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Research Links

A Forum for Natural, Cultural and Social Studies

Kâ Isinâkwâk Askîy:

Using Cree knowledge to perceive and describe the landscape of the Wapusk National Park Area

Maria M'Lot and Micheline Manseau

Cree societies depended on a subsistence lifestyle, which was ultimately reliant on a certain land area providing a wide variety of resources. This lifestyle was imperative because their ability to transform local resources through manufacturing was limited, along with their ability to supplement locally available resources with imports (Gadgil *et al*. 1993). The Cree used their extensive knowledge and experience, accumulated over centuries, to reinforce a pattern of land use. Their traditional knowledge provided continual knowledge and use of sites, areas and resources; prime sites being productive areas selected for maximum access to wildlife, water and timber (Wissink 1993). Knowing these productive areas was important to the Cree and is directly related to their understanding of the relationship between species, land features, and functions which were all part of their daily life. Knowledge of the land was important in every aspect of Cree life, and is the result of the continued use of and attachment to a place.

National Parks are becoming aware of the importance of aboriginal teaching and traditional ecological knowledge (TEK) and their potential to help design more effective management strategies, especially in the area of co-management. In newly designated northern parks, as in Wapusk National Park, efforts are being made to use TEK in describing the resources available, the local landscape and their significance to users. In collaboration with community elders from the town of Churchill, York Factory and Fox Lake First Nations, this study presents the landscape of the Wapusk area through the eyes of the Cree of northern Manitoba. Their knowledge of the land, through the naming of various landscape features, provides a different descriptive "map" of the area. By accepting the use of TEK in park planning and management, alternate ways of describing the landscape, in a way that is meaningful to all users, might be possible.

STUDY AREA

For the purpose of the research, the study area is defined by the extent of the area known by the Cree people of Churchill, York Landing, Gillam and Bird. Those land areas used, traveled and visited by the people throughout their history, both written and oral, are represented. The Cree people, who occupy these communities, have a common ancestry and sense of place. The knowledge of the area is

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Research Links is a publication from the Parks Canada Western Canada Service Centre that highlights research from the natural, cultural and social sciences, and reports this research to a wide audience. Deadlines for submissions to future issues are:

JULY 11, 2003

NOVEMBER 7, 2003

FRANCOPHONES

Le texte de cette publication est offert en français. Vous pouvez l'obtenir en écrivant à l'adresse à la page 28.

RESEARCH LINKS ONLINE

Previous issues of *Research Links* are available online at: http://parkscanada.pc.gc.ca under "Library", in the "Download Documents" section.

Editorial

As I sit through editorial board meetings reviewing submissions to *Research Links*, I am struck by the number of articles and highlights that directly include a human component. This human component ranges from human-animal interactions to purely cultural issues. It occurs to me that managing the parks is at least as much a challenge of managing people, their activities, and their behaviours as it is a challenge of managing the park's natural resources. People management is an area for which biologists have little, if any, training. Yet, to manage the park's resources effectively clearly requires that human use of the parks cannot be ignored. Articles that report on people's impressions of park use, and on successful adaptive management that has come about in response to human pressures placed on park natural resources, are particularly important.

This issue of Research Links contains articles and highlights that make abundantly clear some of the human management challenges that face park managers. Bertwistle's highlight underscores just how busy 77 km of the Yellowhead highway through Jasper National Park is, how its use has increased steadily for the last ~30 years, and one possible solution to reduce the incidence of vehicles hitting wildlife on the highway. Tucker's article focuses on human-bear interactions, an issue that is probably more familiar to most readers. His article goes beyond merely describing the problem to considering how to manage it, and contrasts incentive versus purely regulatory solutions. M'Lot and Manseau's, and MacKay and Couldwell's articles consider the link between the Cree language and land features, and human perceptions, respectively. These articles provide important perspectives to understand the historic use of the landscape in contrast to today's use.

There are also more traditional research and highlight articles that focus on disease (Bergeson), population dynamics (Hebblewhite *et al.*), and vegetation diversity (Warren *et al.*). We hope you enjoy reading this issue's assortment of articles and highlights as much as we enjoyed reviewing them.

Lee Jackson, Ecologist, Department of Biological Sciences, University of Calgary, and member of the Research Links Editorial Board

Noteworthy Items...

CANON NATIONAL PARKS SCIENCE SCHOLARS ANNOUNCED FOR 2002

The following is an excerpt rom a National Park Service news release: November 28, 2002

"Washington, D.C. — The Canon National Parks Science Scholars Program for the Americas has selected eight new Ph.D. students as recipients of its prestigious $78,000/project scholarships. (This funding includes stipend and research support.) This year, the program has expanded to include students and research in national parks throughout the Americas. The Americas include the United States, Canada, Mexico, the countries of Central and South America, and the countries of the Caribbean...

The eight winning students for 2002 are: Linda Erica "Rikki" Grober-Dunsmore, from the University of Florida; Mark Hebblewhite [see his article in this issue, p. 10], from the University of Alberta; Patricia Illoldi, from the National Autonomous University of Mexico (UNAM); Jessica Lundquist, from the University of California, San Diego; Ramona Maraj, from the University of Calgary; Carolina Laura Morales, from the Universidad Nacional del Comahue, Argentina; Ashley Morris, from the University of Florida; and Marc Stern, from Yale University.

This prestigious Ph.D. scholarship program is the first and only of its kind to encourage doctoral students to conduct innovative research on scientific problems critical to the national parks."

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therefore shared amongst them. The study area attempts to cover as much of the cultural area of the Cree people as possible and includes the areas of York Factory, the Nelson River, and the Churchill River, as well as Wapusk National Park.

RESEARCH APPROACH AND METHOD

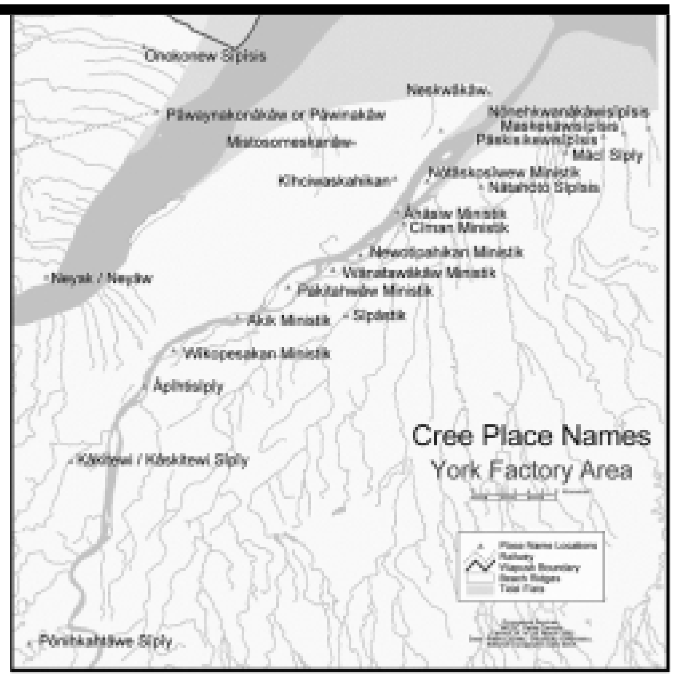
Through the building of relationships, characterized by trust, respect and reciprocity, knowledge can be shared and learned. With the consent of the Cree people from Fox Lake and York Factory First Nations and Churchill, a variety of techniques were used to gather and document information, namely semi-structured interviews, participant observation, mapping and photographs. These techniques were used for the collection of Cree terms for various landscape features. The collaborators were primarily male and female elders interviewed individually and in group settings.

In the absence of a standard orthography, the orthography used in this research follows the Alberta Elders' Cree Dictionary by Nancy LeClaire and George Cardinal (1998). The consonants used in this orthography are *c*, *h*, *k*, *m*, *n*, *p*, *s*, *t*, *w*, *y*. The vowel system consists of long vowels *â*, *î*, *ô*, short vowels *a*, *i*, *o* and the vowel *e*.

CREE ORTHOGRAPHY

The English sounding equivalents of the Cree orthography are as follows:

Short	*a* as in but *i* as in tin *o* as in hood
Long	*â* as in land *î* as in been *ô* as in host
Other	*e* as in get



Locations of Cree place names in the York Factory/ Hayes River area.

CREE KNOWLEDGE OF LANDSCAPE TERMINOLOGY

Cree terms describing the different landscape features were recorded from the elders. The nature of each landscape term was captured once the Cree terms were translated into English, thus making it possible to examine how the Cree view the land. Cree naming of the various landscape features appear to be based on 1) Physical descriptions, 2) Habitats and 3) Human use activities.

PHYSICAL DESCRIPTION

Physical appearance is used by the Cree to establish working landscape terms that provide practical and descriptive information about the appearance of the land, namely the landscape features and land cover types. For example,

maskosîskâw This term means "the ground is covered by grass" and refers to an open grassy area.

paskwawaskamik This term means, "land where nothing grows" and refers to the barren lands, the tundra or area with vegetation of low stature.

okîhcikami kâ niskipepanik This term means "where the great body of water goes up and down or floods". It refers to the tidal flats, since the tide regularly changes the water level.

nipîwaskekâw This term means "land that is watery/swampy". It refers to a swamp or an area where there is standing water for long periods of time, making the ground waterlogged.

wâkinâkaniskâw This term means "land or an area covered with tamarack trees", referring to tamarack fen or swamp.

nakâmâwatinâw This term means "raised land that ends or does not go any further" and refers to eskers.

HABITAT

The landscape, familiar to the Cree people, is diverse and provides many different habitat types. Plants and animals have a place and role on the land and adapt to the local conditions, making it possible for the Cree to name various species according to their environment. For example,

maskekosihtâkon This term refers to black spruce and means "muskeg spruce tree", which is indicative of where the tree commonly grows.

asinîwâkonak The Cree use this term to refer to lichen. In this case, lichens are defined as "plants that grow on rocks". Although there are specific words for the many species of lichen, this term is used in a general sense.

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maskek This term is often used in reference to a muskeg, but it actually means "moss." Since muskegs are largely characterized by the presence of thick moss layer, the term is used interchangeably.

maskekopâkwa This term refers to 'true' Labrador tea, with the large leaves. The Cree name the plant "muskeg tea" in relation to where it grows.

HUMAN USE

The land has always provided the Cree people with everything they needed, from food to shelter to travel routes. Some landscape terms refer to their different land use activities, underlying the importance of certain parts or components of the landscape to their lives. For example,

maskihkiwahtik The direct translation of this term is "a medicine tree or plant" which is used to refer to herbs in general.

wanikop This term refers to a portage trail as "a place for carrying canoes overland or across." Some of these portages are still evident on the landscape today and even marked on topographic maps.

meskanâw This term means "a trail or road" and is used when the Cree talk about distinct travel routes. Trail is used to talk about the walking trails of the past and road is used to talk about the roads and highways of today.

kapesiwin This term describes certain places on the land as "a place to get off and rest," referring to campsites. With the amount of traveling done by the Cree, these rest areas were numerous.

maskosîskâw "caribou"

CREE TERM	DEFINITION
sîpîy	"a river"
sôkicîwan	"it flows through fast," referring to a fast or strong flowing river
kâ sâpostekwîyâk	"it flows or runs through," referring to the channel of a river
sîpîy kâ pimcawâk	"what makes the river flow or travel," referring to a river current
patotecîwan	"water that misses or does not follow the path"
pâwistik	"rapids"
paskestikweyâw	"place where goes off the main river and splits," a fork in a river
sîpâstik	"a river which branches off, flows through a section of trees, and returns to the main river"
sâkitawâk	"end of a river where it pushes the water through," referring to the mouth of a river
wapâk	"narrows of a river"
wâwâkamon	"a crooked or curved part of a river," referring to a meander
natimik	"the area upstream"
sîpîsis	"small body of water flowing into a river" (usually beaver there), referring to a stream connecting a pond to a river

RICHNESS OF THE CREE TERMINOLOGY

This richness can be best portrayed in the many terms used to talk about rivers and their many parts and features. In Cree, the general term for river is *sîpîy*, but there are many more specific terms used to characterize the parts of a river, the flow pattern of a river and different sections of a river. With the role rivers played in the lives of the Cree, as transportation corridors, as important places to camp and find food, and as reference points when traveling, it was important for the Cree to know and describe the different features of the river.

