Chapter 19

Disturbance, Feedbacks and Conservation

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» We were told not to hunt animals for the sense of killing. Because you are not able to use that animal for eternity. I believe we were also taught that there is a certain purpose here in this particular time for us to utilize these marine mammals. That was what I heard the elderly people say from the older generation, like Pelaasi and others, used to say. They were saying: the 'plan' has been already made. The 'master plan' is that our purpose is to hunt marine mammals, but that we should not take that for granted. This is why conservation is so important in our culture.

George Noongwook in Oozeva *et al.* 2004.

A variety of regional, national and international legal mechanisms exist to help manage at risk species such as the IUCN Red List, the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and the various national legislation and regulations. Current and predicted impacts from rapidly warming climate scenarios have led to an almost pre-emptive push to list species as endangered or threatened at the regional, federal and international levels and often across species ranges. Listing of species under various legal articles provides increased public awareness of species status and threats, generally increases legal protections and can boost basic research and monitoring efforts as was seen following the 2007 US listing of the polar bear as threatened.

However, initiating increased protections indicates a failure to manage on other fronts and can have unintended consequences. The addition of species to higher categories of risk under constructs like the IUCN Red List is nothing to strive for or to celebrate. It measures the continued loss of biodiversity and societal or society's lack of understanding, will or ability to successfully manage the challenges facing species today. Range-wide listing decisions, as seen with both the polar bear and ice-associated species of seal listings in the US, may not adequately account for the varying rates of anticipated change across dramatically differing habitats within the Arctic. Existing legal structures, at the international and national levels, were not developed for pervasive, long term threats like climate change and often lack flexibility once enacted.

Polar bears provide one example. There are 19 subpopulations, or management units, of polar bears in the Arctic inhabiting a range of very different habitats. We are likely to see up to 19 different stories unfold as warming affects different areas at different times and in different ways. While scientists are already noting population declines or indices suggesting decline in the most southerly of polar bear populations, it is expected that populations in the higher Arctic will remain more resilient to change in the near term (Wiig *et al.* 2008; see also Reid *et al.*, Chapter 3). Prescriptive, one-size-fits-all solutions will challenge the acceptance of stakeholders and the people who rely on these species for their own survival both culturally and economically (Dowsley 2010).

Successful management of Arctic species will require new management tools and greater flexibility. The overarching threat posed by rapid climate warming will challenge our best efforts and existing legal mechanisms. It must also be recognized that people live in the Arctic and rely on its wildlife. Any plan to protect Arctic species must involve the people who live with them. It must understand the food and economic security challenges that come with increased legal protective status, and potential clashes with established indigenous rights. The situation is complex and demands well thought out and complex responses to the threats of today and the challenges of tomorrow.

19.4.3. Conservation through community involvement

The last several decades have seen continued interest in natural resource monitoring that involves both scientists and local stakeholders (Gofman 2010, Huntington 2011). This partnership, often referred to as community based monitoring (CBM), or community-based observations, continues to evolve and exert increased influence on decision making and resource management (Gofman 2010). The scope of CBM is diverse and complex and continues to develop as experiences of integration are shared. Moreover, the overwhelming connection of Arctic peoples to the land provides opportunities for strong conservation partnerships, for example initiatives related to ecological monitoring, food security or sacred sites.

In essence, CBM seeks to improve the ability to share observations and understanding of local changes that are occurring in a vast and remote region through the eyes of Arctic residents. The idea is that intimate and multi-generational knowledge held by local stakeholders can help governments and local organizations identify and address serious environment and development challenges at early stages (Harremoës *et al.* 2001).

19.4.3.1. Monitoring approaches

Monitoring approaches in all Arctic countries have some level of local involvement. Examples of CBM exist throughout the Arctic. These monitoring approaches range from programs involving local stakeholders only in data collection (citizen science) with the design, analysis and interpretation undertaken by professional researchers, to entirely autonomous monitoring schemes run by local people (see Gofman 2010 for full discussion).

The level of involvement by local peoples beyond project development and planning to include analysis can contribute to longer-term capacity and implementation benefits beyond just the collected data (Tab. 19.3). Although local residents can unquestionably monitor and report on certain observed changes, their interpretation of the changes and any policy implications they may have are sometimes left aside. However, this is not a problem limited to CBM. From a policy implementation perspective, opportunities to involve Arctic peoples in know ledge production, in an open and transparent manner, is critical when considering managing individual and commercial activities in the North.

19.4.3.2. Validity of CBM data

The struggle to break through the perceived limitations surrounding CBM is often linked to the approaches and skepticism at the heart of western approaches to knowledge production. Scientists have documented Arctic community members' detailed knowledge of key components of their environment, such as sea-ice (Laidler 2006), weather patterns (Weatherhead *et al.* 2010) and caribou (Ferguson *et al.* 1998, Russell *et al.* in press).

