The Flux of Trust: Caribou Co-Management in Northern Canada

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Abstract

There is a presumption that the primary goal of creating alternative resource management systems is to increase the efficiency of the management decisions made. However, changing the rules of resource management leads to institutional uncertainty, and such instability is an integral part of developing alternative management systems. In the case of barren ground caribou management, these rule changes include adding the voices of resource users to decision-making, in particular, the marginalized voices of aboriginal caribou-hunting communities. Trust-building is an important process in the development of new management institutions in such cross-cultural situations. Trust develops in conditions where the multiple perspectives of diverse stakeholders are addressed, so that the information for management decisions is clear, accountable and legitimate to all parties. The trust put in the knowledge of linked and dynamic social and ecological conditions changes through time. In this paper the fluctuating trust put in the knowledge of caribou ecology and behaviour is examined with the aid of panarchy thinking and common property theory. This analysis is grounded in the relationship between barren ground caribou (*Rangifer tarandus*) and people in the Dene community of Łutsël K'é on the eastern arm of Great Slave Lake, in Canada's Northwest Territories.

On suppose que l'objectif premier qui sous-tend la création de systèmes alternatifs de gestion des ressources est l'amélioration de l'efficacité des décisions. Pourtant, les modifications des règles de gestion fragilisent les institutions, et cette instabilité fait partie intégrante de la création de systèmes alternatifs de gestion. Dans le cas de la gestion du caribou des toundras, on compte parmi ces changements l'ajout du point de vue des utilisateurs de la ressource dans les prises de décisions, en particulier celui des collectivités autochtones qui en font la chasse. Établir la confiance est un processus important dans la création de nouvelles institutions de gestion dans un contexte interculturel. La confiance s'établit lorsque les perspectives des divers intervenants sont prises en compte, afin que l'information menant à des décisions soit claire, responsable et légitime pour tous. La confiance dans la connaissance des conditions sociales et écologiques dynamiques et interreliées se modifie dans le temps. Cet article se sert de la pensée panarchique et des théories sur la propriété commune pour examiner les fluctuations de la confiance dans les connaissances sur l'écologie et le

comportement du caribou, en particulier dans le cadre des relations entre les caribous des toundras (*Rangifer tarandus*) et les peuples de la communauté déné de Łutsël K'é, dans le bras est du Grand lac des Esclaves, dans les Territoires du Nord-Ouest.

Key words:
Caribou, co-management, panarchy, trust, learning

Introduction

Traditional aboriginal caribou-hunting peoples in northern Canada moved seasonally on the land until the late 1950s and this relationship is thousands of years old (Gordon 1996). Archaeological evidence in the Yukon shows that the relationship between humans and caribou in some parts of the Canadian North is up to 25 000 years old (Cinq-Mars 2001). The distribution of many Dene peoples anticipated the changing migratory movements of the barren ground caribou, especially before settlement. A recent economic valuation of just two of these barren ground herds (the Beverly and Qamanirjuaq herds) found that the domestic hunt of the more than 13 000 aboriginal peoples living on the ranges of these herds has an equivalent economic value of 11.5 million dollars or the cost of replacing the caribou harvest with store bought meat in 2001 (Beverly and Qamanirjuaq Caribou Management Board 2002). The range of each of these herds extends at least 1000 km from north to south and more than 500 km from west to east. A single animal may travel as many as 4 000 km in a year. Currently, more than three million barren ground caribou range the North American North. Human-caribou systems may be thought of as complex adaptive systems – as systems that display unpredictable dynamics, shifting stabilities and require multi-scale thinking. Complex systems problems are difficult to define (Ludwig 2001), requiring multiple perspectives and collective learning (Gunderson and Holling 2002).

Caribou co-management represents joint management scenarios between traditional aboriginal caribou hunters, government managers and biologists and subsequently provides a potentially suitable approach for such complex systems. In addition, many aboriginal communities want their knowledge and perspectives to be included in decision-making without compromising their aboriginal rights to self-determination. Yet these rights can be undermined when aboriginal organizations cooperate with state organizations that may not recognize these rights. The drivers and incentives for these diverse parties to pursue joint management include the mutual need for: 1) mechanisms to make sure that the benefits and costs of maintaining management systems fall to the same parties, 2) monitoring systems that are accountable to and/or carried out by resource users (Ostrom *et al.* 1994), 3) the re-working of the ties between aboriginal and Canadian governance structures (Kendrick forthcoming).

Trust among co-management parties plays a key role in creating space for innovation and mutual education to occur. Without it, joint management can mask multiple perspectives rather than benefit from the opportunities they offer for collective and innovative learning. Such social learning is

possible when diverse ways of knowing are represented at the management table – and when the table provides the conditions for its emergence. The conditions for trust, however, are continually changing as processes for generating knowledge, sharing knowledge and learning about linked human-caribou systems change. The space for trust to develop is connected to the ability of joint management institutions (working rules) to adapt to the changing knowledge of the diverse parties involved in caribou co-management. The objective of this paper is to describe how changing trust levels affect rule changes in co-management systems.

