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Adaptive Co-Management for Climate Change Adaptation: Considerations for the Barents Region

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Abstract: Adaptive co-management is a governance approach gaining recognition. It emphasizes pluralism and communication; shared decision-making and authority; linkages within and among levels; actor autonomy; and, learning and adaptation. Adaptive co-management is just starting to be applied for climate change adaptation. In drawing upon adaptive co-management scholarship and a case in progress of application for climate change adaptation in Niagara, Canada, key considerations for the Barents Euro-Arctic Region are identified. Realistic expectations, sensitivity to context, and cultivating conditions for success are highlighted as key considerations for future efforts to implement adaptive co-management approaches in the Barents Region.

Keywords: adaptive co-management; Barents Region; climate change

1. Introduction

Considerable progress occurred at the close of the twentieth century in addressing some types of environmental challenges. Kettle [1] describes how considerable gains were made under first generation environmental governance policies in terms of challenges such as point source pollution impacting water courses and air quality. At the same time, many of the limitations of “command and control” approaches are being realized. Costs of enforcing compliance, increasing conflicts, and limited effectiveness in addressing complexity and uncertainty are persistent problems [1–3]. In short,

“now policymakers face a new and challenging set of issues: how to develop strategies for attacking new environmental problems, how to develop better strategies for solving the old ones, and how to do both in ways that are more efficient, less taxing, and engender less political opposition” ([1], p. back cover). Climate change is a prominent example of the “super wicked” type of problem now being confronted [4].

The management paradigm, based on the view that the world’s problems can be managed efficiently and objectively by experts using scientific methods, falls short in situations characterized with complexity, plural objectives and competing values [5]. Alternatively, a complex adaptive system or nature evolving perspective is gaining prominence [6]. This perspective emphasizes the coupling of social and ecological systems, system dynamics, non-linearity, and transformative changes which results in ‘surprises’, discontinuities, and emergence [7,8]. A reinvention of governance, the manner in which society is steered towards an end via deliberative intervention [9], is underway.

While past approaches to solving environmental dilemmas have stressed the role of government, governance encompasses “...the whole of public as well as private interactions taken to solve societal problems and create societal opportunities. It includes the formulation and application of principles guiding those interactions and care for institutions that enable them” ([10], p. 17). While the environmental governance literature can be nebulous [11], the main ideas of several existing models (e.g., state, market, community, cooperative management, etc) have been usefully organized [12,13]. Increasingly, there is a clear move away from conventional forms that emphasize the role of government and towards hybrid or boundary crossing forms [14,15]. Scholarship addressing climate change adaptation mirrors these developments. For example, van Nieuwaal *et al.* ([16], p. 8), argue that “dealing with climate adaptation not only demands a rethink of how we arrange our social-ecological or social-technical systems but also how we govern them”.

Climate change in the Barents Region poses both challenges and opportunities. Challenges to infrastructure with decreasing permafrost, difficult sea conditions for shipping and off-shore oil installations are a few of the concerns raised [17]. Rottem and Moe [17] observe that opportunities may be realized by oil and gas industry, with a greater exploration area and longer season; the fisheries industry, with greater fish stocks, and the tourism industry, with a longer ice-free tourism season. However, it is likely that others will bear the cost of these opportunities. For example, reindeer husbandry in the region is highly dependent upon grazing land and calving grounds—these vital ranges will likely be lost along with biodiversity from oil and gas development [18]. While Forbes’ *et al.* [19] assessment of the Yama-Nenets social-ecological systems found high resilience, they note that climate change, infrastructure development, degradation of water, and influx of workers are looming threats. Nilsson *et al.* [20] provide a recent synopsis of the challenges to adaptation from global climate change in the Barents Region and highlight five adaptive strategies. Diverse adaptation efforts are expected at multiple levels by a range of actors [21]. The governance of climate change adaptation is thus an emerging issue of tremendous importance to the Region [21,22].