Table 19.3. Arctic natural resource monitoring schemes across a spectrum of possible monitoring approaches based on the relative participation of different actors (modified from Danielsen *et al.* 2009).

Category of monitoring	Arctic examples	Description	
Fully autonomous local monitoring	Customary conservation regimes, e.g. in Canada (Ferguson *et al.* 1998, Moller *et al.* 2004)	The whole monitoring process – from design, to data collection, to analysis, and finally to use of data for management decisions – is carried out autonomously by local stakeholders	↑ Increasing role of local stakeholders
Collaborative monitoring with local data interpretation	Arctic Borderlands Ecological Knowledge Co-op, Canada (Eamer 2006, Russell *et al.* in press); Community-based monitoring by Inuvialuit Settlement region, Canada (Huntington 2011); Opening Doors to the Native Knowledge of the Indigenous Peoples of the Nenet Autonomous Okrug, Russia (The Association of the Nenets People Yasavey and RAIPON); Piniakkanik Sumiiffinni Nalunaarsuineq, Greenland (Danielsen *et al.* in press)	Locally based monitoring involving local stakeholders in data collection, interpretation or analysis, and management decision making, although external scientists may provide advice and training. The original data collected by local people remain in the area being monitored, but copies of the data may be sent to professional researchers for in-depth or larger-scale analysis	
Collaborative monitoring with external data interpretation	Community Moose Monitoring Project, Canada (Gofman 2010); Integrated Ecosystem Management (ECORA), Russia (Larsen *et al.* 2011)	Local stakeholders involved in data collection and monitoring-based management decision making, but the design of the scheme and the data analysis and interpretation are undertaken by external scientists	
Externally driven monitoring with local data collectors	Bering Sea Sub Network, Alaska and Russia (Gofman & Smith 2009); Environmental Observations of Seal Hunters, Finland (Gofman 2010); Fávllis Network, Norway (Gofman 2010); Monitoring of breeding common eiders, Greenland (Merkel 2010); The Piniarneq fisheries catch and hunting report database, Greenland	Local stakeholders involved only in data collection stage, with design, analysis, and interpretation of monitoring results for decision-making being undertaken by professional researchers, generally far from the site	
Externally driven, researcher executed monitoring	Multiple scientist-executed natural resource monitoring schemes with no involvement of the local stakeholders	Design and implementation conducted entirely by professional scientists who are funded by external agencies and generally reside elsewhere	

Nevertheless, we know of no studies that have examined the accuracy of community-based monitoring of natural resources in the Arctic. Studies from other parts of the world provide cautious support for the idea that monitoring by community members can yield results that can be as reliable as those derived from professional, scientist-conducted monitoring (e.g. Danielsen *et al.* 2005, Jones *et al.* 2008, Rist *et al.* 2010).

Whereas scientists aspire to be impartial (Beardsley 2010), some fishermen, hunters and environmentally interested people may have a conflict of interest in their assessment of the status of those resources on which they depend for their livelihoods or that they are otherwise interested in (Root & Alpert 1994). For instance, a special local interest in certain resources or a preoccupation with certain challenges to resource management may influence which attributes are recorded, when and where. The community perspective is relevant too. Indigenous communities often view the scientific initiatives with suspicion if the scientists do not possess social and cultural skills to appreciate context and locality, creating a need to establish credibility in both directions.

Many of the potential limitations of CBM can be overcome by careful planning, by explicit consideration of likely biases, and by thorough training and supervision of the participants (Danielsen *et al.* 2009, Gofman 2010, Luzar *et al.* 2011). It is a challenge, however, that community monitoring can superficially appear low-tech and therefore primitive in a high-tech world. There remains a huge unexplored potential for strengthening monitoring efforts across the Arctic by engaging more communities and encouraging linkages with scientific monitoring programs (Huntington 2008). Often, an investment to build capacity to collect, interpret and manage data are central to maximizing such monitoring efforts (Gofman 2010).

19.4.3.3. Challenges

As the CBM record evolves and demonstrates continued improvement of accessible information on Arctic biodiversity, it is anticipated that there will be a delay between information production and use, accessibility and integration. In northwestern Canada and northeastern Alaska, for example, the reporting by the Arctic Borderlands Ecological Knowledge Co-op of CBM data on population health and body condition of the Porcupine caribou herd were largely dismissed and undervalued in favor of scientific models projecting substantive population declines (Gofman 2010, Russell *et al.* in press). Moreover, such projected declines prompted government and decision makers to push for and build harvest regimes that limited northern residents' ability to harvest. Indeed in 2012, several years after the CBM results were released, scientific population surveys revealed record numbers of caribou actually existed. In this case, CBM would have limited harvest concerns and supported improved access to northern food. However, the combination of the potential for conflict of interest and the lack of demonstrable validation capacity may have contributed to placing limited value on the information from this source.

