

CARMA's Knowledge to Action Plan

Preamble:

The CircumArctic *Rangifer* Monitoring and Assessment (CARMA) Network is an informal group of scientists, community representatives, and management agencies who formed to better understand the impacts of global changes on migratory tundra caribou. CARMA was formally launched in Vancouver in 2004. This launch was preceded by several events. In 1998 the Arctic Council ministers directed the Conservation of Arctic Flora and Fauna (CAFF) to “identify elements of a program to monitor circumpolar biodiversity” and to “assess the effects of climate change on Arctic ecosystems”. Concurrent with that initiative, in 1999 in Rovaniemi, Finland, the International Arctic Science Committee (IASC) and the US National Science Foundation funded an interdisciplinary conference of *Rangifer* managers, users, and scientists to discuss elements of a circumpolar monitoring and assessment network for human-*Rangifer* systems and the formation of a community to implement the plan (Russell *et al.*, 2000). After a meeting to implement the Arctic Council's directive, *Rangifer* was confirmed as a key indicator species and the CARMA network was officially endorsed by CAFF. With that endorsement and the plan from the Rovaniemi conference in mind, the IASC human-*Rangifer* study group met in Minery, New Hampshire, in 2001 and fleshed out the elements of a *Rangifer* network, leading to the official launch of the CARMA network. Subsequently, in 2005, CARMA was invited to become an official network under the Circumpolar Biodiversity Monitoring Program (CBMP). The CBMP reports to the CAFF.

CARMA has held annual meetings since 2004. At the initial meeting CARMA adopted the mission to: “monitor and assess the impacts of global change on human-*Rangifer* (reindeer, caribou) systems across the circumarctic, through cooperation, both geographically and across disciplines”. In 2005, two large grants provided support. One was through the Canadian International Polar Year (IPY) program and the other through the US National Science Foundation. CARMA's Canadian IPY project, “Starting the clock for the CARMA Network: Global Change, Resilience and Human-*Rangifer* Systems of the CircumArctic”, aimed to develop protocols for monitoring at the individual and population level, and funded a number of projects to either initiate standardized monitoring programs or develop monitoring methodologies that could be incorporated into monitoring manuals. The funding also gave us an opportunity to: 1) develop a communications website (www.caff.is/carma), 2) develop data sharing and handling policies, 3) initiate programs to better understand how change is affecting communities across the north, 4) document local knowledge about changes in human-caribou relationships, 5) provide educational tools to schools, 6) provide materials and training for hunters to participate in monitoring the health of caribou, and 7) further our capability to synthesize data and assess herd-specific vulnerability and resilience to global change through modeling.

We are now at a stage where CARMA needs to develop a Knowledge to Action Plan that will guide us through the next few years. This white paper highlights the elements of that Plan. Once accepted CARMA needs to find the funding required to implement the Plan.

Introduction to the Knowledge to Action Plan

CARMA's Knowledge to Action Plan has the vision of answering questions of the Arctic people who live with caribou about the future and how to look after caribou. CARMA's Knowledge to Action is moving from describing *what* is happening to caribou (symptoms) to understanding *why* it is happening (causes) and, with the implementation of this Knowledge to Action Plan, *how can* we manage into the future. At CARMA's annual gatherings, aboriginal communities and co-management boards ask similar questions; 1) why have our herds declined and what should we be doing to foster recovery, 2) how is climate change and development impacting our herds, and 3) are caribou safe to eat?

A common thread throughout CARMA's Knowledge to Action plan is our vision to foster youthful leadership and cross-generational learning. CARMA will invite one early career scientist to lead, with mentoring support, to produce a "repository of lessons learned" from caribou declines over the past 15 years. The same early-career scientist will lead on a plan to lay out the options for managing and monitoring herds through their "cycle of abundance". CARMA's Knowledge to Action plan's second priority is using the existing knowledge to assess herd-specific vulnerability and resilience to human-related change in the Arctic. The network will develop a user-friendly interface for the climate database, a demonstration application of climate data for calving grounds, and on-line resources to enable people to use the CARMA cumulative effects models to assess impacts of development and climate change on individual herds. The third Knowledge to Action priority will be to invite a second early career scientist to lead developing a caribou health monitoring plan, with guidelines for community-based monitoring of caribou health. On-line and practical teaching aids will be developed for youth, hunters, and elders in order to test and improve the health monitoring protocols.