Changes in technology and land use create a dynamic tension in the trust levels that aboriginal caribou hunters, biologists and managers have in their own observations – and in the exchange of their knowledge with each other. Fluctuating trust in the legitimacy of different kinds of knowledge plays a major role in the ability of co-management organizations to take decisive management actions. There is never a clear linear transition in caribou co-management activities from collecting information about caribou populations, to negotiating, monitoring and enforcing rules for caribou harvesting activities. These phases are better pictured as circular and simultaneous. The trust involved in negotiating this dance is a dynamic and on-going process, it is not an end in itself.

Changing trust catalyzes changes in the institutions (rule sets) that guide management decision-making. In the case of co-management involving aboriginal and non-aboriginal governance systems, mechanisms of change must recognize how knowledge, stakeholder representation, and resource rights are held individually *and collectively*. Trust is therefore a multi-faceted mechanism, bridging gaps between aboriginal and Canadian governance and knowledge systems.

Adapting Ostrom's (1994) insights to the case of caribou co-management, the work involved in creating viable management systems should include:

1. the repatriation of lost information,
2. the creation of rules about the ways in which information may be shared, and
3. the guarantee that all those involved in making decisions about a resource are aware of *and trust* the information used to make these decisions.

The efforts of aboriginal communities to document traditional knowledge and revitalize culturally relevant institutions amid tremendous forces of colonization are efforts to regain "lost" or marginalized information about caribou-human systems. The creation of rules for sharing information that avoid the co-optation of aboriginal knowledge systems by mainstream society also plays a role in revitalization efforts (*e.g.* community-designed research protocols). This paper concentrates on the third challenge: creating viable resource management systems; making sure that all co-management decision-makers are not only aware of the information used to make decisions, but have trust in the information. It is argued that this trust is not concrete unless co-management parties find a way to share with each other the means of acquiring and interpreting knowledge about the environment, possibly driven by the co-production of knowledge through innovative ecological monitoring programs. It should be emphasized here that further

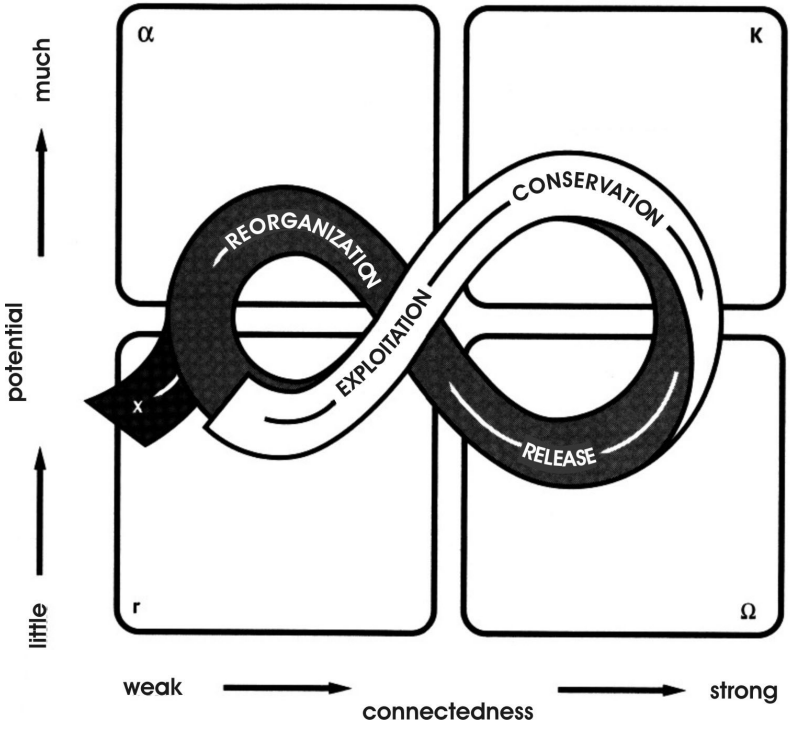
references to monitoring in this paper refer primarily to observations that document the state of barren ground caribou populations and their habitat and not to the monitoring of harvesting activities.

This paper first describes information exchange in formalized co-management organizations and how uncertain information is handled. It is then argued that community-based monitoring is central to any fundamental knowledge exchange between aboriginal caribou-hunting communities and government agencies. Finally, the paper discusses mechanisms for social learning in caribou co-management arrangements through the co-production of knowledge and the mutual recognition of knowledge limitations.

Theoretical Background

Panarchy thinking (Gunderson and Holling 2002) provides useful models for thinking about connected social and ecological systems. The panarchy model is applied here to human-caribou systems to examine the role of variability and diversity in maintaining these systems. Human social processes that create novelty, and promote or destroy innovation are also described. Panarchy thinking searches for an understanding of how linked and adaptive human institutions and ecological systems function. The basic unit of the panarchy model is the adaptive cycle (Figure 1):

