction**

Climate change is a threat to Arctic plant and animal life. It is also a risk to the health and well-being of northern indigenous peoples. Subsistence is a way of life for many indigenous peoples, such as the Gwich'in and Inuvialuit. Gwich'in settlements extend from northeast Alaska in the United States to the northern Yukon and Northwest Territories in Canada. Caribou are important to these people. Traditionally, Gwich'in life and culture are based on the Porcupine Caribou Herd (PCH). The Herd is their main source of food, tools, and clothing. Fish, berries and other plants and animals supplement their diet.

## **Climate Change in the ABEKC Region**

Global warming in the range of the PCH is causing faster melt periods in spring, warmer summers and greater snowfall in winter. It is also changing the structure of snow, resulting in harsher traveling and feeding conditions for caribou. Warming may also be contributing

to the decline in population of the PCH. Melting glaciers, reductions in the extent and thickness of sea ice, thawing permafrost and rising sea levels all provide strong evidence that temperatures are increasing. This warming has the potential to change migration patterns as well as the diversity, range, and distribution of animal and plant species. Caribou movements are dictated by the weather. Residents of northern indigenous communities who rely on caribou must intercept the PCH at key times of the year and are therefore vulnerable to changes in the migration routes. In addition, a warming climate increases the level of contaminants in the food chain. Therefore, climate change threatens both the supply and safety of Gwich'in and Inuvialuit peoples' traditional foods, such as caribou, berries and fish.

### **Traditional Environmental Knowledge**

The pace of climate change is increasing and the effects on the surrounding environment are becoming clear. In response, traditional

environmental knowledge (TEK) systems are being used to monitor the environment and assess climate change. TEK is the outcome of interactions between a culture and the natural environment. It is developed through everyday activities such as harvesting and hunting. TEK systems are used by researchers, land use planners, government agencies, policy-makers and indigenous peoples.

### **Arctic Borderlands Ecological Knowledge Co-op**

The Arctic Borderlands Ecological Knowledge Co-op (ABEKC) is an example of one agency that uses TEK systems to monitor the environment. ABEKC is a cooperative effort between Gwich'in and Inuvialuit communities in northern Canada and Alaska. The geographic focus of the Co-op is the U.S. - Canada Arctic Borderlands, which is defined by the range of the PCH and nearby coastal environments. ABEKC was founded in 1994 and seeks to strengthen the role of aboriginal knowledge in environmental assessment. The goal of ABEKC is to improve understanding of

landscape change and ecological trends. It also seeks to increase the integration of local knowledge (from northern indigenous peoples) and science.

### **ABEKC's Community Monitoring Program**

For the past ten years ABEKC has conducted interviews with the most active fishers, harvesters and hunters in the communities of Aklavik, Arctic Village, Fort McPherson, Kaktovik, Old Crow, and more recently, in Inuvik, Tsiigehtchic, and Tuktoyaktuk. These interviews are a great way to monitor plants, animals and climatic conditions in the homelands of northern communities. The surveys include questions about berries, weather, fish, human activity, caribou and other animals. These observations are used to learn what is changing in the environment and why the changes are occurring.

## Research Objectives

This paper investigates how these observations can be displayed in mapped format. TEK has a long, rich history of use, but because it is traditionally oral, putting it into mapped format is challenging. This research uses Geographic Information Systems (GIS)<sup>1</sup> to explore ways to illustrate the observations in the form of maps. During the interviews, community experts are asked to draw on a map such sightings as where they observed wildlife, human activity, caught fish or picked berries. In this paper, I look at how ABEKC collects, records and displays TEK. There are two research questions explored in this paper. The first is whether the data gathering and mapping process used by ABEKC can be improved. One of the goals of this research is to provide recommendations for improving the interview process. The second question is whether more useful information can be obtained from the data, in other words, how land-

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<sup>1</sup> GIS are sophisticated tools that allow geographic data to be stored, retrieved, displayed, analyzed and mapped.

user's observations can be displayed in a way that yields more information.

## **The Structure and Organization of the Database and Spatial Information**

Since 1999, land-user observations have been translated into map format using a GIS. Interviewees are asked several questions about each type of observation. The responses are then recorded in a database<sup>2</sup>. This descriptive information contains an identifier that is used to relate the two types of data. Therefore it is possible to display observations on a map (such as the location of wintering caribou) and look up details of the sightings in the database (such as caribou body condition). It is also possible to show all observations for a certain year or those made by interviewees in a particular community. Being able to display different types of sightings for any year should provide a basis for tracking changes over time. However,

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<sup>2</sup> A database is an organized collection of data, arranged for ease and speed.

currently the maps are somewhat cursory. They show where interviewees described landscape phenomena but they do not tell a useful story about the landscape and landscape change. There is also a large amount of information contained in the database that is not being used because of the complicated design and nature of the database. It is hoped that this critical examination will help to paint a more useful picture of the changing environment of the upper Mackenzie, the northern Yukon and eastern Alaska.