The following table presents terms specific to the mouth of a river, the narrows of a river, a river meander, fork in a river and others. There are also terms that differentiate between the channel and current of a river as well as the source of a river. Aside from landscape terms, a number of key river attributes were communicated through place names. This is the case with *Sîpâstik* which means "a river that branches off, flows through a section of trees, and returns to the main river". Information of this type would be useful for establishing alternate travel routes and camping or stopover areas. Place names also communicated details relating to safety of a river or waterbody, especially where travel is concerned. An example is *Kâpipikowâk Sîpîsis* which means "rough water creek" (M'Lot 2002).

DISCUSSION

In presenting the traditional knowledge of the Cree, it is important to consider the views held by the culture. The strong cultural base of the Cree makes their society dynamic, complex and intricate, and thus their views are grounded in a few principles that form the foundation for the generation, communication, transmission and characterization of Cree knowledge (Simpson 1999). However, a key consideration that must be remembered is the ever present spiritual aspect, of living and non-living entities, possessed by the Cree.

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Spirituality is the underlying and most important value of Cree traditional knowledge – this statement referring to the notion that spiritual entities, like plants and animals, can also distribute or share knowledge, as opposed to assuming that only people can pass on knowledge.

An important view of the Cree is the notion that everything is 'alive'; earth, air, fire and water have a life force, as well as all parts of the natural world and the cosmos. This sense of life can be felt in the way the Cree named places and characteristics of the land. Each Cree name or term is expressed in a manner that shows life, as if a person was describing another person. Although there are many examples, this feeling of 'life' needs to be felt as the definitions of the terms are read. In addition, each name or term reflects the idea that everything has a purpose in the world, therefore everything is treated as being 'alive' and all things are equal and related (Knudtson and Suzuki 1992). It is this equality that makes it important for the Cree to show respect toward all things, especially to the land that has become their provider and partner since time immemorial and therefore considered sacred.

Another important view of the Cree is that knowledge is cyclical, holistic and dependant on linkages, in the form of relationships and connections, with all that has life and spirit, meaning both living and non-living beings and entities (Colorado 1988). In this view, everything is connected; therefore good relationships must be formed so as not to harm anything or anyone. These connections and/or relationships are expressed in some of the place names and terms used by the Cree to describe the landscape. For example, a connection between water and land is shown in the Cree term that refers to tidal flats or "where the great body of water goes up and down". Also, a connection between people and land is represented in such terms as *maskihkiwahtik* or herbs that are used by the Cree as "a medicine tree or plant".

These basic views allow the Cree to possess a unique system of knowledge and a different way of understanding, perceiving and experiencing reality, the world and the land. They also help to understand or get a sense of what is at the core of Cree society and what molds their culture and everything associated with it. It must be realized that relationships and linkages are important and always present, when dealing with any aspect of Cree knowledge. Cree landscape terminology and place naming, reflecting traditional knowledge and understanding, includes spiritual components, which are of utmost importance when it comes to understanding and using the terms (Inkpen 1999).

CONCLUSION

As indicated by Cree Board Members, the use of traditional names is essential to their participation in the management of the park. It is critical for adequate communication with the communities and for the development of management tools that are more meaningful to all and easily understood. In parks planning, the use of traditional names can provide a different understanding of key sites, structures, and processes. Presentation of the landscape through the 'eyes' of the Cree contributes to their cultural vitality and the continued evolution of their knowledge.

As a result of this research, there has also been talk amongst the Cree Board Members of continuing the documentation of landscape terms in order to establish a 'living project' within their communities. Many of the elders who grew up living on the land are passing away, and with them their knowledge of the land and of the traditions of their people. For this reason, it is important to compile this specialized terminology since such words and terms are slowly being lost with the passing of the elders and the loss of various habitats. As long as the use of the land, water and its resources are protected, and people still use them, this knowledge will continue to exist and evolve.

ACKNOWLEDGEMENTS

To all the people who generously shared their time and knowledge with me, I owe a great debt of gratitude. Your patience, acceptance and trust were overwhelming and showed the true spirit of a people. To the elders who allowed me to listen and learn from them, many thanks, your spirit and passion was compelling and full of life. *Kinanâskomitin* Catherine Anderson, Fred Beardy, Richard Beardy, Robert Beardy, Thompson Beardy, Abel Chapman, Douglas Chapman, Barbara Gordon, David Massan, Dorothy Morand, John Neepin, Roderick Ouskan, Archie Redhead, Mary Redhead, Donald Saunders, Joseph Saunders, Tommy Saunders, Obediah Wastesicoot, Dorothy Wavey. Flora S.N. Beardy, thank you for making this project easier by giving me guidance and helping me learn.

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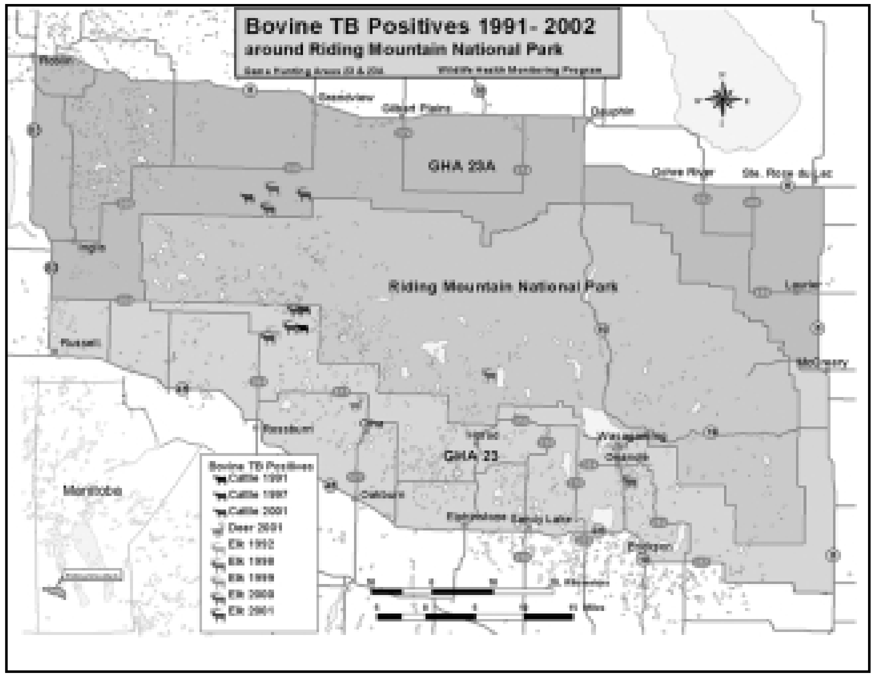
BOVINE TUBERCULOSIS in the Riding Mountain National Park Region

Douglas Bergeson, Ken Kingdon and Pat Rousseau



Bovine Tuberculosis *(Mycobacterium bovis)* was identified in the Riding Mountain National Park (RMNP) Region in 1991. Five cattle herds were associated with this confirmed occurrence of Bovine Tuberculosis (BTB) south west of RMNP. During the hunting season of 1992, one bull elk (*Cervus elaphus*) was killed in the vicinity of the positive cattle herds and was confirmed to have the same BTB biotype as the cattle. In 1997, two cattle herds were confirmed with BTB in this same general area, and in 2001, BTB was confirmed in a cattle herd north west of RMNP. During these outbreaks, approximately 1600 infected or exposed cattle were destroyed.

ABOUT BOVINE TUBERCULOSIS

Bovine Tuberculosis is a contagious disease caused by an infection in the lymph nodes which is then spread to other organs, often to the lungs and will cause death in advanced cases. In 1986, Manitoba was certified BTB free, which meant that there were no cases of BTB in bovines in Manitoba during the previous five years. As a result of the three separate incidents of BTB being confirmed in domestic cattle near RMNP between 1991 and 2001, Manitoba was classified as BTB Accredited in August 2002. The change in status meant that all sexually-intact (heifers, cows and bulls) bovine stock from Manitoba now require a BTB test prior to entering the United States. Currently the Canadian Food Inspection Agency is working to establish a smaller surveillance zone around RMNP. Once in place and approved it is hoped that the remainder of Manitoba will be reinstated as BTB free, once again allowing free movement of cattle from most of Manitoba into the United States. This proposed smaller zone including RMNP contains approximately 45,000 cattle, 4,000 elk, 4,000 moose (*Alces alces*) and 8,000 white-tailed deer (*Odocoileus virginianus*).

WILDLIFE HEALTH SURVEILLANCE PROGRAM

In 1997, RMNP initiated a wildlife health surveillance program and began examining hunter killed wildlife samples from areas surrounding RMNP. Since that time, 1286 elk heads have been examined and nine have been confirmed positive with BTB (<1% prevalence). There have also been 486 white-tailed deer sampled, one of which was confirmed positive for BTB in 2001. Four hundred, fifty-four (454) moose samples were also examined, and to date there have been no moose found with BTB. Other species that have been examined and to date and have not been confirmed with BTB include: bears (*Ursus americanus*), wolves (*Canis lupus*), coyotes (*Canis latrans*), foxes (*Vulpes vulpes*), bison (B*ison bison*), badgers (*Taxidea taxus*), Richardson Ground Squirrels (*Citellus richardsoni*), beavers (*Castor canadensis*), racoons (*Procyon lotor*) and mink (*Mustela vison*).

INTERAGENCY TASK FORCE

In 2000, an action plan for Bovine TB Management in Manitoba was developed by an interagency group consisting of: Parks Canada, the Canadian Food Inspection Agency, Manitoba Conservation, and Manitoba Agriculture and Food. The long-term vision of this working group is to eradicate BTB from the regional ecosystem. The group agrees that the key objective required to attain the long-term vision is to focus on research and management actions that minimize wildlife-livestock interactions. Within this working group's BTB Implementation Plan there are four main components:

1) Disease surveillance

It is mandatory that all hunters in the hunting zones surrounding RMNP turn in elk and deer heads and lungs to the RMNP Field

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ELK-AGRICULTURE INTERACTIONS
in the Greater Riding Mountain Ecosystem

Approximately 3900 elk are distributed throughout Riding Mountain National Park (RMNP) and surrounding private lands of the Riding Mountain Biosphere Reserve. Elk use of areas adjacent to the park can adversely affect agricultural producers through crop damage and disease transmission. Cases of Bovine Tuberculosis (TB) in elk and cattle have intensified concerns that transmission between wildlife and livestock may be occurring. Manitoba has established the Riding Mountain TB Eradication Area to try to contain the disease, yet little is known about elk movement patterns.

This project uses both local rural knowledge and "expert-based" science to determine the environmental factors and farm management practices that influence elk use of agricultural lands. We conducted a mailed questionnaire and interviews with knowledgeable stakeholders to determine the distribution of elk on agricultural lands and to summarize any existing concerns. Moreover, in February 2002, 40 elk were captured inside RMNP and fitted with VHF radiocollars to track movement patterns and determine habitat use.

Preliminary results indicate that elk movements were highly variable, as some remained inside RMNP during the first 10 months of the study and others spent days, and even months, outside the park. Ranges of movements were sometimes considerable, and two males were located in the Duck Mountain Provincial Forest, more than 30km from RMNP. This study will provide critical information for evaluating management options in dealing with elk-agriculture interactions, identify factors that contribute to risk of TB transmission for producers, and provide local landowners an opportunity to share their knowledge and concerns.

Approximately 55 VHF and 10 Global Positioning System satellite collars will be deployed in February, 2003. This research is being conducted in co-operation with Riding Mountain National Park, Manitoba Conservation, Manitoba Food and Agriculture, and Riding Mountain Biosphere Reserve. Rocky Mountain Elk Foundation, Prendeville Industries, Eastlands Wildlife Association, and Seven Oaks Game and Fish provided additional project support to Ryan Brook while Social Science and Humanities Research Council (SSHRC) and Natural Science and Engineering Research Council (NSERC) provided project support to Stéphane McLachlan.

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Figure 1. Elk feeding on a hay bale in a farmyard.