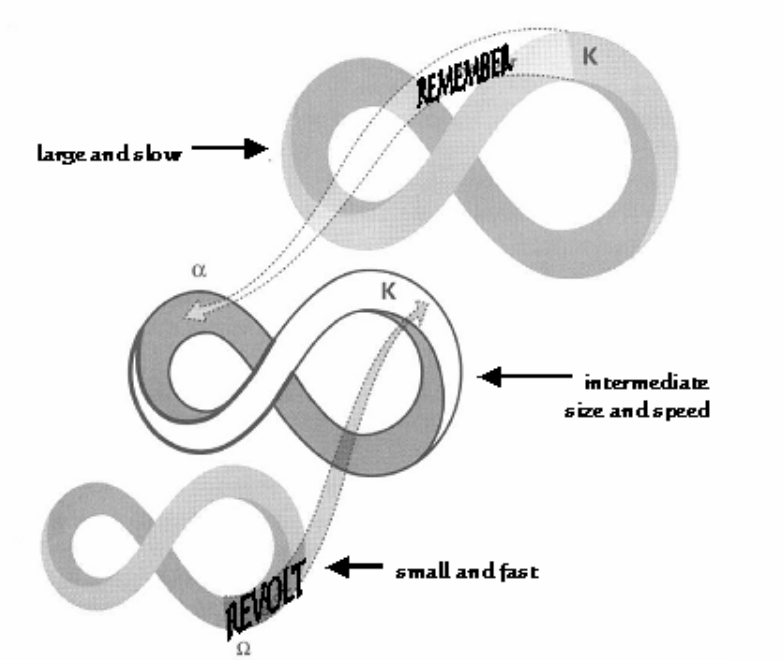
Figure 1 The Adaptive Cycle



(Adapted from Berkes *et al*. 2003)

The restructuring (or release) phase of an adaptive cycle is one of rapid innovation, exhibiting high resilience, low connectedness, and decreasing predictability. The release phase is a time of both crisis and opportunity and increasing uncertainty. The slow phase of accumulation (or exploitation) of capital – including ecological, economic, social, and cultural – is one of increasing efficiency, predictability and connectedness. The rigidity and vulnerability of the system increases, while its resilience decreases through the exploitation phase. With foresight and active adaptive methods, human systems can stabilize variability and draw on opportunity. At times of change, the revolt and remember phases are important mechanisms interacting across scales. These are illustrated as nested adaptive cycles in Figure 2. The revolt phase spurs innovations at larger scales due to changes in smaller scale cycles. The remember phase draws on the experience of larger and slower scale cycles to stabilize the effects of change occurring at smaller scales.

Figure 2 Nested Adaptive Cycles

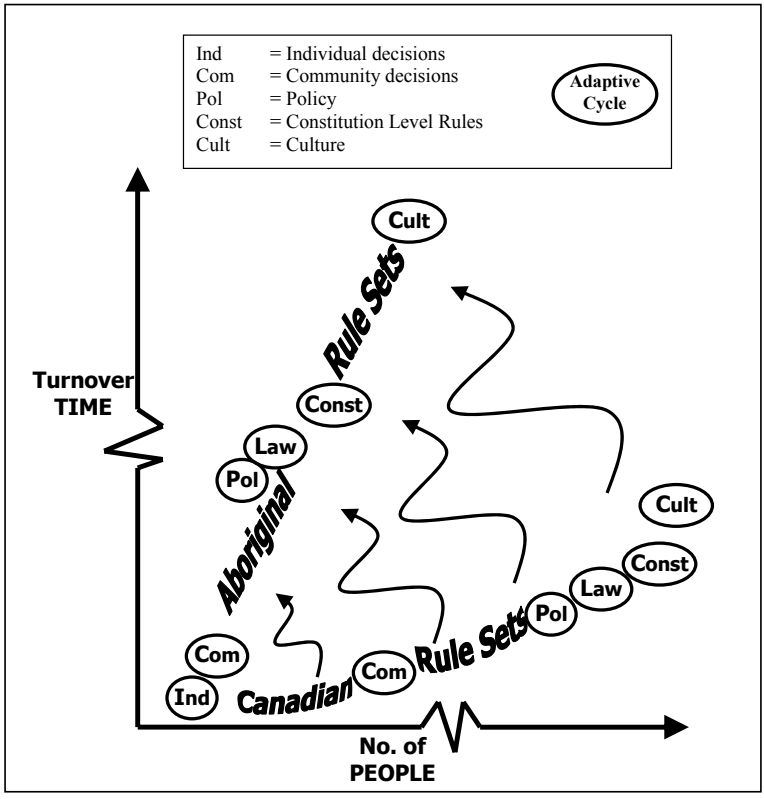


Human institutions can be portrayed as cross-scale, nested sets of adaptive cycles, or rule sets influenced by intentionality, communication and technology. The social learning of co-management systems can be pictured through the models of panarchy theory (Figure 3):

It is the role of co-management organizations to develop mechanisms to bridge, not dissipate, the divide between aboriginal and Canadian governance systems. There are obvious challenges in bridging the

differences in scales such as time frames and numbers of people involved. For instance, aboriginal leaders emphasize the differences between aboriginal and Canadian representations of individual and collective rights and responsibilities. Aboriginal cultures are rooted to landscapes through time in ways that Canadian institutions are not. For these reasons, it is important to look not only at the trust developed between individuals and organizations of individuals, but to look at the trust that exists in the diverse knowledge bases of these multi-scale interactions.