The Plan

PRIORITY 1. Managing through abundance

The Need: Caribou herds experience a cycle of abundance that lasts about 40 to 60 years. Over the last 15 years, most caribou herds around the circumpolar world have experienced rapidly declining populations, a phenomenon not experienced since the 1950s and 1960s. The major difference between the latest declines is that, particularly in Canada, management of the herds now depends on the recommendations of co-management institutions created under the land claims. What is also different is the unprecedented rate of global Arctic changes: 1) increased industrialization and transportation corridors, 2) unprecedented access and sophisticated technology for hunters to access caribou, and 3) climate change.

Background: During the last caribou cycle (1970 to 2010) a clear "management pattern" emerged. Essentially herd abundance was not actively managed until numbers of caribou reached the near-crisis point. In some cases delayed monitoring resulted in the almost total disappearance of once large herds. Some herds lost over 90% of their peak numbers, including the Bathurst and George River Herds. While at least one herd is

recovering (for example the Porcupine Caribou Herd), other herds are still declining (for example the George and Leaf River herds).

There was a clear need identified by CARMA collaborators to develop a monitoring and management strategy through the entire cycle of abundance. Management actions and monitoring when herds are rapidly increasing is just as important as when herds are declining. Through Priority 1, the Knowledge to Action plan will address two key questions, 1) what lessons did we learn during the recent period of decline, and 2) during the next cycle of abundance, how do we monitor and manage our herds?

Goal and Objective: to ensure that the knowledge and experience gained during recent declines are not lost, but rather turned into both a repository of lessons learned and a plan of how to manage and monitor caribou herds over the next cycle of abundance.

CARMA Action Set 1:

1. Produce a *Repository of lessons learned* from recent caribou declines over the last 15 years compared to when caribou numbers were at their peak. This will include lessons on how to recognize peak numbers; how to manage the land for recovery when it is devoid of caribou; what management actions worked, what didn't, and why. This on-line repository will be immediately accessible to managers facing declines in the near future and will remain a legacy for future managers.

2. Produce a *Manage through abundance plan* built on advice from scientists, boards, committees, Aboriginal and federal/territorial/provincial government agencies, and university researchers. This plan will lay out the options for managing herds through various phases of their cycle of abundance, based on a clear set of management goals. The plan will help managers address questions like, how do we detect the peak? What is the best way to monitor harvests? How can we use harvest to slow the rapid growth, reduce the speed of the decline and enable herds to rebound quickly?

Performance Indicators:

1. Hiring and orientation of an early-career scientist (year 1)
2. Completion of *Repository of lessons learned* from recent caribou declines (year 2)
3. Completion of a practical and accepted monitoring and management plan, for decision-makers to monitor their herds through the complete cycle of abundance (*Manage through abundance plan*).

PRIORITY 2. Assessing impacts in the changing caribou world

The Need: All co-management boards have expressed a need for a coordinated, credible approach to assessing the cumulative impacts of development on their caribou herds. As well, boards and agencies wonder both 1) how climate change will factor into impact assessment and 2) how to factor in the cycles of caribou abundance. We hear the same message directly from communities as people recognize the need to determine how herds will be impacted by incremental development – not only during the “good

times” of herd expansion, but also during the “bad times” when herds are in rapid decline.

Background: CARMA has already begun to address the challenges posed by cumulative effects and has a workable and tested approach. CARMA uses a modeling approach to project a caribou’s forage intake then determine the growth and fattening of an individual female caribou and her calf as it “walks through” its environment. Climate is a major factor that impacts how well a caribou will do throughout the year. The model can incorporate climate change or human activity as the caribou moves through its seasonal ranges, thus different scenarios can be imposed on the caribou to assess cumulative impacts of human activity. From modeling scenarios in the energy-protein model, output of key indicators such as fall fat weight of cow and fall condition of calf can then be used to link condition with herd productivity at the population scale. When modeling the impacts on the population, the impact of management policies, such as harvesting strategies, can also be explored.

Goal and Objectives: To ensure that CARMA’s knowledge base is available and accessible for users, CARMA will develop demonstration applications and on-line manuals for climate modeling and cumulative effects.

CARMA Action Set 2:

1. Develop and test an *On-line user manual for the climate database.* Users have expressed a strong need for a user-friendly interface to make the climate database more accessible. With an on-line manual to introduce and explain the climate database, co-management boards and other users can access the data to annually predict risks to their herds. Applying the climate database will provide input into the cumulative effects modeling.

2. Assess each herd’s vulnerability and resilience to change. We will build the herd-specific datasets required to run the models, combined with generic runs to demonstrate herd vulnerabilities and resilience to global change. Further for three herds with extensive monitoring data, we will run a current and potential analysis of cumulative impacts.