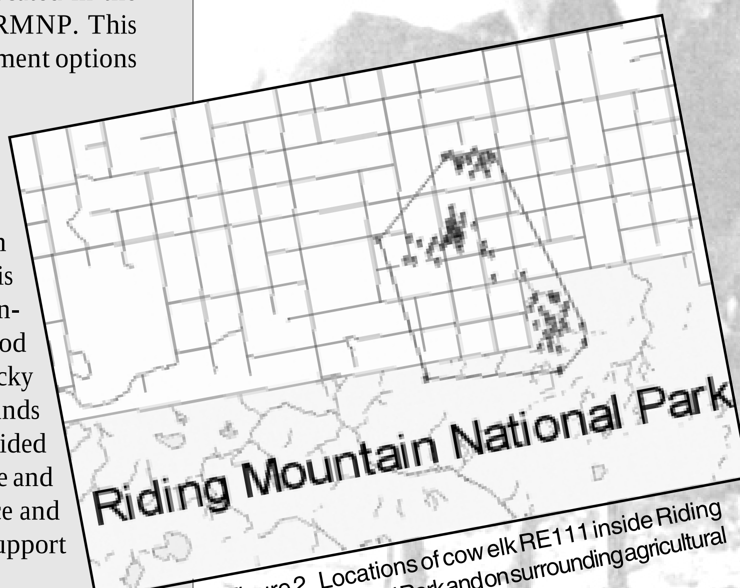

Figure 2. Locations of cow elk RE111 inside Riding Mountain National Park and on surrounding agricultural lands (Feb.-Dec.2002).

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Elk head dissection for evidence of tuberculosis.

Laboratory for gross examination. The Canadian Food Inspection Agency will test all cattle in the designated zone.

2) Disease Prevention

Elk and white-tailed deer populations will be managed, mainly by regulating hunting seasons for areas adjacent to RMNP, and by controlling the number of hunting licenses. Hay storage yards will be fenced to keep wildlife from eating hay ear-marked for livestock. Regulations on baiting and feeding of cervids were established by Manitoba Conservation in an attempt to reduce the spread of disease directly (through nose to nose contact) or indirectly (through feed). Elk habitat will be maintained as part of the prescribed burning program for RMNP.

3) Research and Monitoring

Annual ungulate population monitoring surveys are to be completed in and around RMNP. An elk movement and distribution study that tracks movements of elk, herd sizes, and habitat use is also underway (see side bar on page 8 for preliminary results). A comprehensive landowner survey will identify concerns and attitudes toward wildlife and disease. There will also be a comparative elk habitat assessment that focuses on changes in elk habitat over time within RMNP. Surveillance of other species such as wolves (i.e. identifying items in their diet and noting the presence/absence of disease found in wolf scat) is also occurring. Potential genetic relationships between elk that are infected with BTB will be identified through DNA analysis.

4) Disease Control

The Canadian Cattle Identification Agency has initiated a project to identify and track cattle electronically in order to trace infected animals adequately.

Challenge

The issues associated with agricultural/wildlife diseases are becoming the focus of wildlife managers across Western Canada. The presence of BTB in the elk and white-tailed deer populations in and around RMNP represent a significant threat to the region's cattle industry. Within RMNP the challenge involves weighing the impacts on the ecosystem due to the presence of a non-native disease (BTB) with the potential impacts on the ecosystem from active management initiatives that may be required in an attempt to remove the disease.

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ELK POPULATION DYNAMICS FOLLOWING WOLF RECOLONIZATION OF THE BOW VALLEY

OF BANFF NATIONAL PARK

Mark Hebblewhite, Daniel H. Pletscher and Paul C. Paquet

Wolves recolonized the Bow Valley of Banff National Park (BNP) during the mid 1980's following extirpation in the 1960's (Paquet *et al*. 1996). Human presence appeared to prevent wolves from recolonizing areas surrounding the town of Banff (Paquet *et al*. 1996, Figure 1). Wolf avoidance of humans was hypothesized as a mechanism explaining increasing urban elk populations. Similar trends were occurring throughout other western national parks, and park managers were faced with pressing questions about urban ungulate management. We used the serendipitous experiment provided by differential wolf recolonization to examine the effect of wolf predation on elk population dynamics in three different zones of the Bow Valley of BNP from 1986 to 2000. Wolves first recolonized the western zone of the Bow Valley in 1987, followed by partial recolonization of the eastern zone in 1991. The central zone surrounding the town of Banff was never fully used by wolves due to human presence (Paquet *et al*. 1996) until the last year of the study (see Figure 1 for the 3 zones).

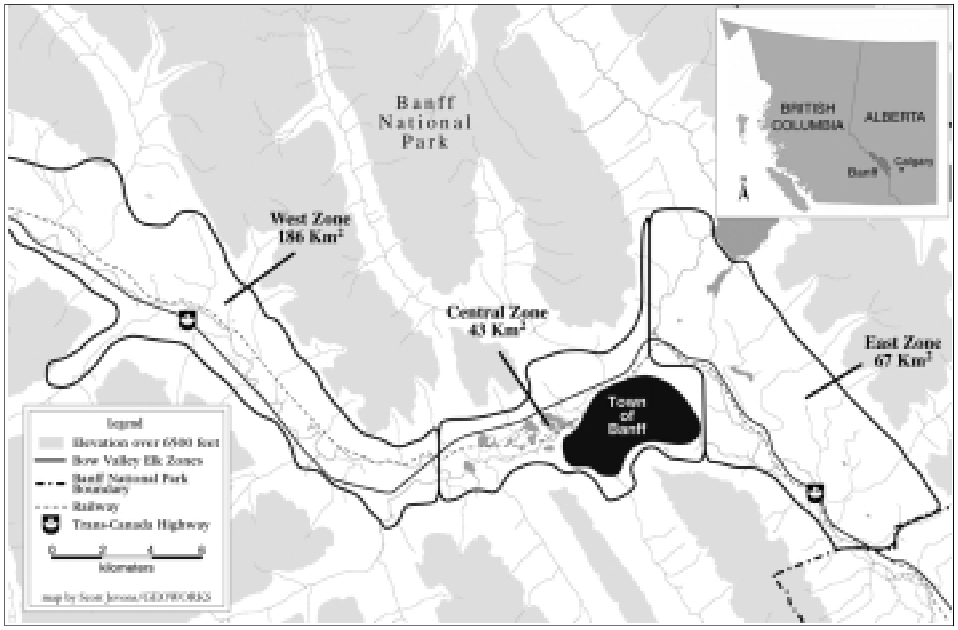

Figure 1. Location of Banff National Park, Alberta, and the Bow River Valley study area showing the three Bow Valley analysis zones. During winter months, 99% of elk range is below 6500 feet, which we used to approximately demarcate boundaries of the Bow Valley zones. The central zone is occupied by the Townsite of Banff, which includes the town itself, outlying campgrounds (>800 sites), secondary roads, hotels, and a golf course.

METHODS

Our basic approach was to model elk population growth rate (herein = r_t) within each of the three zones (Figure 1) of the Bow Valley of BNP as a function of the following independent variables; 1) wolf predation (WOLF, # of elk killed/day), 2) elk density (ELK), 3) human-caused elk mortality (HUMAN, # elk killed/day), 4) snow depth in cm (SNOW) and 5) whether the Trans-Canada Highway (TCH) was fenced or not (i.e. 0 = before 1988, 1 = post 1988). We compared models in zones with and without wolves to determine the overall impact of wolf predation on elk r_t. See Hebblewhite *et al.* (2002) for full details of independent variables, and the sidebar for an exposition of our population modeling approach.

RESULTS

Elk populations declined in the eastern and western zones, and increased in the central zone after starting at similar densities in 1986 (Figure 2, p. 12). Wolf kill-rates on elk were highest in the western zone (0.17 kill/day/pack = k/d/p), intermediate in the eastern zone (0.12 k/d/p), and lowest in the central zone (0.06 k/d/p)(See Hebblewhite *et al*. 2002, for more detail.)

Eastern Zone

Wolves recolonized this zone mid way through the time series, and both the effects of SNOW and WOLF were important in this zone. The top model (SNOW) was 1.4 times as likely as the second model (WOLF + SNOW) to be the best approximating model (Table 1, p. 13) as indicated by the ratio of the model weights for the 2 models. Summing the Akaike weights ($\Sigma\omega_i$) for individual independent variables in the top model set ranked individual variables importance in the following order; SNOW (ω_i= 0.87), WOLF ($\Sigma\omega_i$= 0.37), WOLF*SNOW ($\Sigma\omega_i$= 0.12), and ELK ($\Sigma\omega_i$= 0.11). SNOW and WOLF had strong and consistent negative effects on elk r_t, but the effects of elk density were inconsistent (Hebblewhite *et al.* 2002).

Central Zone – Low Wolf Density

The top model, ELK + TCH (ω_i=0.41) was 3 times more likely to be the best approximating model compared to the second model, ELK+ HUMAN+ TCH (ω_i=0.13, DAIC$_c$ =2.4, Table 1). In all models, r_t strongly declined with increasing elk density, and TCH fencing increased r_t. The effect of SNOW on elk r_t was inconsistent and weak.

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Western Zone – High Wolf Density

Elk r_t in the western zone was best explained by a constant rate of decline (Y=INTERCEPT) following wolf recolonization. Model selection was uncertain (low ω_i's for all models), and all models fit poorly. SNOW was the best predictor ($\Sigma\omega_i$= 0.28) and had consistent and negative effects on r_t, followed by ELK($\Sigma\omega_i$ = 0.17), and HUMAN ($\Sigma\omega_i$= 0.07). However, variables other than SNOW had weak and inconsistent effects in all models.

MODEL EVALUATION

In the eastern zone, the model WOLF+SNOW best fit observed elk population trends (Figure 2a, R^2=0.77, p=0.01), and in the western zone, the INTERCEPT model was the best fit (Figure 2c, R^2=0.85, p=0.04), indicating elk were declining constantly in this zone. The model ELK+HUMAN+TCH fit observed elk populations closest in the central zone (Figure 2b, R^2=0.71, p=0.01). Using this central zone model reformulated as equation 2 under mean conditions with the TCH fenced, the population stabilized close to a carrying capacity, K, of 450 elk (Figure 2b).

DISCUSSION

Without predation by wolves, elk in the central zone increased during the early part of the study while elk in other zones decreased, suggesting an important limiting role of wolf predation (Figure 2). Reduction in road kills after the TCH was fenced in 1988 in the central zone increased elk r_t in this zone. Population growth declined with increasing elk density in the central zone, and was regulated around a carrying capacity (K) of approximately 450 elk (~ 10 elk/km^2, Figure 2b). In the eastern zone, snow depth and wolf predation limited elk r_t. The western zone was more difficult to interpret. A constant rate of decline and no relationship between wolf

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FITTING POPULATION MODELS TO ELK POPULATION COUNTS

Elk population data were mid-late winter aerial elk survey counts conducted by the Banff Warden Service from 1986 to 2000. Mark-recapture and aerial sightability model corrections suggested aerial elk counts were robust (Hebblewhite *et al.* 2002). We next constructed a set of a-priori candidate population models based on knowledge of elk population dynamics and previous studies using these factors (wolf, snow, human, elk density, TCH) to explain variation in elk r_t. We included biologically relevant interactions between elk density and snow, and wolf predation and snow. We then fit elk population data to this set of candidate models using the following General Linear Model (GLM) of elk population growth rate over time:

$$r_t = \ln\left(\frac{N_{t+1}}{N_t}\right) = \beta_0 + \beta_1 X_1(t) + \beta_2 X_2(t) + ... + \beta_m X_m(t) + \varepsilon$$

(equation 1), where r_t= elk population growth rate, N is population size at time t, Nt+1 is the size at time t+1 and $\beta_1 X_1 \ldots \beta_m X_m$ are the linear combination of independent variables where β_1 is the coefficient of independent variable X_1. For example, studies on moose on Isle Royale suggested snow depth and wolf predation might be important, thus we included the model $r_t = \beta_0 + \beta_1(\text{SNOW})_t + \beta_2(\text{WOLF})_t$ in our candidate set. We fit models to the data using Maximum Likelihood Estimation in SAS, obtaining parameter estimates for the β_m's for all independent variables. We used Akaike Information Criteria (AIC, Burnham and Anderson 1998) to select the best candidate model(s) in each zone. AIC is a new approach based on information theory that selects the "best" model or set of models, and then ranks these models such that the best model has a ΔAIC_c =0, and the largest Akaike weight. This information theoretic approach to model selection improves on traditional stepwise approaches and is relatively easy to learn; readers are directed to Burnham and Anderson (1998) for further information. We graphically assessed model fit by comparing predicted to observed population size in each zone. Modeling elk populations in this fashion allows for the estimation of carrying capacity for models that include elk density as a independent variable, by rewriting equation 1 as a form of the logistic growth equation:

$$N_{t+1} = N(t)e^{(\beta_0 + \beta_i X_i(t) + ...\beta_m X_m(t))}$$

(equation 2), and solving under average conditions for $\beta_1 \ldots \beta_m$ using starting N_t, While applied to elk population surveys, these techniques can be applied to counts of any organisms over time, and highlight the value of long-term ecological studies in national parks.