Figure 3 Social learning in co-management systems



Aboriginal communities are currently involved in the lengthy historical process of recovering from the exogenous shock that European colonization represented to their social systems. In the language of panarchy thinking, colonization led to a loss of potential through loss of knowledge, population base, lands, *etc*; to low connectedness through loss of societal organizations, institutions; and to low resilience, represented by a "poverty trap." Northern aboriginal societies are working to revitalize their institutions by re-building and recovering lost potential by documenting traditional knowledge, fashioning alternative resource management organizations, gaining legal

recognition of aboriginal rights, recovering control over traditional lands, *etc.* It can be argued that aboriginal efforts to resist colonization and to revitalize damaged systems – for example, by building new institutions – are mechanisms of "revolt" and that efforts to recover language, cultural practices and traditional knowledge are mechanisms of "remember" (Figure 2). In contrast, early Canadian government bureaucracies in the North were maladaptive, displaying high potential, connectedness and resilience, but ultimately leading to a "rigidity trap."

Management strategies adopted from Europe regarded hunters purely as "exploiters" in need of control, and invested heavily in moulding aboriginal communities to European notions of individual rational resource use in ways that began to circumvent linked Dene-caribou systems (Abel 1993, Cranston-Smith 1995). Contemporary Canadian governance organizations – in the midst of realizing the complexity and variability of northern ecosystems – are looking for ways to break out of "rigidity traps" where conventional resource management systems – ignoring the complexity, uncertainty and variability of northern ecosystems – led to questionable resource management decisions in the past (Fumoleau 1975). The role of co-management institutions in bridging rather than entrenching this challenging divide is one of flux, constant transformation and learning. There is no archetypal model for co-management, but trust-building is critical for its success.

Methods

The author worked with the Dënesoɬine (Chipewyan) community of Łutsël K'é, one of four communities situated in the Akaitcho Territory of the Northwest Territories. The village site of Łutsël K'é is located in the East Arm of Great Slave Lake and is home to approximately 400 band members. The author lived in the community for two years (2000-2001), attending more than five dozen resource management-related meetings and working full-time in the Łutsël K'é Wildlife, Lands and Environment (WLE) Office for several months. A research agreement negotiated between the Łutsël K'é Dene Band and the author laid out the terms and conditions of the author's work with the community (see Kendrick forthcoming). The author worked with youth in the community's land use planning office for 12 months at the request of WLE committee's board members and elders, to help develop an information management system. The thoughts of community-based researchers on the advantages and disadvantages of documenting traditional ecological knowledge and sharing it with organizations outside of the community were recorded as were elders' thoughts on Dene rules of respect toward caribou and understandings of caribou herd dynamics. The research for this paper is also informed by the author's attendance at more than a dozen meetings of the Beverly-Qamanirjuaq Caribou Management Board, Bathurst Caribou Management Planning Committee, and other co-management and ecological monitoring meetings in 2000-2001. This research also involved an analysis of selected documents housed at the Public Registry of the Department of Indian Affairs, as well as conversations with government caribou biologists, mining industry representatives and monitoring agencies.

Information Exchange in Formal Co-management Organizations

> *There is a kind of frustration that the Beverly Qamanirjuaq [caribou management board] members are asking the same questions that still have no answers. There must be more local involvement… An educated person only looks in one direction, a profession only looks at a branch of a tree. Local people with education [on the land] look everywhere; they look at the whole tree (Beverly-Qamanirjuaq Caribou Management Board, Chair, Nov. 2001).*

Despite the formation of the first formal barren ground caribou co-management board (the Beverly-Qamanirjuaq Caribou Management Board) more than 20 years ago, there continues to be a struggle to include the knowledge of aboriginal communities in co-management decision-making. It is important for political and social capital to be developed in order to encourage traditional caribou hunting communities and Canadian government agencies to engage in a genuine exchange of knowledge about barren ground caribou herds. This cannot be achieved through formal management meetings alone (Kruse *et al.* 1998). As a way to achieve this, co-management boards are beginning to become forums that support – or at the least recognize – local initiatives that document and share traditional knowledge of the barren ground caribou ranges. However, this co-management institutional capacity has developed recently.

How Co-management Boards Handle Uncertainty

In less than 50 years, significant advances have been made in understanding how to estimate caribou populations, define herd discreteness and decide upon taxonomic classifications. However, the uncertainty of the information available to understand fluctuations in barren ground caribou population numbers means that it is not possible to project when significant changes in many barren ground herd populations will occur (Kruse *et al.* 1998).

Aboriginal communities are relatively unaware of how and why information gathering techniques used by biologists have changed through time. For example, even in the last few years, new techniques for calving ground surveys, photo surveys and statistical analysis have been developed. However, even with these new techniques biologists have to make assumptions about general population trends in order to choose appropriate survey techniques. What seems most fundamental to exchanges between aboriginal caribou-hunting communities and government biologists and managers attempting to make allocation and research decisions, is how the uncertainty of the information that exists about barren ground caribou populations is communicated cross-culturally, and ultimately how information affects access to and use of the herds.

While elders, hunters and biologists may come to similar conclusions about what they observe on the barren ground caribou ranges, elders worry about how and where resource management policies are made. Caribou co-management efforts have recently started looking toward community-based

monitoring as a means to actively include the knowledge of elders and active hunters in management decision-making.

Key to Fundamental Cross-Cultural Exchange: Community-Based Caribou Monitoring

Much is gained by the wide view of the aerial camera
but something is lost,
matters which are important to those that dwell there
(Blanchet 1949: 9).