Such examples suggest that efforts to emphasize analysis and integration between the two knowledge production approaches should continue. Indeed, more recent biodiversity monitoring planning processes are proposing ways of integrating and coordinating the methods for knowledge co-production (Gofman 2010, Vongraven *et al.* in press). Indeed, the Circumpolar Biodiversity Monitoring Program's (CBMP) strategy for bridging some of the structural challenges over the next few years includes improving the access to CBM data via improved provision of and access to metadata, modeling and demonstrating integration examples of CBM with scientific monitoring processes (Gill *et al.* 2011, Culp *et al.* 2013 in press).

19.4.3.4. Contributions to biodiversity monitoring

Full participation in biodiversity monitoring programs continues to be a challenge for many Arctic peoples. Greenland's effort to increase involvement of CBM with management provides one of the success stories becoming more common in the Arctic. The Greenland government is piloting a natural resource monitoring system whereby local people and local authority staff are directly involved in data collection, interpretation and resource management. The scheme is called *Piniakkanik sumiiffinni nalunaarsuineq* (Opening Doors to Native Knowledge). Four communities in Disko Bay and Umanak/Uummannaq Fjord are involved: Akunnaaq, Kitsissuarsuit, Qaarsut and Jakobshavn/Ilulissat.

As in other parts of the Arctic, the communities in Greenland are widely distributed over a vast territory, and the opportunities for environmental monitoring and for implementing hunting and fishing regulations on the ground are limited. It has long been a priority of the Greenland government to increase the involvement of local citizens in the decision-making process related to natural resources (Greenland Government 1999, Haaland *et al.* 2005). However, there is limited funding available for monitoring Greenland's resources, and many species and populations are thus monitored infrequently or not at all (Nielsen 2009). There is therefore insufficient knowledge available about some wildlife populations to guide government decision making and consequently a need to supplement the existing scientist-led monitoring programs with low-cost monitoring, for example through CBM.

The following are examples of how the influence and impact of the data are increasing when it comes to Arctic resource management. In each of the examples, local community observations were central to affecting changes to management regimes.

Conservation of marine habitat: In Akunnaaq, Greenland, the Natural Resource Committee (NRC) recorded trawlers fishing for shrimp in a shallow sea area adjacent to their village on a daily basis. There were 4-5 vessels almost every day throughout April and May 2010. This number was the same as in 2009 but higher than in previous years. Moreover, the vessels were larger and used heavier fishing gear. The NRC in Akunnaaq was worried that potential degradation of the seafloor might affect the breeding and production of Atlantic wolf-fish *Anarhichas lupus*. The NRC therefore proposed that the municipality should issue an ordinance to restrict the size of vessels in the area.

Influencing marine harvest techniques: One of the attributes recorded by Qaarsut NRC concerned their catch of Greenland halibut *Reinhardtius hippoglossoides* in Umanak Fjord. On the basis of their catch-and-effort data from long-line fishery, they estimated that the local Greenland halibut population was the same in May 2010 but higher in June-September 2010 than in the same months of 2009. Nevertheless, the NRC was concerned that many nets were being set over their longlines and that some nets were left at sea when the sea froze over. This resulted in many rotting fish, which attracted Greenland sharks *Somniosus microcephalus*. The NRC therefore proposed that the municipality should issue an ordinance to restrict net fishing in Umanak/Uummannaq Fjord. The fisheries legislation in Greenland allows municipalities – subject to ministerial approval – to prohibit the use of certain vessels and equipment in specific areas (Greenland Government 1996).

Influencing goose harvest pressure: Members of the Qaarsut NRC have observed that, over the past decade, the population of Canada goose *Branta canadensis* has risen sharply. Canada goose may out-compete the threatened Greenland white-fronted goose *Anser albifrons flavirostris* (Boyd & Fox 2008 *versus* Raundrup *et al.* 2012). Hunting seasons in Greenland are decided by the Ministry of Fisheries, Hunting and Agriculture on the basis of advice from scientists and from public input during a hearing process. The current hunting season for Canada goose is 15 August to 15 October (Department of Fisheries, Hunting and Agriculture 2011). The NRC proposed that the municipality should suggest to the Ministry that the hunting season for Canada goose be extended, for example by two weeks, to help keep the population from expanding further. However, a recent study has not found such a competition between Canada geese and Greenland white-fronts during molt (Raundrup *et al.* 2012).

In all three examples, it is noteworthy that the proposals if implemented will benefit the people having put them forward. International experiences however suggest that CBM also often leads to people suggesting restrictions in their own take of resources (Danielsen *et al.* 2007). CBM encourages people to take a long term perspective on the use of resources through facilitating agreements at community and municipal level to increase or reduce the use of resources.