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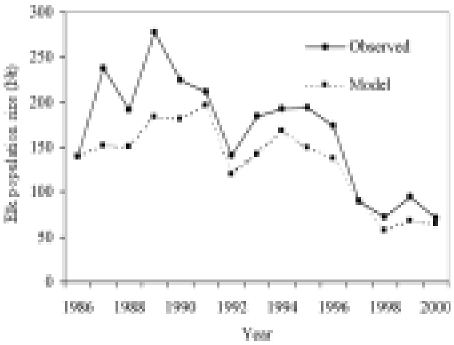
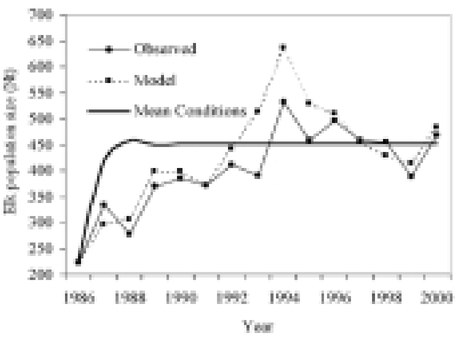
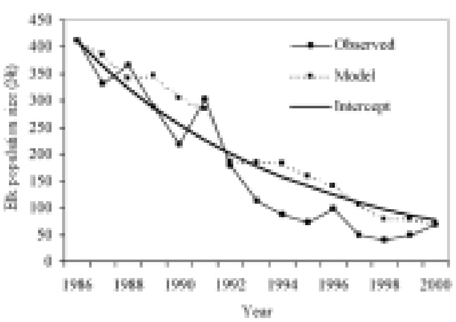


a) Eastern Zone Y= SNOW+WOLF



b) Central zone (reduced wolf predation) Y=ELK+HUMAN+TCH



c) Western zone Intercept Model and Y=SNOW

Figure 2. Observed spring elk counts in Banff National Park (BNP) in the a) eastern, b) central, and c) western zone versus elk count predicted using top candidate GLM converted to difference equations for each zone from 1986 to 2000. For the central zone, elk population size is predicted assuming average human caused mortality and a fenced highway using the GLM expanded as an approximation of the logistic growth equation.

kill-rate and elk r_t seemed counter to the eastern zone. However, we feel this may be due to the pitfalls of correlative studies in population dynamics (Boyce and Anderson 1999; Royama 1996), which have limited utility in an individual time-series without experimental comparisons across time-series.

Differential wolf recolonization approximated experimental conditions, and comparison across zones provides a clearer test of the importance of wolf predation on elk populations. With wolves present, density-dependence was not observed, although there was density-dependence in the eastern zone before wolf recolonization (Hebblewhite *et al*. 2002). Therefore, wolf predation limited elk density below densities that regulated r_t. Furthermore, snow only impacted elk in combination with predation; previous research in BNP indicated increasing snow depths increased wolf kill-rates (Huggard 1993). Thus, it was the combined effects of wolf predation and snow depth appears to be the main factors limiting elk since wolf recolonization. Our results do not suggest wolves are the only predators influencing population dynamics. Certainly, other predators including bears (*Ursus* spp.) and cougars (*Felis concolor*) affect elk in BNP. However, wolves were the main cause of adult elk mortality in BNP (McKenzie 2001), wolf predation explained elk population dynamics well (Figure 2a), and other predator populations appeared more stable than recolonizing wolves during the study.

MANAGEMENT IMPLICATIONS

Wolf predation on elk has positive conservation implications for the maintenance of ecological integrity. Declining elk density reduced elk herbivory on willow (*Salix* spp.) and trembling aspen (*Populus tremuloides)*, (Nietvelt 2000; White 2001), and could reduce competition between elk and moose (*Alces alces*)(Hurd 1999), beaver (*Castor canadensis*), and riparian passerines (Nietvelt 2000). This indirect evidence suggests a mechanism of human disturbance altering

wolf distribution with associated cascading effects to lower trophic levels. Future research should test this hypothesis.

Management implications of our research are clear. Human-use surrounding the townsite of Banff displaced wolves (Duke 2001), decoupled predator-prey relationships, and contributed to the development of an urban elk population. Fencing the TCH reduced mortality, allowing elk populations to stabilize near a carrying capacity of 450 elk. This information was used in a population model to guide BNP elk management (Parks Canada 1999). Furthermore, corridor restoration surrounding the townsite of Banff had positive effects on wolf movements and predator-prey dynamics (Duke *et al.* 2001). However, managers should not forget elk may increase to a carrying capacity of 450 assuming no changes in conditions, requiring continued active management to reduce carrying capacity through elk management, carnivore corridor management, and by removing townsite attractants.

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Table 1. Top elk population growth rate model for each Bow Valley zone with model deviance, model structure and corresponding ΔAIC_c and Akaike weight (Burnham and Anderson 1998), where models with high weights and low ΔAIC_c have better model fit and more support as the best model. The sign of the β_i indicates whether the effect increases or decreases elk population growth rate. See Hebblewhite *et al.* 2002 for individual model parameter estimates and standard errors.

Population Model	Deviance	ΔAIC_c	Weight
Eastern Zone Models			
1. β_0 - β_1(SNOW)	0.609	0.00	0.37
2. β_0 - β_1(SNOW) - β_2(WOLF)	0.573	0.63	0.27
3. β_0 - β_1(SNOW) - β_2(WOLF*SNOW)	0.577	2.38	0.12
4. β_0 - β_1(SNOW) - β_4(ELK)	0.586	2.60	0.11
Central Zone Models			
1. β_0 - β_4(ELK) + β_5(TCH)	0.175	0.00	0.41
2. β_0- β_3(HUMAN) - β_4(ELK) + β_5(TCH)	0.157	2.40	0.13
3. β_0 - β_4(ELK)	0.255	2.44	0.12
4. β_0 - β_1(SNOW) - β_4(ELK) + β_5(TCH)	0.172	3.60	0.07
Western Zone Models			
1. $\beta_0+\varepsilon$	1.459	0.00	0.21
2. β_0 - β_1(SNOW)	1.229	0.11	0.20
3. β_0 - β_4(ELK)	1.364	1.68	0.09
4. β_0 - β_1(SNOW) - β_4(ELK)	1.127	2.00	0.08
5. β_0 - β_3(HUMAN)	1.406	2.13	0.07

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WILDLIFE COLLISIONS

in Jasper National Park

Jim Bertwistle

Mortality as a result of vehicle-wildlife collisions along highways can be a threat to the long-term survival of wildlife populations (Page *et al.* 1996). In fact this type of mortality can equal or exceed mortality rates in hunted populations outside park boundaries (Gibeau and Heuer 1996). In Jasper National Park a variety of wildlife species are killed in collisions on highways and the railway (Figure1).

The Jasper National Park (JNP) portion of the Yellowhead Highway is 77 km in length, enters JNP at the East Boundary and exits at the West Boundary. Eighty seven percent of JNP traffic uses the Yellowhead Highway. In 1997, annual traffic volume reached 1.2 million vehicles (Parks Canada 2000). The number of vehicles on the Yellowhead Highway has increased by 3% annually since 1973 (Parks Canada 2000). Collisions with wildlife have also increased during this period.

After reviewing data from wildlife-vehicle collisions dating back to 1980, I classified the data into groups (summarised by three main groups for the purposes of this report): passenger vehicles, transport vehicles, mid-sized vehicles and undetermined vehicles. I collected specific traffic volume data between September 1, 1994 and August 31, 1995. Those data were used in correlation with the collision data to estimate collision rates for different types of vehicles. Passenger vehicles comprised 80%, and transport vehicles comprised 12% of the total Yellowhead Highway traffic volume through JNP. However, transport vehicles were responsible for disproportionately more collisions (Table 1).

Table 1. Proportion of vehicle volumes and number of wildlife collisions, September 1,1994 to August 31,1995

Vehicle Type	Proportion Vehicle Volume	Proportion Collisions	No. Wildlife Killed
Passenger vehicle	80%	34%	48
Transport trucks	12%	34%	48
Undetermined	N/A	31%	43
Mid-sized vehicles and buses	8%	<1%	Negligible
Total	100%	100%	139

There are a variety of factors influencing collision rates (Bertwistle 2002). Among these is vehicle speed. However, average vehicle speed data collected in a 90-km/hr zone during 1995 show that the average speed of passenger vehicles and transport trucks is similar. Speed differences are likely not a factor in the higher collision rate of transport vehicles. A more likely explanation is that transport trucks require much greater stopping distance than do passenger vehicles travelling the same speed.

There is an obvious correlation between traffic volumes and wildlife collision rates however; predicting collision rates should include an analysis of traffic types as well as traffic volumes.

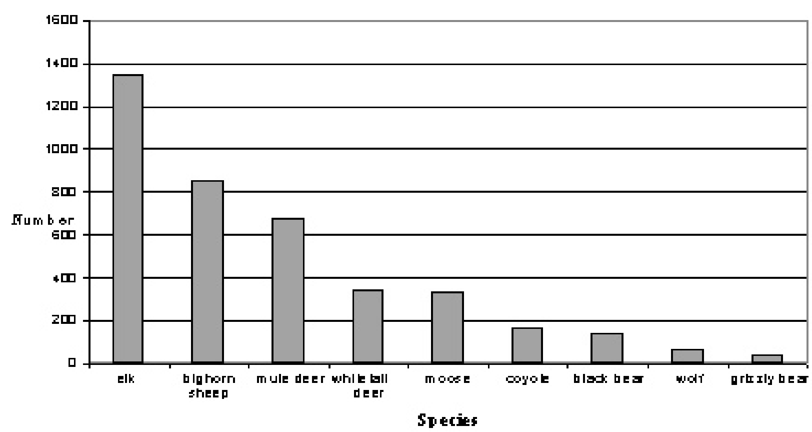

Figure 1. Main species involved in vehicle collisions.

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LESSONS FROM THE ISLANDS:

Introduced Species and What They Tell Us About How Ecosystems Work

Research Group on Introduced Species (RGIS)

— Conference Synopsis —

The Research Group on Introduced Species (RGIS) is a multi-national, multi-disciplinary research group formed in 1995 to explore changes in the ecology of Haida Gwaii (Queen Charlotte Islands) caused by the introduction of non-native species. The principle partners in the group include: the Laskeek Bay Conservation Society; the French Government (Centre National de la Recherche Scientifique); the Province of British Columbia (Ministry of Water Land and Air Protection); Canadian Wildlife Service (National Wildlife Research Centre); and, Parks Canada (Gwaii Haanas National Park Reserve and Haida Heritage Site). To date, the main focus of the research has been on the impacts of Sitka black-tailed deer, which were first brought to the islands in 1878.

In October 2002 RGIS hosted a conference so that researchers could share the results of their work with the island communities and with others interested in introduced species and their management. This synopsis provides a brief overview of the research and ideas presented at this conference.

Next to habitat destruction, introduced species are considered the most important global threat to biodiversity as they can successfully establish themselves and then overwhelm native ecosystems. Because they have evolved in isolation, island ecosystems such as Haida Gwaii are especially vulnerable to introduced species. Concerns about introduced species are not unique to Haida Gwaii. Conference participants heard about introduced moose in Newfoundland as well as over-abundant native white-tailed deer in Ontario and the northeastern U.S., and deer-predator interactions in Southeast Alaska.