There is very little understanding of temporal and geographical fluctuations in barren ground caribou sub-populations. Little documentation of aboriginal communities' knowledge of long-term range use and movement patterns has occurred (exceptions include Thorpe and Kadlun 2000, Łútsël K'é Dëne First Nation 2001, Whaèhdôö Nàowoò Ko (Dogrib Treaty 11 Council) 2001). There are signs that caribou movements and distribution are becoming increasingly variable. This means that decision-making about the capacity of caribou to cope with change cannot be properly gauged without the historical interpretation and ground-truthing afforded by the traditional knowledge of aboriginal caribou-hunting systems. Aboriginal communities are beginning to insist that community-based caribou monitoring become a priority of future management efforts and that it be linked to local research efforts.

The inevitability that caribou co-management boards support community-based monitoring efforts is more than a matter of adding another layer of information to the increasingly complex information needs of decision-makers. Indeed, many jurisdictions are weary of attempting to make management decisions without adequate information. Ecological studies of barren-ground caribou movements and fluctuations in population size have been done over a relatively short-time frame and comparisons between surveys are often not possible (Bergerud 1996). The traditional knowledge of caribou-dependent communities extends over a very long time period, in the case of the Dënesołine in the Great Slave Lake region it extends for *thousands* of years.

The expression and exchange of traditional knowledge outside of its cultural context, however, is not easy – just as it is difficult for scientists to explain results without the technical terms and jargon of specialized knowledge when they attempt to relate information to lay-people. Often, traditional knowledge is expressed in ways that are difficult for biologists and resource managers to comprehend. Recollections of historical patterns of movement and distribution are often intimately tied to the personal recollections of hunters (Ferguson *et al.* 1998, Thorpe 2000). Explanations of abundance may be tied to grim memories of need in times of scarcity. The observations of young, active, aboriginal caribou hunters are often interpreted through the eyes of experienced elders. In these circumstances, some questions – such as "What is "normal" change and what is "dangerous" or unprecedented change?" – become central. Aboriginal elders often emphasize the importance of understanding ecological relationships. For example, focusing on whether or not these *relationships* are being sustained rather than on whether a critical *number* of animals exist. Elders not only

share their knowledge of changing caribou movements, but insist on the notion that animals "monitor" and react to the changing movements and distributions of people – for example, by approaching people, not just avoiding people as a source of disturbance – as much as their movements are externally altered by people. (See Kendrick forthcoming, for accounts of Łútsël K'é elders and hunters knowledge of variations in caribou movements.)

The collection of information that will be useful to management decision-making is becoming more complex due to increasing variability in caribou movements and distribution resulting from climate change, expanded range use and the effects of industrial development. While there are endogenous effects integral to caribou systems that cause variability, there are increasing exogenous effects – and little understanding of where and when caribou populations are affected by them. For example: What are the effects when numbers are high versus low? What is the period of time between regular fluctuations in numbers?

Caribou co-management organizations are revisiting the frequency and type of monitoring done on barren ground caribou ranges. Significant changes are occurring on the barren ground caribou ranges as a result of changing weather patterns. Barren ground caribou herds in the Northwest Territories and Nunavut are currently much larger (in population numbers) than they were 20 years ago when co-management boards were first established. In addition, their range use has expanded and overall knowledge of their range use has changed. Herds that were previously marginal in numbers are experiencing population increases and expanded range use. Without grounding the scientific knowledge of long-term range use patterns through the use of the traditional knowledge of aboriginal caribou-hunting communities, it will be hard to determine whether human-induced or natural variations in caribou movements are occurring and to decide how to go about ensuring the survival of barren-ground caribou herds in the face of these changes. It appears that if caribou surveys are not supplying the information needed to make management decisions, especially in increasingly variable conditions, then feedback from aboriginal hunters' observations is all the more important.

Collective Learning Leading to Institutional Change

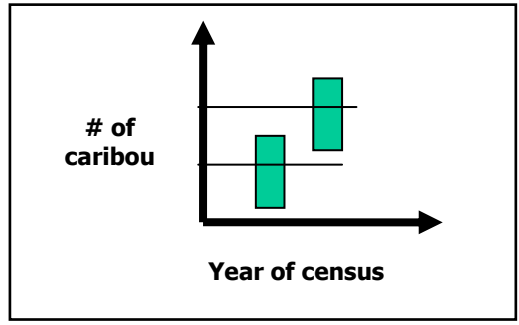
It is difficult to gain first-hand knowledge of barren ground caribou migrations. This is primarily because barren ground caribou move the furthest distances and at the greatest speeds during periods of snow melt and snow accumulation. In addition, the timing of migration events may change with changes in abundance; seasonal locations may also vary with changing numbers. Not only is there limited scientific knowledge of caribou movements, but there is limited time depth to scientific observations about caribou and the length of time between regular fluctuations, which are thought to occur anywhere between 35-100 years. Given the uncertainty of the information available about barren ground caribou, how do people come together in co-management scenarios to understand range assessments and caribou monitoring observations in a way that is accessible to all co-management participants? Is it possible for all parties – no matter what their perspectives – to have trust in the knowledge used to make management

decisions? There are a number of barriers to overcome in order to build co-management arrangements. These include: resolving conflicts over the control of biological or harvesting data, achieving consensus decisions on harvest allocations that incorporate societal values and goals into decision-making about sustainable resource use, and overcoming a lack of institutional capacity for developing alternative solutions to management problems (Pinkerton 1999).