19.4.3.5. Future prospects

The Arctic environment is rapidly changing (e.g. Hinzman *et al.* 2005, CAFF 2010) and there is increasing pressure on its natural resources. There is therefore also an increased need for monitoring. To date, many examples exist of Arctic peoples describing the changes they witness related to climate, sea ice and especially to harvested wildlife species. There is a persistent need for more CBM that can detect change, interpret and integrate results, and lead to prompt decision-making to help tackle environmental challenges at operational levels of resource management (Huntington & Fox 2005, Danielsen *et al.* 2010).

Representatives of indigenous communities practice wildlife management guided by their indigenous knowledge, realizing that indigenous knowledge and western scientific knowledge are based on different knowledge generation systems or epistemologies (e.g. Agrawal 1995, Huntington *et al.* 2004). Through CBM, however, it may be possible to find a suitable means of cooperation and collaboration in which monitoring can be based on local observations and knowledge (Pulsifer *et al.* 2010, van der Velden 2010) and, at the same time, follow principles of data handling and data management in accordance with Western concepts of scientific accuracy (Yoccoz *et al.* 2001), which is what national government agencies and international conventions require. Several Arctic programs (including the CBMP) and Arctic peoples have already started to implement strategies to bridge this gap by building structures such as inventories and metadatabases to better access, use and integrate CBM knowledge in the arctic (e.g. Pulsifer *et al.* 2012).

In combination, the increased need for data and the necessity of promoting locally relevant knowledge and management actions suggest that there are substantial prospects in the coming decades for more CBM around the Arctic, and that such an increase will contribute to effective local conservation actions.

19.5. DISCUSSION AND CONCLUSIONS

The sections of this chapter have addressed a wide range of topics, quantitatively where possible and qualitatively otherwise. Evaluating the status and likely trends of disturbances, feedbacks, and conservation efforts is not easy (see Tab. 19.4). For example, an increase in the number of species listed as threatened or endangered may indicate greater commitment to species protection, or it may indicate a greater number of species at risk. More extensive habitat protection will benefit biodiversity, but what occurs outside of protected areas may ultimately be more important, since protected areas are unlikely to cover a majority of the Arctic.

Table 19.4. Trends in the five indicators considered in this chapter. Note that "increasing" may be regarded as positive or negative depending on the indicator.

Indicator	Trend	Notes
Disturbance	Increasing	Roads and industrial activity are expanding, creating more potential for disturbance
Feedbacks to ecosystems and climate	?	Positive feedbacks, especially to climate, are exacerbating feedbacks from the Arctic to the globe
Habitat protection	Increasing	Parks and protected areas are more numerous, but additional designations may become harder; marine protection is nearly absent
Species protection	Increasing	Protective measures are increasing, but perhaps reflecting more species in need of protection
Conservation through community involvement	Increasing	Interest in this approach is growing, though the creation of new programs is slow

Community involvement offers a number of clear benefits, but should not replace national and other monitoring and conservation efforts, since community practices may not always be consistent with the protection of biodiversity (see Huntington, Chapter 18). Disturbance is equally clearly a negative outcome of human-ecosystem interactions, though the causes vary from industrial exploitation of petroleum and minerals, heavy grazing and trampling, and the impacts of climate change. Determining how to address disturbance is thus not always straightforward, especially where large financial interests are at stake. The potential for climate feedbacks to magnify warming trends is worrisome, pointing to the need for global action to address threats with global causes. Action within the Arctic will not always be sufficient to conserve Arctic biodiversity.

To monitor trends in these indicators of human actions that affect biodiversity, a set of quantitative indicators should be developed. Other types of disturbance, feedbacks and conservation measures should also be considered. Noise and chemical pollution, including ocean acidification, may disturb the metabolism or behavior of many animals. The Arctic hydrological cycle, including the potential for sea level rise from melting of ice caps, has feedbacks to the global climate system, and the well-being of migratory species depends on the interrelationship of Arctic conditions with conditions elsewhere in the annual journeys of those species. Conservation outside of protected areas, the regulation of fishing and hunting, human population growth and the rate of consumption of non-renewable resources are all relevant to the success of biodiversity conservation generally.

Tracking all potential indicators is not possible, but a robust set of measures against which progress or decline can be monitored would greatly help in providing the public and policy makers with a means of assessing whether Arctic communities, Arctic countries and the world as a whole are contributing to the conservation of Arctic biodiversity or the opposite. Without timely and unambiguous measures of performance, uncertainty will provide an excuse for inaction or for accepting greater levels of risk than are consistent with a commitment to protecting the future of Arctic ecosystems and those who use them.

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