This paper came about as the result of a request to consider adaptive co-management in the context of climate change and governance in the Barents Region, and to identify key considerations for incorporating adaptive co-management for climate change adaptation. It was undertaken in the form of a desktop study and presented at the Northern Political Economy Symposium 2011: Climate Change in the Barents Region (CLIM-BEAR) in 2011. The paper is structured as follows: the concept of adaptive

co-management is succinctly set forth and an example of its implementation in the Niagara Region of Canada as an approach to address climate change adaptation is given. The Barents Region is described and, drawing upon scholarship and the Niagara example, key considerations for potentially transferring adaptive co-management for climate change adaptation in that context are probed.

2. Adaptive Co-management: An Overview

Adaptive co-management (also known as adaptive collaborative management) was initially developed in relation to an indicators and assessment project at the Centre for International Forestry Research (CIFOR) in the late 1990s as well as by a North American group of scholars looking to bring together co-management and complex systems thinking in early 2000 [23]. It brings together two well established traditions in natural resources management—collaborative management and adaptive management. Synergies are realized from bringing together these approaches and a distinct approach is engendered that emphasizes linking actors (vertically and horizontally) across scales in a process of shared learning and capacity building [24]. Adaptive co-management is often defined as “a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, on-going, self-organized process of learning by doing” ([6], p. 20, adopted by [23,25, 26]).

Scholarship and experiences with adaptive co-management have amassed quickly. In an effort to better understand the state of the field, Plummer *et al.* [27] undertook a systematic review of both the scholarly and applied literature from inception of the concept to May, 2010. Their review reveals an upward trend in the number of publications addressing adaptive co-management over the past decade and identifies some 108 items (*i.e.*, book chapters, journal articles, thesis, *etc.*). Their qualitative analysis to understand these studies found that adaptive co-management literature is: an amalgam of conceptual and applied scholarship, often involving case studies; most frequently examined in the location/socio-political context of North America, Europe and Asia; most often studied at a regional scale; and, most frequently considering resource or environmental aspects of forestry, fisheries and water resources.

It is helpful to recognize the attributes of adaptive co-management in unpacking the concept. Plummer and Fennell ([28], p. 154–155) build upon initial efforts to capture how adaptive co-management is being understood [23,25,29] to arrive at the following attributes.

- Pluralism and communication. Actors from diverse spheres of society (and at multiple levels) and who have varying principal interests enter into a process to generate shared understanding of an issue or problem. This process is grounded in communication and negotiation. Conflict is viewed as an opportunity.
- Shared decision-making and authority. Transactive decision-making is employed as a basis for achieving decisions. Multiple sources of knowledge are acknowledged. Authority (power) is shared in some configuration among the actors involved.
- Linkages, levels and autonomy. Actors are connected or linked both within levels (*i.e.*, a community) and across scales (*i.e.*, community, provincial, national). Despite shared interests and commitments, actor autonomy is appropriate at multiple levels. Institutional arrangements therefore encompass multiple levels as well as retain flexibility.

- Learning and adaptation. Actions and policies are considered experiments. Feedback provides opportunities for social learning in which outcomes are collectively reflected upon and modifications to future initiatives are based. Learning may concern routines, values and policies, and/or critical questions of the underlying governance systems; referred to as multiple-loop learning. Capacity to change and adapt develops as trust and knowledge accumulates in the collective social memory.

As signaled by the above definition and attributes, it is useful to understand adaptive co-management as a process [30,31]. Figure 1 illustrates the process of adaptive co-management. As an abstract representation, the process of adaptive co-management is divided into three specific stages. In the first stage, labeled inchoate, the actors have a mutual interest in the resource/environmental issue, but are separate and not interacting. In the second stage, labeled formulation, these actors come together and begin communicating and interacting. During this stage deliberation often begins about different perspectives and values associated with the landscape/environmental question under consideration. Learning occurs through the process of knowledge acquisition and information exchange. Factors prompting the transition between the formulation and the conjoint stages have been of particular interest with studies documenting the contributing factors of social capital and social learning [31]. In the conjoint phase the actors continue to interact and deliberate and undertake shared actions, reflect upon the results, and consequently modify their activities, values and governance approach. It is entrance into shared action and multiple loop learning that distinguishes the process as adaptive co-management. While Figure 1 conveys an abstraction of the process as a linear view, it is important to recognize that it is dynamic and ongoing.