Example:
Beverly-Qamanirjuaq Caribou Management Board

At the autumn 2002 meeting of the Beverly-Qamanirjuaq Caribou Management Board a pivotal decision was made to manage the herds based on multiple indices to be collected and formulated not only by scientists, but also by traditional caribou hunters. The work to develop such indices is set to proceed in 2003. In the past, government departments made management decisions based on the results of population estimates thought to provide enough information to make sound decisions. A survey that revealed low numbers (even if there was a large confidence interval associated with the estimate) would have left the Board in the difficult position of recommending potentially unnecessary restrictions based on the lowest level of the population estimate range (Figure 4).

Figure 4 The Uncertainty of Caribou Survey Census Results



Because surveys have been done every 5-7 years since the late 1980s, the Board would then be stuck with a number that would determine management actions for several years, potentially not reveal anything different about the herd's status than the estimate done several years previous to that (Figure 4), and still not have any information about actual domestic use levels. The Board's recent discussion of a revised management plan reflects the long-standing need for: 1) new means of collecting information about the herds and, 2) alternative management actions.

The Board has acknowledged that it cannot make effective management decisions when information about population levels and harvest rates is lacking. The only way to address this lack of information is to develop multiple methodologies for collecting information about herd status from the

multiple perspectives and knowledge sets that are held by people sitting at the co-management table.

Community-based monitoring is to be made a priority of the management plan and more emphasis is to be put on incorporating traditional knowledge into decision-making. The Board will continue to base its decisions on the precautionary principle especially when there is a lack of information available about a given issue.

While census surveys in the past were carried out roughly every six years – unless there were extenuating circumstances – population surveys will now be triggered by multiple indices monitored annually. This new approach will ensure that population surveys are done when they are needed instead of every 6 years. Caribou use categories will still prioritize traditional domestic hunting over sport hunting or commercial meat sales. However, allocations will be based on the ability of the herds to sustain use. This will be assessed by using the findings from monitoring population trends such as signs of decline or increase as well as the body condition of the animals monitored.

The revised plan also addresses risks associated with different types of use. For example, the assignment of commercial quotas on the calving grounds in the spring is considered a high risk allocation. Degrees of control on use will also be context-dependent and relative under the new plan, allowing, for example, a high degree of control on the allocation of tags for sport hunting to be maintained. In addition, if a proposed use is determined to be high risk and little control over the use can be exercised, then the Board can recommend that an allocation for use not be granted. The Board hopes that this kind of revised thinking on hunting allocations may allow more liberal allocations for some uses, while maintaining traditional domestic use as the highest priority. However, there is some tension and conflict over the ties between different use priorities. Aboriginal representatives argue that by lumping aboriginal commercial or sport hunting aspirations alongside non-aboriginal commercial allocations, they are denied the opportunity to support domestic community hunts through the revenues they could be accruing from commercial hunts because commercial quotas have already been allocated to non-aboriginal commercial enterprises, pre-empting further commercial allocations.

Setting a herd population crisis level has always been a contentious issue given the high uncertainty associated with the accuracy of population counts. At the current time, the crisis level set for both the Qamanirjuaq and Beverly herds is 150,000 animals. The Board aims to make recommendations that limit harvest rates to a level that can be supported by the herds so that when a decline in numbers occurs, the time lag between a decline and a recovery in numbers is reasonable, and does not impinge on traditional domestic use needs. The “decision-making tree” of the Beverly-Qamanirjuaq Caribou Management Board’s management plan has now been rewritten so that in the event of a crisis – such as low caribou population numbers – it is the traditional aboriginal hunter’s observations and perspectives, rather than the views of scientists, which will have final authority on actions to be taken. Regular monitoring by *both* traditional caribou hunters and scientists, however, is key to making the revised management plan work.

The Board will standardize the evaluation of development projects to be used across all jurisdictions on the barren ground caribou ranges so that they can take positions on the impact of development based on what has a higher impact from the "herds' perspective." The sensitivity of caribou to development will be based on factors like the location of a development project and on the range and the timing of the development activity in relation to caribou movements. The Board also has recognized that there must be better inter-jurisdictional links to enable effective fire suppression efforts on the caribou ranges. The plan is to up-date fire history maps annually. The effects of fire on the wintering ranges of the caribou have long been emphasized as a top management priority by aboriginal community representatives sitting on the Board. The Board is also concerned that protection measures will require information identifying inter-annual variations in the use of calving and post-calving areas and has taken measures to obtain this information.

Linking Co-Management Participants and Their Trust in Knowledge of Barren Ground Caribou Herds

The social systems of traditional caribou hunting societies and caribou populations are linked. Aboriginal representatives continually draw attention to this relationship at co-management meetings. While co-management arrangements have opened a window to aboriginal communities about resource management decision-making processes in wider society, they have rarely adopted aboriginal decision-making structures into their make-up. There is an irony, therefore, that in recent years, aboriginal representatives have found themselves arguing that conventional population surveys are needed – even though they may not actually trust the information collected through these means. However, if there is no other way to force the protection of a herd they observe to be declining, or to gather arguments allowing for increased commercial quota allocations, then pushing for a population survey that gives decision-makers the mandate to say that harvest rates do not surpass sustained yield becomes a necessity.