3. Develop and test an *On-line user manual for cumulative effects assessment.* Based on the results of the first two actions, develop a manual and access to expertise for users to apply the CARMA cumulative effects models to assess development and climate change on a herd-by-herd basis.

Performance Indicators:

1. Herd specific databases required to run models in year 1.
 2. At least three assessments of herd-specific vulnerability and resilience to human-related change in the Arctic (Porcupine, Bathurst and Leaf River herds) in year 1
 3. Two on-line manuals for the CARMA cumulative effects models and the climate database (year 2).
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PRIORITY 3. Caribou health and food safety in a changing world

The Need: Throughout the North, traditional food security is a major concern. The rapid and unprecedented Arctic climate change is already influencing diseases and parasites in caribou.

Background: During IPY, we developed and implemented, for the first time, standardized protocols to measure the biodiversity of pathogens in caribou across a broad geographic range. CARMA, through the University of Calgary's school of veterinary science, and using IPY funding, established a knowledge foundation (biodiversity, effects, and geographic, seasonal, and age-related patterns of pathogens in caribou) that will now allow us to explore the effects of climate change on host-pathogen dynamics, and, ultimately, on host population dynamics. We also recognize and share the concerns of users that they need to have more information about diseases and parasites – especially new and emerging ones.

Goal and Objectives: To ensure the flow of useful information and effective training on caribou health monitoring through a collaborative health monitoring plan and through development of teaching aids and delivery of training.

CARMA Action Set 3:

1. Develop a *Caribou health monitoring plan*. Invite an early-career scientist to work through the CARMA caribou community in the development of the plan, in close co-operation with other team members. The plan will make use of existing datasets and epidemiology to develop evidence-based guidelines for ongoing health monitoring of caribou with strong emphasis on community-based monitoring.

2. Create a training team and develop and deliver training both on-line and in communities. Early-career scientist 2 will lead the training team that will create on-line and practical teaching aids for youth, hunters and elders, making use of existing organizations and opportunities (for example, Arctic College and university field programs). The training program will feed back into the first action item, as it will provide opportunities to test and improve the health monitoring protocols.

Performance Indicators:

1. Hiring and orientation of an early-career scientist (year 1)
2. The early-career scientist leading at least two field programs to work with youth, elders and hunters to develop, test and disseminate the caribou health monitoring plan.

Expected Impacts and Added Value

Social and economic impacts: The expected social impacts of the CARMA Knowledge to Action Plan will be the increased opportunities for strengthened cross-generational conversations: not only between the two early-career scientists and their mentors, but also between the elders and youth during the development of both mentoring program for aboriginal youth and the health monitoring protocols. Intangible but nonetheless

real benefits will be from the solace that caribou users have in contributing their information and seeing shared solutions to questions raised by climate change and human activities on caribou.

Direct economic benefits will accrue through the increased efficiency of cumulative effect assessments based on the demonstration project (assessing herd vulnerability and resilience) and the enhanced availability of the tools through the on-line manuals for the climate database and the cumulative effects model. Other economic benefits will flow from the Knowledge to Action through efficiencies in early disease and parasite detection which relates to food safety and security for caribou users.

Communication Plan

Much of CARMA's Knowledge to Action Plan is about communications: bringing data, experience on management, and tools, from both community knowledge holders and scientists, for co-management agencies. Building sustainability is a collective process and requires communication to keep team members and other participants in this plan working together. CARMA communications are through its website, via email distribution lists, announcements, Skype conference calls, and participation in co-management board and council meetings. CARMA communications for the Knowledge to Action Plan:

1. **Launch Knowledge to Action major products:** 1) *Repository of lessons learned*; 2) *Manage through abundance plan*; 3) *On-line user manual for the climate database*; 4) *On-line user manual for cumulative effects assessment*; 5) *Caribou health monitoring plan*; 6) *Report from CARMA*. Each product launch will consist of a notice in a press release format, sent via email individually and by lists to the CARMA Network, co-management institutions, northern Canadian media; Arctic Council community, Arctic researchers, and the international biodiversity and sustainability research and policy community.
2. **Maintain and develop the CARMA website.** The website is the core repository for CARMA information: keeping it up to date and easily navigated is a team priority.
3. **Maintain regular communications within the CARMA Network:** quarterly newsletters distributed via email and available on the website; conference calls and meetings among team members and working groups involving other CARMA participants.