Figure 1. A model of the adaptive co-management process, Adapted from [31,32].

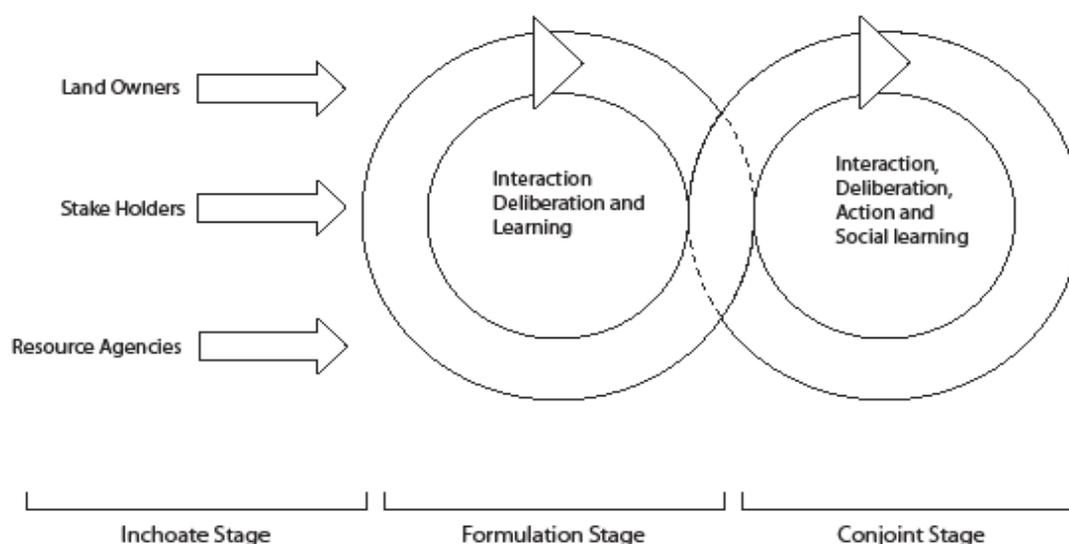


Figure: The Adaptive Co-Management Process

Moreover, adaptive co-management can be visualized as “a governance system involving networks of multiple heterogeneous actors across various scales which solve problems, make decisions and

initiate actions” ([33], p. 68, [24,34]). This association between adaptive co-management and governance is well established as the former is routinely regarded as a mechanism or hybrid form to the latter e.g., [29,35,36] and “good governance” is a characteristic of adaptive co-management e.g., [24,30,37]. This connection between environmental governance and adaptive co-management has received concerted attention recently as Huitema *et al.* [38] have employed the water governance literature to analyze the institutional prescriptions of adaptive co-management and Plummer *et al.* [39] have conducted a systematic review of how the adaptive co-management literature addresses the challenges of environmental governance.

Although the application of adaptive co-management is well established in resource sectors such as fisheries, forestry and wetlands, the possibility of adaptive co-management as a governance mechanism for climate change adaptation is nascent. The Centre for International Forestry Research [40] identifies the possible transferability of the concept in writing that “although climate change issues were just a faraway twinkle in the eyes of the original ACM researchers, the relevance of ACM results to climate change adaptation has become increasingly clear... ACM researchers have produced tools, methods and conceptual frameworks that can contribute significantly to efforts to adapt to climate change and perhaps to efforts to mitigate it” [40]. Particularly applicable to the Barents Region are applications of adaptive co-management to address environmental change in the Arctic. For example, Armitage *et al.* [41] describe institutional arrangements in the Canadian Arctic in terms of adaptive co-management and documents that “these arrangements provide emerging networks, or horizontal and vertical linkages that give rise to new social practices and stakeholder interactions, and thus a greater ability to cope with variability and build longer-term adaptive responses to minimize risk and uncertainty” ([41], p. 995). In the most specific application of ACM in regards to climate change adaptation to date, May and Plummer [42] conceptually argue that infusing the spirit of adaptive co-management (*i.e.*, collaboration and adaptation) into conventional risk management (e.g., CAN/ISO 31000) is aligned with emerging trends in climate change adaptation of participatory approaches, co-creation of knowledge, and multiple-loop learning. In so doing, they pioneer the approach of adaptive collaborative risk management and are applying it in the Niagara Region of Canada.