The connection between commercial allocations, the support of local aboriginal economies, and the ability to finance domestic harvests is increasingly expressed by community representatives. A recent study in the Northwest Territories reveals that the rather rigid line drawn in management planning between domestic and commercial caribou harvests may be far more blurred than allocations reveal. For example, there has been a study to quantify the informal sale of caribou meat between General Hunting Licence holders (Dragon 2002). The latter can only be held by status Indians, Metis and Inuit in the Northwest Territories (GNWT 2001). Community representatives make connections between allocation rules (who has access) and provision rules (who has the authority and the responsibility to regulate use) for caribou management. They point to the inability of communities to maintain linked aboriginal-caribou systems without modification of allocation *and* provision rules. Aboriginal representatives cannot understand why many government agencies and industry do not see the ties that they are trying to maintain between local health, traditional economies and caribou populations.

There is also the problem of herd range overlap and the question of how to allocate use levels in these situations – in particular, since particular herd use can only be determined retroactively by performing DNA analysis on skin samples from animals after they are harvested. The problem of herd range overlap means that allocation decisions in overlap areas can only be based on historical use rather than on future need. The danger is that allocation decisions can come to be seen as purely administrative matters rather than as tools to prevent over-harvesting.

Another significant challenge is the relationship between the current state of knowledge of critical caribou habitat and the need to achieve protection for such areas. There are 23 calving grounds in the Northwest Territories and Nunavut. Currently, only Nunavut actively uses the Caribou Protection Measures (CPMs), however, the information used to implement the CPMs is old. The measures are applied to areas that were identified as critical caribou habitat in the 1980s and this information has not been up-dated since that time. Of primary concern is what happens when there is a conflict between development activity and caribou that are not using the "traditional" ranges identified 20 years ago. Barren ground caribou herds have significantly shifted and expanded their range use in the last 20 years. This includes changes in the areas used for calving, which have been considered relatively stable. The problems of identifying critical caribou habitat with static boundaries are well-illustrated through the CPMs and indicate that 25 years of documentation about the use of the barren ground caribou ranges is not enough. To successfully implement the CPMs, information must be continually up-dated.

Applying the concept of resilience may be particularly apt for thinking about the impacts of development activity on caribou systems (Gunn 2001). The resilience of caribou systems is described as the ability of caribou populations to buffer changes in their environment. When natural conditions are favourable, caribou have an increased ability to cope with human disturbances. However, if caribou spend more time near a development in a severe insect year, they may be in poorer condition and have less resilience to human-induced disturbance. It may be possible to start separating the effects of industrial development – such as a mine – from natural changes and, subsequently, to begin ranking the uncertainty of what we know about the effects of human industrial activities on caribou populations.

When contemplating the effects of development, information about a variety of factors – in addition to critical habitat considerations – must be gathered. This information should include consideration of caribou condition between seasons, between year classes as well as inter-annual variation. If caribou are in good shape, they can handle a certain amount of disruption, but if they are compromised, they may not be able to absorb the stress induced by development activities. For example, if cows are in poor condition when they get to the calving grounds, then protection of these areas may be immaterial. Focusing only on critical habitat may also ignore the importance of protecting spring staging areas or winter feeding grounds. Without a broadened perspective, factors such as the movement of wolves into post-calving areas at post-calving time, or the effects of summer browsing on the resilience of plant biomass, may also be lost. With changes in range use, there are changes in migration patterns and changes in physical condition.

Understanding these changes will involve multiple knowledge sets and will require a space for multiple knowledge-holders – including hunters, elders, and biologists – to exchange ideas with each other and to continue learning about caribou populations as adaptive and complex systems.

Conclusions

The foregoing discussion indicates that existing knowledge about caribou is frequently uncertain. The social learning involved in making management decisions, subsequently includes mutual acknowledgement among co-management participants of the limitations of what is known about caribou systems. To address this challenge caribou co-management participants work toward the development of learning processes that allow people to share multiple perspectives on what is known about caribou systems and to establish thresholds of acceptable change in linked caribou-hunting systems. At the local scale, biologists and traditional caribou hunters are looking at ways to measure changes in caribou body condition and to map their migration routes over time – and to do this in ways that are legitimate in their respective learning traditions. At regional scales, aboriginal leaders and Canadian government policy-makers have the task of identifying the kinds of changes that are culturally and socially acceptable to traditional caribou hunting societies and the wider Canadian society. Ultimately these cross-scale choices must be combined so that changes measured on the ground shape decisions made about evolving social and cultural values. Through time, trust in the range of knowledge possessed by caribou co-management participants is built around the ways caribou can buffer and respond to environmental and human-induced changes.

Through the establishment of community-based monitoring programs, co-management systems may produce better ideas about the convergence and/or complementarity of multiple spheres of knowledge. Community institutions – for knowledge collection, interpretation, and use – would be rooted at a local level. Co-management systems that support such community institutions would truly be espousing the subsidiarity principle – where larger scale decision-making structures exist to support local needs. Such enactment of the subsidiarity principle can help to avoid hypocritical scenarios – which are documented by co-management scholars – who often observe forums where traditional knowledge is given stature at the international level, but little acknowledgement at local and regional levels (Feit 1998), which is where traditional knowledge lives.

Ultimately, co-management systems must establish the space and the humility to acknowledge the importance of trust between participants as well as trust in the knowledge that is employed to make management decisions. This trust will not be created unless there is agreement that it is the responsibility of aboriginal co-management participants to determine when and how to include traditional knowledge in the co-management process. Without trust, between people and in the knowledge that shapes decisions and actions, it is impossible to supply alternative institutions that recognize changing resource management settings.