Local people have a broad range of concerns regarding the deer on Haida Gwaii. People in favour of limiting the deer population cite aspects of Haida culture and traditional lifestyle that are threatened because deer browse reduces access to food, medicine, and fibre plants; and the negative impact of deer on forest management (delayed tree re-generation) among other concerns. On the other hand, deer are an important food source for islanders.

A number of recent RGIS studies show significant changes to groundcover, plant diversity, tree growth/re-generation, insect populations and songbird communities where deer are present. However, there are no simple solutions for controlling the effects of introduced species.

Participants agreed that an attempt to eradicate deer on the islands would be extremely difficult, and undesirable, given the resource value of deer. Instead, serious consideration will be given to managing deer in a way that reduces deer browsing impacts and maintains/restores native biodiversity, species at risk and culturally significant plants and animals (including deer) in our island ecosystems. It is also a goal of RGIS to establish a locally-based working forum to consider, recommend and communicate issues related to all introduced species and to provide a clear vision with consensus.

If you would like to find out more about introduced species and the work of RGIS, you can obtain a detailed summary of the conference proceedings from RGIS or visit the RGIS website at http:// www.rgisbc.com

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The Boreal Forest:
Mapping Vegetation Diversity from Space

Anthony J. Warren, Michael J. Collins and Edward A. Johnson

To understand patterns of species and diversity in vegetation across the landscape, ecologists make field observations within individual stands and construct models that relate stand attributes to environmental parameters. Chipman and Johnson (2001) have developed a simple linear model that predicts vegetation species richness at the stand scale using four variables: 1) distance to nearest drainage basin ridgeline (DFR), 2) time elapsed since the last forest fire (TSF), 3) canopy species type and 4) canopy stem density (CSD).

Our objective in this work was to generalize the linear model beyond the stand scale. To do this we developed algorithms that estimate the values of the same four independent variables over the entire landscape. We accomplished this using several geospatial data types including spaceborne imagery (electro-optical and synthetic aperture radar) as well as vector format elevation contours, lakes and streams. We paid close attention to uncertainty estimates associated with each of the input variables. The resulting map predicts diversity and shows patterns that are consistent with our expectations. The results show that combining spatially estimated input parameters with this model is reasonably successful and an innovative use of remote sensing and GIS. This is a first step toward providing forest managers with an important tool to assist in making decisions.

STUDY AREA

The study site is part of the boreal mix-wood forest located in and around Prince Albert National Park (PANP) in central Saskatchewan (Figure 1). PANP is located on the southern fringe of the boreal forest where it gives way to an expansive agricultural region to the south. Long cold winters and short cool summers are characteristic of the regional climate. The area receives between 400 and 500 mm of precipitation, with approximately 70% falling as rain.

The two major disturbance regimes in the area are forest fires and forest harvesting, although the latter is not an issue inside park boundaries. Weyerhaeuser Canada operates a Forest Management License Area (FMLA) in the region and is responsible for regenerating harvested areas. However, within PANP there is no harvesting and the only significant natural disturbance is fire.

Eight tree species, both coniferous and deciduous, dominate the area. The coniferous species are White Spruce (*Picea glauca* (Moench) Voss), Black Spruce (*Picea mariana* (Mill.) B.S.P.), Jack Pine (*Pinus banksiana* Lamb.), Balsam Fir (*Abies balsamea* (L.) Mill.), Tamarack (*Larix laricina* (DuRoi) K. Kock). Trembling Aspen (*Populous tremuloides* Michx.), Balsam Poplar (*Populus balsamifera* L.) and White Birch (*Betula papyrifera* Marsh.) make up the deciduous species. There are also many herbaceous shrubs and ground cover plants.

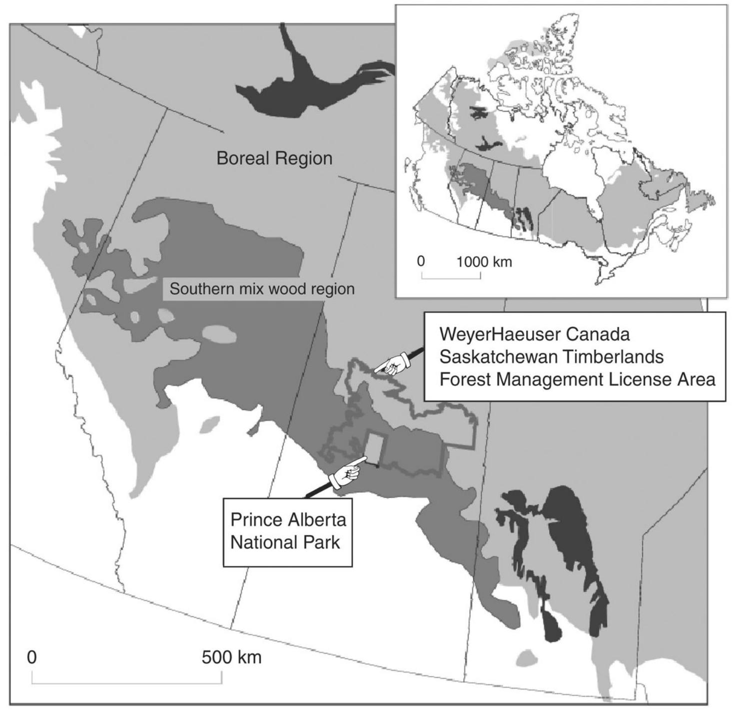

Figure 1. The study area

We collected field data in 150 sampled forest stands to truth the predictions made by the predictions generated from the four independent variables. Samples were taken using the point centered quarter method as described by Cottam and Curtis (1956). Measurements included: selected tree diameters at breast height (DBH) for canopy and understory; -tree distances from each sample point (if less than or equal to 10m); selected shrub distances and base diameters; tree seedling counts in 2, 1m x 1m opposing quadrats (centered on each sample point); and herbaceous species and moss counts.

INDEPENDENT VARIABLES

1. Distance From Ridgeline

The distance-from-ridgeline (DFR) parameter is a surrogate for moisture and nutrient gradients that are a result of hillslope processes. The correspondence between DFR estimated from a

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map for each of the forest stands and that estimated using our algorithm is shown in Figure 2.

2. Time-since-fire

This variable is a surrogate for the manipulation of resources as a result of a disturbance. This vector-based data set was produced by Weir (1996) from extensive field reconnaissance and 1:12000 scale aerial photograph interpretation.

Initial estimates of uncertainty with regard to stand age were ±1-10%, which was increased by uncertainty in the location of polygon boundaries defining stand age (see Warren (1999) for details).

3. Canopy Type

Canopy type is an important aspect of biodiversity as the species composition of the canopy overstory is an important controlling variable of the herbaceous understory. To estimate canopy type from satellite imagery we require a set of canopy categories that are both ecological meaningful and amenable to classification algorithms. Based on the ground surveys and photointerpretation, the forest classes chosen were jack pine, black spruce, trembling aspen and a mixed class of trembling aspen, white spruce and balsam fir. In addition to these forest classes, water, anthropogenic (towns, roads, recent harvests and other man-made features), and wetland classes were also defined for completeness. The reference pixels for the forest classes were located in the geocoded imagery using the GPS stand coordinates measured in the field; these data were expanded with the aid of forest inventory maps.

We ran a k-nearest neighbor classifier using Landsat TM and SIR-C polarimetric SAR. We then used a Dempster-Shafer based algorithm for combining the results of the individual TM and SAR k-NN class likelihoods (Collins *et al*, 2000) which gave classification accuracies (between 44% and 100%).

4. Canopy Stem Density

Canopy stem density is simply a measure of the number of canopy tree stems or trunks per area (stems/ha). For this study, a canopy tree is defined as one taller than 10m with a trunk diameter at breast height (DBH) 10 cm. Lieffers *et al* (2000) state that understory development is inversely proportional to canopy development. Hence it is not uncommon to find very little herbaceous vegetation below a mature forest with a well-developed canopy (Smith and Huston, 1989).

Estimating CSD proved to be very difficult. Unlike Ranson *et al* (1995), who reported strong correlation between LHV backscatter and forest biomass, we found the strongest relationship was between the LHH/LHV ratio and stem density directly. The results are shown in Figure 3 (see page 24).

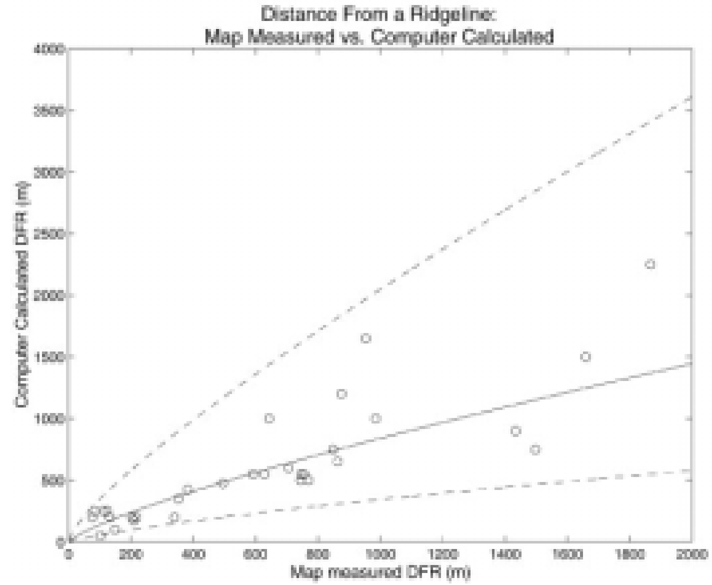

Figure 2: A regression between the distance-from-ridgeline estimated from a topographic map to DFR estimated using the algorithm described in the paper. The solid line is a second order polynomial fit between the observed DFR and the estimated DFR and was used to correct the latter. The dashed lines are 95% confidence intervals and are used as an estimate of uncertainty.

RICHNESS MODEL

The richness model was built using observed values of the four independent variables. To generalize this model the four estimated variables were fed into the model to generate an estimate of species richness at each pixel location. (see Warren (1999) for details.)

Results

Eight tree species, both coniferous and deciduous, dominate the area. The coniferous species are White Spruce (*Picea glauca* (Moench) Voss), Black Spruce (*Picea mariana* (Mill.) B.S.P.), Jack Pine (*Pinus banksiana* Lamb.), Balsam Fir (*Abies balsamea* (L.) Mill.), Tamarack (*Larix laricina* (DuRoi) K. Kock). Trembling Aspen (*Populous tremuloides* Michx.), Balsam Poplar (*Populus balsamifera* L.) and White Birch (*Betula papyrifera* Marsh.) make up the deciduous species. There are also many herbaceous shrubs and ground cover plants.

Figure 4 synthesizes the results. The top left graph shows the correspondence between the richness observed in the field and richness predicted using independent variables observed in the field. The result is statistically significant and shows the quality of the model at the stand level.

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Seeing our Sites through our Visitors' Eyes:
Investigating Visitors' Images of Motherwell Homestead National Historic Site

Kelly J. MacKay and Christine Couldwell

Image generally refers to a compilation of beliefs and impressions, from a variety of sources that result in an internally accepted mental construct (Baloglu & McCleary, 1999). Destination images include cognitive and affective dimensions that weave together various attractions and attributes into a visitor's overall impression of a place (MacKay & Fesenmaier, 1997). One of the challenges in destination image research is that image is frequently measured by examining specific attributes as opposed to the integrated impressions that are acknowledged as the foundation of destination image construction (Jenkins, 1999). Visual-based approaches can enhance validity of the research and provide a means to explore complex phenomena, such as destination image, from alternative perspectives that originate from the visitor not the researcher.

Visitor employed photography (VEP) is a technique that has been used in understanding landscape aesthetics, outdoor recreation experience, and community planning (Chenowith, 1984; Cherem & Driver, 1983; Hawkins, *et al.*, 1999; Taylor, *et al.*, 1995). Generally, the technique involves distributing cameras to respondents and asking them to photograph aspects of the site that relate to the research objectives. Although VEP has been used successfully for assessing perceptions of natural environments, the technique has not been used specifically to understand place image in a heritage environment. The research presented here is an example of a study conducted by the University of Manitoba in cooperation with Parks Canada at Motherwell Homestead National Historic Site (NHS). Thus, the purposes of this paper are threefold: 1) to investigate visitors' images of a national historic site; 2) to assess the utility of visitor employed photography as a method to elicit site image; and 3) to provide practical information regarding image elements that contribute to heritage theme communication.