## **Methodology**

Many different types of resources are used to address the research questions. I reviewed previously written work, conducted meetings with ABEKC personnel, critically examined the database and associated maps and reviewed commentary from community experts. In the first part of the paper I examined literature (including projects similar to this one) related to the following topics:

- Harvesting and hunting in the ABEKC region
- The use of GIS by indigenous governments, agencies and co-management bodies
- Climate change
- Caribou herd movements
- GIS and the use of TEK systems in the Yukon

I also met with ABEKC staff and key players involved in TEK-based projects in the Yukon. I compiled the steps involved in the production of knowledge through discussions in the Yukon with personnel involved with the following agencies and institutions:

- Canadian Wildlife Service
- Environment Canada
- North Yukon Planning Commission
- Yukon Department of Environment
- Yukon Land Use Planning Council
- Private consulting company
- Educational institutions (University of Alaska Fairbanks and Yukon College)
- Other key players involved in the various stages

From these meetings I received useful information about the many steps that ABEKC follows in order to produce knowledge. The steps are explained in terms of how, why and by whom they are performed.

These discussions also helped me identify stages of the process that need improvement. The stages are critically evaluated based on user-friendliness, overall efficiency, room for error and subjectivity. I also learned about what type of information is useful to agencies that operate in the ABECK region.

Finally, suggestions are provided which will improve the usefulness of the information that is collected from the interviews. The paper concludes with recommendations that will improve how the observations are illustrated on maps.

### **Organization of the Paper**

In the first chapter of the paper, the research is introduced. The objectives of the paper are explained and background

information on the Co-op is provided. The second chapter establishes the research context. It also stresses the urgency of this research. The methodology used to address the research objectives is outlined in chapter three. Chapters four and five address the first research question concerning whether the data gathering and mapping process can be improved. The way in which ABEKC produces knowledge is critically examined in chapter four. Each year, information from the interviews is entered into a database. Observations that have been hand-drawn on the interview maps are entered into a computer. Each circle representing the location of a sick caribou sighting or line representing a trap line is traced using a device called a digitizing tablet<sup>3</sup>. This is just one of several steps that the Co-op follows before the information collected from the interviews is displayed on a map. Chapter five contains a critique of ABEKC's knowledge

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<sup>3</sup> A digitizing tablet is an input device that allows users to enter information, such as sketches on a hard-copy map, into a computer. The digitizing "puck" is used to trace the drawings and put them into digital form.

production process. The critique is used to establish how the information gathering and mapping process can be improved. Critical comments which will make the processes more efficient are provided. In addition, the chapter makes suggestions for improving the usability of the database. These recommendations are derived from exploring the database, conducting interviews with ABEKC staff and reviewing commentary from community experts. At the end of each interview, respondents are asked how the interviews could be improved. I used input from community experts interviewed from 1996 to 2002 to compile the recommendations in chapter five. The final chapter explores options for handling the spatial information. Recommendations for improving the visualization of the data are provided.

### **Improving Visualization of the Spatial Information**

The second research question is whether more useful information can be obtained from the knowledge collected by ABEKC. The

question is addressed in chapter six by looking at possible mapping approaches that make trends easier to see and understand. Many observations made by interviewees are overlapping. The areas on the maps that overlap are important areas to the community. These areas should stand out on a map. Different approaches to depicting overlapping observations are explored. Since 1999 ABEKC has translated land-user observations into map format. Therefore, chapter six also looks at how similar types of observations from each interview year can be displayed to show changes over time.

The integration of the Co-op data with satellite data from radio-collared caribou is also explored. Approximately thirteen caribou in the PCH are currently equipped with radio collars. The collars contain special transmitters which send a signal to a passing satellite. A satellite can pick up a signal from a collar in the dark or even in a snowstorm. Therefore, these collars are useful for tracking the migration routes of animals in the north, especially those that travel long distances (such as caribou and Canadian geese). Fall and spring

caribou migration, spring calving, and winter caribou observations are mapped using both Co-op and satellite data. Differences in the two data systems are discussed.

The final part of chapter six examines unmapped information in the ABEKC database. The last chapter summarizes the findings of the research and provides recommendations for better data collection and depiction. Limitations of this project and points for further investigation are explained.

## **Conclusion**

Through this research I have determined that the mapping process can be improved and more useful data can be obtained from the Co-op's community monitoring database. The Co-op's database has the potential to make a significant contribution to environmental monitoring and resource management. The interviews are important and should be continued every year.