References

Abel, K. 1993. *Drum Songs: Glimpses of Dene History*. Montreal & Kingston:McGill-Queen's University Press.

Bergerud, A. T. 1996. Evolving Perspectives on Caribou Population Dynamics, Have We Got it Right Yet? *Rangifer*, Special Issue No. 9: 95-116.

Berkes, F, J. Colding and C. Folke, eds. 2003. *Navigating Social-Ecological Systems: Building Resilience to Complexity and Change.* Cambridge University Press: Cambridge, U.K.

Beverly and Qamanirjuaq Caribou Management Board. 2002. *Beverly and Qamanirjuaq Caribou Management Board Agreement*. Beverly and Qamanirjuaq Caribou Management Board: Ottawa.

Blanchet, G. H. 1949. Thelewey-aza-yeth. *The Beaver*, Outfit 280: 8-11.

Cinq-Mars, J. 2001. *The Significance of the Bluefish Caves in Beringian Prehistory* <http://www.civilization.ca/academ/articles/cinq1_1e.html> [Accessed on May 24, 2003].

Cranston-Smith, V.V. 1995. *Chipewyan Hunting, Scientific Research and State Conservation of the Barren-Ground Caribou, 1940-1970.* unpublished M.A. thesis, Department of Native Studies, University of Saskatchewan, Saskatoon.

Dragon, J.I.D. 2002. *Commercial use of caribou (*Rangifer tarandus*) in the Canadian Arctic*. Unpublished Ph.D. Thesis, Edmonton: Department of Renewable Resources, University of Alberta.

Feit, H.A. 1998. Reflections on local knowledge and institutionalized resource management: Differences, dominance and decentralization. In Dorais, L.-J. and M. Nagy, L. Müller-Wille (eds.) 1998. *Aboriginal Environmental Knowledge in the North.* Québec: GÉTIC, Université Laval.

Ferguson, M. A. D., R.G. Williamson and F. Messier 1998. Inuit Knowledge of Long-term Changes in a Population of Arctic Tundra Caribou. *Arctic* 51: 201-219.

Fumoleau OMI, R. 1975. *As Long as This Land Shall Last: A History of Treaty 8 and Treaty 11, 1870-1939*, Toronto: McClelland and Stewart Ltd.

Gordon, B.C. 1996. *People of Sunlight People of Starlight: Barrenland Archaeology in the Northwest Territories of Canada, Mercury Series, Paper 154*, Hull Québec: Archaeological Survey of Canada, Canadian Museum of Civilization.

Gunderson, L. H. and C. S. Holling (eds.) 2002. *Panarchy: Understanding Transformations in Human and Natural Systems*, Washington, D.C.: Island Press.

Gunn, A. 2001. Presentation to the November 2001 meeting of the Beverly-Qamanirjuaq Caribou Management Board, Yellowknife, Northwest Territories.

Government of the Northwest Territories 2001. *Wildlife Act.* <http://www.nwt.wildlife.rwed.gov.nt.ca/legislation/wildlifeact2001> [Accessed on May 24, 2003].

Kendrick, A. forthcoming. *Caribou Co-Management and Cross-Cultural Knowledge Exchange.* unpublished Ph.D. Thesis, Winnipeg: Natural Resources Institute, University of Manitoba.

Kruse, J., D. Klein, S. Braund, L. Moorehead and B. Simeone 1998. Co-Management of Natural Resources: A Comparison of Two Caribou Management Systems. *Human Organization* 57: 447-458.

Ludwig, D. 2001. The Era of Management is Over. *Ecosystems* 4: 758-764.

Łútsël K'é Dëne First Nation 2001. Traditional ecological knowledge in the Kaché Tué study region – Final Report, Yellowknife, Northwest Territories: West Kitikmeot Slave Study Society.

Ostrom, E., R. Gardner, and J. Walker 1994. *Rules, Games and Common-Pool Resources*, Ann Arbor: University of Michigan Press.

Pinkerton, E. 1999. Factors in overcoming barriers to implementing co-management in British Columbia salmon fisheries. Conservation Ecology 3(2): 2. <http://www.consecol.org/vol3/iss2/art2> [Accessed on May 24, 2003].

Thorpe, N. L. 2000. *Contributions of Inuit Ecological Knowledge to Understanding the Impacts of Climate Change on the Bathurst Caribou Herd in the Kitikmeot Region, Nunavut.* Unpublished Thesis Research Project Report. Vancouver, B.C.: School of Resource and Environnmental Management, Simon Fraser.

Thorpe, N. and Kadlun, M. 2000. *Tuktu and Nogak Project - Inuit Knowledge about Wildlife in Bathurst Inlet: Focus on Caribou and Calving Areas - 1999/2000 Final Report*, Yellowknife, Northwest Territories: West Kitikmeot Slave Study Society.

Whaèhdôö Nàowoò Ko (Dogrib Treaty 11 Council) 2001. *Dogrib Traditional Knowledge: Relationship between Caribou Migration Patterns and the State of Caribou Habitat– Final Report.* Yellowknife, Northwest Territories: West Kitikmeot Slave Study Society.

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