METHODS

The study occurred during the summer of 2000 at Motherwell Homestead (NHS) in Saskatchewan. Sample selection for the photo image study was integrated with sampling for the site's biannual visitor satisfaction survey developed by Client Research Services and conducted by Motherwell Homestead NHS staff. During 42 randomly selected sample days throughout the study period, a cluster sample of all visitors was taken. A short intercept interview determined willingness to participate, language preference, residency, previous visitation, and group size. Following the intercept interview, every 10th visitor over the age of 18 was requested to complete a photo image survey, instead of the regular follow-up satisfaction survey. For reasons beyond the scope of this paper, only visitors screened as Canadian were eligible to participate in the photo image survey.

Photos of building exteriors, taken by visitors to Motherwell NHS

Photo image surveys, consisting of disposable cameras and diaries, were distributed to 136 site visitors. Visitors were requested to photograph scenes that contributed most to their image of the site. In addition, they were asked to record in their diaries, the main subject of their picture and the main reason they took the picture. Surveys were returned on-site at the exit. Participating visitors were sent copies of their photographs as an incentive/reward. Photographs were content analyzed based on visitors' descriptions of pictorial content (subjects and reasons) moving from a descriptive phase, to analytic, to interpretive (Yin, 1989). Following Yin (1989), researchers first transcribed the diary comments and identified emergent concepts. The photo-diary data was read and re-read to identify preliminary key phrases and themes. Frequencies were calculated for photograph subjects and rationales for selection and descriptive statistics appropriate to the level of data were used to profile respondents, and reveal dominant image subject matter and rationales for selection.

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Photo of interpretive tour guide, taken by a visitor to Motherwell NHS

RESULTS

A total of 132 photo-image surveys were returned for a response rate of 97%. Respondents were mainly female (74%), English speaking (98%), and first time visitors to the site (69%). Most of the respondents were over 35 years of age (85%) with 40% between the ages of 35 and 49. They tended to travel in groups of two (37%) or more than 5 (24%). The survey respondents produced a total of 1642 photographs for analysis. The content analysis of stated subjects and reasons initially resulted in 50 subjects and 39 reasons.

The 50 subjects were classified into seven main categories. In order of photographic frequency they were: exterior buildings, interior house, demonstration of way of life, farm equipment, animals, grounds, and people (family/friends). The two most frequent photographic subjects featured building exteriors (Figure 1). These subjects portray the facade of the site as the most salient visual imagery

Other subjects in this category that related to this "outside" image were architecture and design of the main house, porch, ramp to barn, and other buildings. The bedroom and parlor, and specific objects inside of the house were also popular subjects of photographs; for example, the piano, stove and artwork, suggesting that Motherwell Homestead National Historic Site's infrastructure is the most dominant image theme. Tour guides and the demonstration of a way of life were also primary subject matter of the site's image and suggest animation of the site's infrastructure (Figure 2). Farm animals and the horses, in particular, were frequently photographed subjects that also support animation of the site. Landscape, gardens, and grounds are another exterior theme that focuses on the natural instead of the constructed elements of the site. Finally, the presence of people (other than tour guides, e.g., family, friends, children) in photographs comprised another thematic category that personalized place image. There were very few photographs designated by visitors as negatively contributing to their image of the place. One example included the location of the picnic tables.

Reasons for selecting particular subjects as contributing most to site image ranged from the idiosyncratic, "It reminded me of mom's summer kitchen, especially the smells," (based on a photograph of the kitchen in the main house) to the predictable and very frequent, "because I like it." In general, themes that emerged for why respondents took their pictures pertained to aesthetics or nostalgia. Aesthetics related to the design or tangible elements of the subject matter. Nostalgia related to both representation of a way of life; thereby supporting the historical significance of the site as germane to its visual representation, as well as, a reminder of personal memories, linking historical and personal significance. There were very few photographs designated as negatively contributing to image of the place.

CONCLUSIONS AND IMPLICATIONS

Motherwell Homestead was designated as a national historic site because it represents a typical prairie homestead of the early 20th century. It commemorates W.R. Motherwell's role in the development of agriculture on the prairies as well as agriculture settlement patterns (Canadian Parks Services 1988). Photo image study findings suggested three major subject themes- infrastructure, animation, and personalization, and two underlying rationales for the photographs taken- aesthetics and nostalgia. These appear generally congruent with the desired image (based on historic significance) of the site.

Practically, this method provided highly visual records of what best captures images of the site for these visitors and can be compared to the pictures currently used in Parks Canada's educational and promotional materials. The results can be used to combine visitor-determined images with site-determined images in a meaningful way. In the case of Motherwell Homestead NHS, the findings already have been used in management planning to decide whether to continue and expand period demonstration farming using live farm animals because of the heritage interpretation, operational, and financial implications. A business case analysis approach (conducted by Client Research Services) was used to evaluate period demonstration farming compared to the alternatives available for communicating the Site's commemorative theme of Motherwell's role in the evolution of scientific agriculture on the prairies. Data from the Photo Image Study (e.g., volume, content, and meanings of photographs that related to the contribution of

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animals to the site's image) provided valuable, credible information confirming the importance of demonstration farming to visitors and its effectiveness in heritage theme communication. The business case analysis concluded that full-scale demonstration farming was superior to the alternatives and this recommendation was included in the management plan, which has now been approved.

Other benefits to using the VEP method for image assessment were high response rate (97%), unprompted visitor-generated themes and visuals, and enjoyment expressed by respondents. The challenges associated with VEP included logistics of site visitors managing more than one camera if they brought their own; control over respondent - versus visitor party image (i.e., whose idea was the picture?); cost of cameras, developing, and mailing; and the sheer volume of pictures/data generated. These drawbacks could be addressed by requiring fewer photographs, or by distributing fewer cameras based on response saturation (of photograph subject and reasons) as the photographs were developed and analysis occurred.

Study findings provided insights into visitors' images of Motherwell Homestead National Historic Site, as well as, direction on the innovative application of visitor employed photography in place image and heritage resource assessment. Results of this study demonstrate that VEP is a viable alternative to traditional data collection techniques for image assessment and it holds promise for many other possible applications in future research efforts at national parks and historic sites.

ACKNOWLEDGEMENT

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Christine Couldwell, received her Master of Arts in Recreation Studies in October2002 and was the project coordinator for the Motherwell Homestead NHS Photo-image study.

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Effectiveness of the Voluntary Use Program as Applied on the Odaray Highline Trail

Yoho National Park

Wayne Tucker

An observer overlooks Lake O'Hara, YNP (Photo: Parks Canada)

In the early to mid-1990's a number of negative human-bear interactions on the Odaray Plateau in the Lake O'Hara area of Yoho National Park triggered a lengthy area closure and extensive grizzly bear habitat research (McCrory et al, 1997). McCrory et al concluded that the Odaray-Plateau is seasonally important habitat and part of a multi-species wildlife corridor. With specific thresholds established for the wildlife corridor and grizzly bear access to the seasonally important habitat areas, it was feasible to allow people to again have access to some of the adjacent areas. The key research question was to determine whether we could effectively communicate our goals to the public, and whether they would show support through their actions.

During the summer of 2000, Parks Canada piloted an initiative to allow limited access to the Odaray-Plateau. Through targeted communication to the users on the ways they potentially compromise the effectiveness of the corridor, users were asked to voluntarily avoid the Odaray-Highline trail to protect the wildlife corridor. The effectiveness of the study was evaluated using an on-site questionnaire.

Specific targets were established prior to the implementation of the study. The targets were based on our best available research into habitat effectiveness for various wildlife species, the known types of disturbance and how disturbance can be minimized, as well as some common sense as to what would be reasonable. The targets and communications were grouped as access protocols, Odaray travel ethics, and qualitative changes.

Access protocols refer to when and how much human use occurs throughout the corridor. To achieve our access protocol objectives, users of the Odaray Highline trail were requested to hike within a certain time frame, and to limit their use to two groups /day. Each group would pass through the corridor twice, resulting in four disturbance events, and a maximum of 120 disturbance events/month – approximately a 20% reduction in use from previous years. The grizzly bear habitat effectiveness for core security areas is set at 100 disturbances (groups) per month.

Odaray travel ethics refer to the way people use the corridor. To minimize their disturbance impact on wary species, users of the trail were asked to increase their group size and stay together during their hike through the corridor. Trail users were also asked not to take their pets with them, and not to stop on the trail below treeline (in the corridor).

Finally, we evaluated the qualitative changes or the effect that the voluntary initiative had on the experience of the users of the area. Managing human use, both in terms of asking people to follow protocol, as well as helping them understand why, will help ensure that a high quality visitor opportunity remains in the Odaray Highline area.

METHODS

The Lake O'Hara area operates under a quota system. Visitors ride a bus to the campground, Lake O'Hara Lodge and Alpine Club of Canada hut. While on the bus, Parks Canada staff relay current information about the area such as recent bear sightings and trail conditions. During the summer of 2000, people were also asked if they would be willing to participate in a study on their views of the management of the Lake O'Hara area. Response to the survey was voluntary (n=249). A second opportunity to interact with visitors was on the trail being targeted for the voluntary use protocol. The next-to-pass technique[1] was used to identify potential survey parties, and again, participation was voluntary (n=57).

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1 The next-to-pass technique allows the researcher to survey groups. While the survey is proceeding, others are free to pass. Once the survey is complete, the next group to pass is then selected.

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A remote Trailmaster TM1500 trail counter was set up on the Odaray-Highline trail, the trail leading to Grandview Prospect. The counter was situated so that all individuals crossing the Odaray Highline would be counted. Each time the infrared beam of the counter was broken by a user, a time stamp was collected. Analysis of the data allows us to determine total volume of use, time of day and group sizes. The data from the trail counter were also used to compare the logbook sign in with the actual volume of use.

Survey data was analyzed with SPSS and considered to be accurate with 5.6% 19 times out of 20. The trail counter data was analyzed using MS Access.

RESULTS

The data presented in Table 1 shows how effectively Parks Canada has met the stated goals.

Previous surveys identified the Odaray area as receiving approximately 1700 visitors/ summer. The historic average group size was 3.7 people/group, resulting in approximately 5-groups/ day (10 disturbance events as each group passes through the area twice) on the Odaray-Highline trail. We concluded that users of the area would modify their patterns of use to meet the goals for the area. Approximately 31% of all of the area users indicated that they understood how their behaviour affected the corridor and how they could ensure its long term effectiveness by choosing to travel through other areas.

DISCUSSION

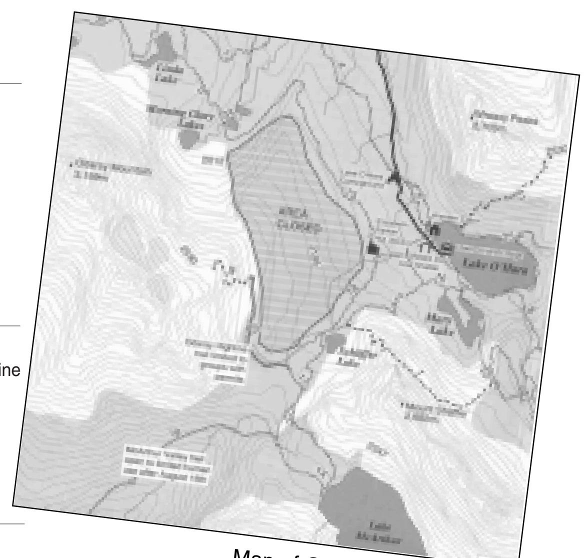
While gauging the level of support for the program was not a direct objective of the evaluation, it is important to present public reaction to the program. Responses to the question “Do you support Parks Canada’s approach to reduce human use in the Odaray area as an attempt to maintain the wildlife corridor?” indicated that approximately 91% of the survey respondents support the voluntary use initiative. Top-box-theory suggests that if services or facilities are satisfactory, then 40% of the surveyed population will select the “top box” (i.e. strongly support the program). The results identified that approximately 78% strongly supported the initiative.

These are important findings when we consider the management implications for other areas. There is a sense that the users of the area prefer the educational approach taken at Lake O’Hara versus more regulatory approaches to limit human use. While asking people to voluntarily change the way they use an area may not be viable in all areas, results of this study provide an impetus to examine the applicability of this approach in other areas of the parks where there is a need to alter patterns of use.

Clear communication regarding why and how particular initiatives are being established is key to the success of our approach for better human use management. We need to learn who visits the parks, how they access the parks, and what types of media are most effective for influencing visitor behaviour. Clear communication goals, linked specifically to management action,

Table 1. Targets and Results of trail management on the Odaray-Highline for the summer of 2000

	Identified Management Targets	*Performance Levels*
Access Protocols	120 events during critical period (Aug 15 – Sept 15)	122 events
	Concentrate use between 0930 and 1630, so that the human use is more concentrated and predictable to wildlife	89% of use within the stated time-frame
	Overall reduction of use on the Odaray by 20%	50% reduction during critical period from previous years
Odaray Travel Ethics	Increased group size	Slight increase from 3.3 people/group to 3.4 people/group on the Odaray Highline
	Prevent/Deter people from stopping on the 400m section of trail crossing the wildlife corridor	Identified 5-6 stopped parties
	No pets on the Odaray	1 dog observed
Qualitative Changes	Support identified by non-use	31% of survey respondents indicated non-use due to the strategy objectives (specific question respondents n=172)
	Adequate opportunities with limited access to Odaray Highline	94% of the general area users were satisfied with opportunities in area (specific question respondents n=234).



Map of Odaray Highline Area

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enabled us to influence visitor behaviour in the Lake O'Hara area. Simple messages, communicated through various media, and letting people know how they could help in maintaining this important place all contributed to the success of the programme.

Throughout the summer of 2000, Parks Canada hosted three communications evenings (August 7, August 17 and September 11) at Le Relais (a day use shelter) at Lake O'Hara. These evenings provided an opportunity for Parks Canada to share the research and objectives and engage the users of the area in a discussion about the approach. Attendance for each communication evening ranged from 20 to 40 visitors.

Overall, those who attended the communications evenings provided comments that supported the program. Visitors were receptive to the approach, and noted that education rather than regulation was an effective way to empower visitors. Visitors also supported the flexibility of the program and the creativity required to make it a success.

The success of the voluntary use program piloted throughout the summer 2000 season at Lake O'Hara is its ability to actively involve visitors in the areas' protection. By providing the tools and information needed to understand the importance of the wildlife corridor and the program objectives, visitors become empowered to make ecologically responsible decisions. The piloting of this voluntary approach takes a great step forward for Parks Canada in their approach to managing human use.

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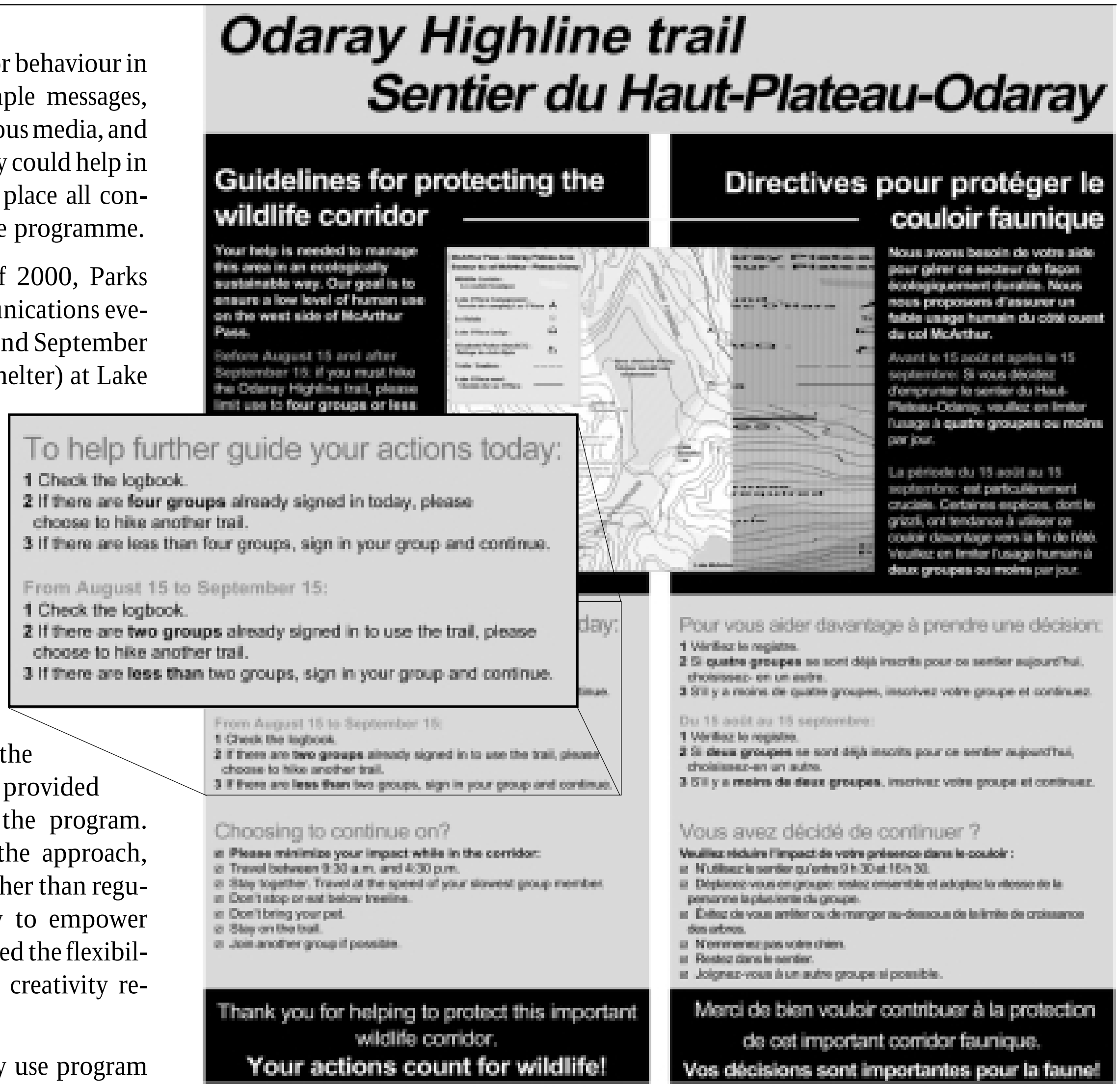

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We next examined now our estimated values of species richness compared with those estimated from the observed independent variables of Chipman and Johnson (2001). The correspondence between these values was very high (see Figure 6 top right).

The final result on the bottom of Figure 4 shows predicted richness using estimates of the four independent variables versus richness observed in the field. The result, while relatively poor, is statistically significant. Also shown are the error bars associated with each image-based richness estimate. The size of the errors is a product of rather conservative estimates of error in the time-since-fire variable and the large errors associated with canopy-stem-density.

CONCLUSIONS

We have successfully developed a system for estimating the four important variables (gradients and disturbance) used by a simple linear biodiversity prediction model together with their uncertainties.

We have propagated these uncertainties through the model to allow estimates of the uncertainty in the predicted richness at the landscape level. While these uncertainties are large, they at least give realistic limits on the use of the vegetation diversity maps that could be otherwise misused.

Through the combined use of remote sensing and GIS technology we can predict vegetation species richness at the landscape scale. Importantly, we can also estimate uncertainly to these predictions which can feed into decision-making.

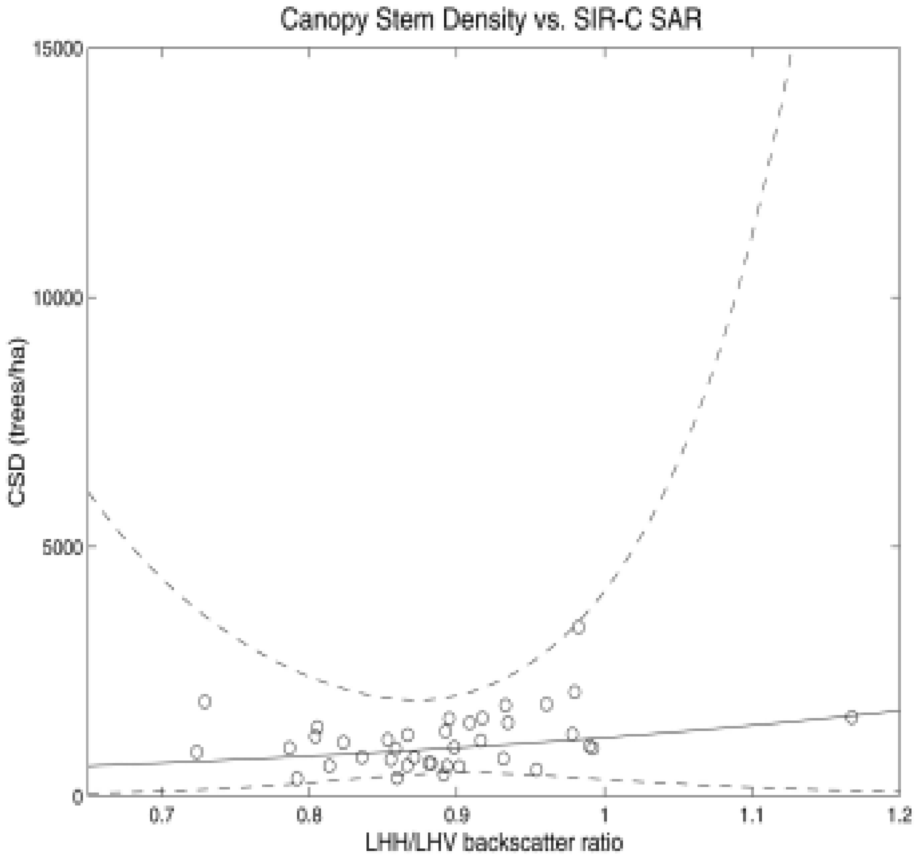

Figure 3: Measurement data and the linear regression model used to predict canopy stem density from the SAR backscatter ratio. The solid line is the least squares linear fit while the dashed lines are the 95% confidence intervals that we used as the uncertainty for the CSD estimate.

ACKNOWLEDGEMENTS

The field data used in this study were collected by Simon Bridge, Sylvia Chipman, Jeff Weir and Anthony Warren. Parks Canada is acknowledged for facilitating the field work and providing data. The Canada Centre for Remote Sensing provided the Landsat TM data. The research was funded by NSERC, the Sustainable Forest Management NCE and The University of Calgary.

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Mapping Vegetation Diversity from Space

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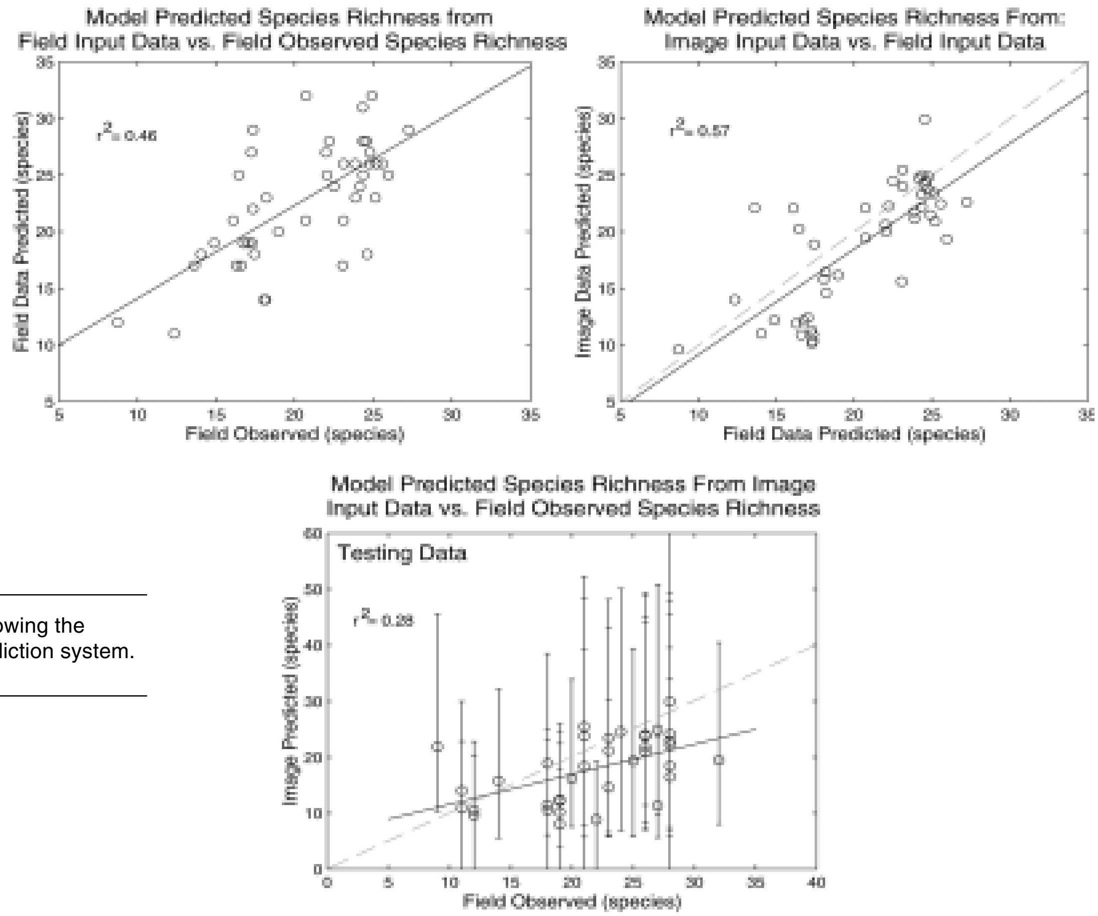

Figure 4: Three graphs showing the results of the richness prediction system.

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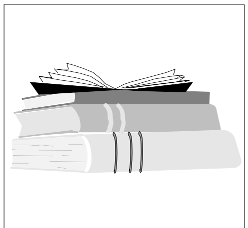
Environmental Ethics: A Challenge



Environmental Ethics: What Really Matters, What Really Works

Edited by David Schmidtz and Elizabeth Willott. Oxford University Press, 2002. 566 pp.

ISBN: 0-19-513909-7 (paperback)

Reviewed by C.J. Taylor

One author has said that environmental ethics is concerned with abstract questions of value theory, focused on questions such as whether nature has 'intrinsic value.' As such, the subject has been of interest to a limited group of philosophers. This collection of essays attempts to take the subject to a wider audience, especially those concerned with the real world by describing "what really matters, what really works." The essays examine cognitive models for understanding humans and their environment along with various issues and controversies associated with the topic. The book seems to be intended primarily as a textbook for use in a university environmental studies program. In some respects the specialized language of philosophy is challenging: the reader needs to be comfortable, for example, with a discussion centred on "the moral standing" of plants and animals. Nonetheless, the book is intended to have a broader appeal, especially to those engaged in environmental issues.

The editors have selected readings around a series of topics intended to provide progressively greater enlightenment of the larger subject. The first topics treat the notion of the rights of humans versus those of the environment. This leads to discussions of sustainability and controversies surrounding the rights of people around the world to feed and clothe themselves conflicting with threatened and diminishing resources. There are attempts to deal with applied issues. One topic, for example, is entitled "Ecofeminism in Theory and Practice." The final sections discuss various forms of activities and attitudes aimed at protecting the environment. There is an article by Paul Watson describing the activities of the *Sea Shepherd* in attacking Japanese drift nets in the Pacific. A concluding argument sums up the importance of developing new attitudes toward the environment by saying: "philosophy is both crucial to and a component of activism and that thinking and acting are both essential components of long- and short-term constructive change." The point of this last piece is to inform and guide forms of environmental activism.

The book serves a useful purpose by bringing together important essays on the subject of environmental ethics into a single accessible volume. In this regard it will be useful to university teachers and students. Its usefulness to wider audiences, however, is moot. While the book presents many issues that are critical to environmental policies, their relevance to public policy makers is not often developed. In the section "Sustainable Use and Institutional Structure," for example, the authors introduce a controversial topic: the tragedy of the commons. Developed by Garett Hardin in an essay of that title in 1968, the tragedy of the commons describes an intrinsic conflict in common property. This is based on the premise that, in publicly accessible land, benefits accrue to individuals while the costs are borne by the collective. This model is used to explain the difficulties with fisheries and oil reserves where the resources are managed collectively but the profits are realized by individuals. The incentive of this situation is for individuals to maximize their profits at the expense of the collective good. This model has been discussed in its variations by many writers over the past 30 years. While useful as a description for a particular kind of environmental dilemma, the tragedy of the commons has been subjected to much debate. Carol Rose's article, "Environmental Lessons," is meant to provide a revision of the commons theory but it is too narrowly focussed to adequately function as a counterbalance. The discussion of how the unregulated commons need not be a disaster by offering examples of how hunting and gathering groups have organized exclusive hunting rights is not extremely helpful to developed nations of the 21st century. Part of the limitation of the discussion may stem from focussing too strongly on philosophical writing.

> *Environmental ethics teaches us how to enjoy the world, not just how to fix it... On one hand, to "fix" is to repair or improve... On the other hand, to "fix" is to stabilize or set in place so as to prevent further change... Of course, human nature being what it is, flux makes people nervous. Rightly or wrongly, we feel more secure when things are "fixed."*
>
> Elizabeth Willott and David Schmidtz, from "Introduction: Why Environmental Ethics?"

If philosophical debate of the commons theory appears narrowly focussed, debate involving historians and public policy types over the same topic has been extremely wide ranging. A 1988 bibliography on the subject of the tragedy of the commons runs to 23 pages. And, though the term was only coined in 1968, the problem has been acknowledged for many years before that. Especially in North America where the disappearing frontier of the late 19th century caused many land-use conflicts, there has been much theorizing about solutions to the dilemma of the open access commons. As a result, public land has been increasingly subjected to government regulation over the past 100 years. Forest reserves, watersheds, rangeland classification, energy resource boards and even national parks were all outgrowths from this political thought. Government intervention and regulation, it was argued, could resolve this dilemma and benefit both the capitalist developer and the larger environment. Ideas and policies have been around long enough to have been put into practice and tried, tested and revised. As such, there has been considerable discussion over the relative merits of various kinds of pubic land management in over the years. An aspect of national park as commons has recently been explored in Louis S. Warren's recent history entitled *"The Hunter's Game: Poachers and Conservationists in Twentieth Century America."*

The section examining the idea of cost benefit analysis in relation to the environment is more fully explored, perhaps because there is a greater body of philosophical literature to draw on. The most enlightening, from this reviewer's perspective is David Schmidt's article "A Place for Cost-Benefit Analysis." It argues that CBA is a useful tool for environmental policy makers so long as it takes into account the full range of costs incurred in proposed environmental development.

In sum, this is a useful and interesting book for those who have followed or are interested in the specialized world of environmental ethical philosophy. Some may find it interesting for the issues it raises and the methods of understanding that it introduces. Others may find the philosophical language difficult to penetrate and those interested in discussions relating to applied environmental policies may be disappointed at the lack of scope of the discussions.

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Recently In Print

Clevernger, A.P., B. Chruszcz and K. Gunson. 2003. Spatial patterns and factors influencing small vertebrate fauna road-kill aggregations. *Biological Conservation* 109: 15-26

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Walking the Big Wild

Heuer, K. 2002. Walking the Big Wild: from Yellowstone to the Yukon on the grizzly bears' trail. McClelland & Stewart.

ISBN: 0771041209

Excerpt from an Amazon.com Editorial Reviewer:

"...Bears and other large animals naturally wander across an enormous range but increasingly they are safe only in isolated, protected parks that are hemmed in by human development... If only the islands of safety could be connected by corridors of preserved habitat to allow free movement by animals like bears, then an enormous problem in conservation would be solved.

Karsten Heuer's journey was intended to show that such a system of parks and corridors is feasible. He set out in June 1998 from Yellowstone Park, Wyoming, on the beginning of a 3,400 kilometre hike that would end, 18 months later, in Watson Lake, Yukon Territory... He came to terms with difficult public relations problems when he spoke to loggers and others with a stake in the economic exploitation of wild lands. And, above all, he overcame extraordinary physical challenges: ferocious storms, avalanches, apparently impassable rivers in full flood, and bears that mistook him for dinner.

Accompanied by occasional human companions and a remarkable border collie named Webster, Heuer demonstrated that there is nearly continuous wilderness up and down the length of the Rocky Mountains, much of it still occupied by bears..."

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Meetings of Interest

April 14-18, 2003 Protecting our Diverse Heritage: The Role of Parks, Protected Areas and Cultural Sites. Town and Country Resort Hotel and Conference Centre, San Diego, CA. The George Wright Society Biennial Conference, presented jointly with Cultural Resources 2003. This conference will encompass the second in a series of nationwide forums, convened by the National Park Service (NPS), for discussing how to increase awareness of cultural resources, for strengthening communication among cultural resources staff and NPS partners, and for discussing best practices and recent developments in cultural resources management. Visit the website at: www.georgewright.org/2003overview.html

May 1-2, 2003 9th National Forest Congress. Ottawa Congress Centre, Ottawa, ON. This congress will celebrate Canadian accomplishments, address priority issues, and endorse new initiatives to face long-term challenge. For information: contact the National Forest Congress Committee: congress@forest.ca or visit the website: http://nfc.forest.ca/home.html

May 4-6, 2003 Biannual Conference on Assessment and remediation of Contaminated Sits in Arctic and Cold Climates (ARCSACC). Edmonton, AB. The objective of this conference is to bring together technical experts, regulators, land owners and others to address contaminates sites remediation an assessment in the unique context of cold climates. This workshop is designed to be useful to engineers, technologists and other environmental professionals who deal with these issues. Contact: kbiggar@civil.ualberta.ca or visit the website: www.civil.ualberta.ca/arcsacc

May 5-11 2003 "More than a Marsh" - Wings Over the Rockies Bird Festival. Columbia Valley, BC. This year's events will highlight the complex relationship of wetlands with wildlife and humans. They include presentations and field trips with key speakers: David Schindler and Suzanne Bayley from the University of Alberta, as well as Larry Halverson, Parks Canada Naturalist. For information: wings@adventurevalley.com or www.adventurevalley.com/wings

May 11-16, 2003 The 5th International Science and Management of Protected Areas (SAMPA) conference: "Making Ecosystem Based Management Work." University of Victoria, BC. The conference will provide a variety of activities ranging from plenary, concurrent sessions, field trips, poster sessions and opportunities to develop resolutions for follow-up action. Visit the website at www.sampaa.org/sampaa_conference.htm

August 11-14, 2003 Annual Wildlife Disease Association Conference. Saskatoon, SK. This conference will consist of presentations and posters on all aspects of wildlife disease, with special sessions on the population effects of disease, immune function and other bioindicators of disease and cervid diseases. Visit the website at http://wildlife.usask.ca/WDA2003

September 11-14, 2003 The 8th Annual Meeting of the Canadian Amphibian and reptile Conservation Network and 3rd Annual Pelee Island Winery Endangered Species Festival. Pelee Island Winery Pavilion, Pelee Island, ON. Sessions are open to all aspects of the conservation biology of amphibians and reptiles, and herpetological research such as: population dynamics, genetics, diseases, status assessment, recovery plans etc. Presentations on public education projects and ethics are also welcome. For more information contact: David Cunnington c/o #202 - 2775 Spruce Street, Vancouver, BC V6H 2R3. david.cunnington@pc.gc.ca or visit the webiste: www.eman-rese.ca/partners/carcnet/annual meeting.html

October 24-26, 2003 The 7th ACUNS Student Conference on Northern Studies: Breaking the Ice: Transcending Borders through Collaboration and Interdisciplinary Research. University of Alberta, Edmonton, AB. Hosted by the Canadian Circumpolar Institute and organized by the Circumpolar Students Association of the University of Alberta. This conference will showcase student research with a northern scope, and welcomes interdisciplinary inquiries. to register or submit: http://scns.onware.ca