3. Adaptive Co-management and Climate Change in Niagara: An Example in Progress

The Niagara region is a unique social-ecological system in Canada. Surrounded by Lake Ontario, Lake Erie and the Niagara River, the 1863 square kilometer land mass is often referred to as the “Niagara Peninsula”. The area is famous for the Niagara Falls. The unique physical and ecological features of the Niagara Escarpment were recognized in 1990 with a UNESCO Biosphere Reserve designation. The area is home to approximately 425,000 people and government is administratively organized into 12 lower tier municipalities and Niagara Region. Manufacturing, agriculture and tourism are important sectors of the economy; the latter is often highlighted as 30 million people visit the area and are expected to spend \$2.3 billion [43].

Climate change is a concern in the region; a recent report outlined the challenges of climate change to the region with potential impacts to economically important sectors including agriculture and tourism, as well as shifts in demand and supply of water and power and increasing infrastructure demands [44]. The issue of climate change adaptation provided a window of opportunity to initiate an

adaptive co-management approach. The window of opportunity opened when a planner from Niagara Region who was charged with the task of developing a climate change adaptation plan requested a meeting with researchers at Brock University and Environment Canada who were conceptualizing the application of adaptive co-management to climate change. Recognizing that many individuals and organizations were active on the landscape, a social-ecological inventory was undertaken. A social-ecological inventory is a technique to identify active individuals/organizations, gain insights about their activities and values, understand the social-ecological system and “prime” it for engagement. A total of 38 individuals representing 33 organizations were interviewed to gain an enriched picture of the existing activities and network.

These individuals were then brought together in an interactive and learning oriented process facilitated by a research team member. Gaining knowledge about climate change projections and impacts, and learning about one another’s current efforts and interests related to climate change were identified as important first steps. In a series of four workshops, scenarios of climate changes were described and potential impacts of these changes were detailed. This information provided the basis for much discussion as the participants reflected upon the implications. Over the course of these workshops other information was shared with participants, including: initial results from the social-ecological inventory that identified the range of activities underway in relation to climate change in the region; information to supplement existing climate change knowledge, and guest speakers providing experiences with climate change adaptation from other places. Interaction among the participants increased as they engaged with this information and each other in person at the meetings as well as through an electronic portal, which served as a repository for all materials.

In time, and with several additional, less structured, general meetings the individuals began to coalesce and a group identity emerged with the name Niagara Climate Change Network. The group felt it was imperative to come to a shared understanding and expression of concern about climate change. A tremendous amount of effort was put into crafting a climate change charter which individuals and organizations could sign. The group also formed an administrative structure in the form of a steering committee to start taking action.

4. The Barents Region—Key Considerations for Applying Adaptive Co-Management for Climate Change Adaptive

The Barents Euro-Arctic Region includes 13 territories situated across the northernmost parts of Finland, Norway, Russia, and Sweden and encompassing 1.7 million square kilometers. The Region is rich in natural resources, including minerals, forests, and oil and gas deposits. Approximately 7% of the Region’s 5.3 million residents rely on hunting, fishing, reindeer herding, and forestry for their livelihoods [45]. There are anticipated impacts of climate change on many of these sectors and others, including tourism. Changing temperatures are likely to impact sea ice cover, sea levels, ocean currents and salinity, permafrost, and frequency and type of severe weather events. These impacts, and responses to these impacts by sectors that are interconnected, will have uncertain implications for some sectors in the Barents Region [46]. Also important to note is that the Barents Region cannot be considered in isolation; rather, climate change impacts and adaptation strategies employed elsewhere may also impact the Region [20]. A window of opportunity may exist for the Barents Region as

adaption at the regional scale is increasingly becoming an important part of policy discussions in the Arctic, and new research that draws upon vulnerability science and complex systems is emerging [46–49].

Armitage *et al.* observe that “... adaptive co-management represents a potentially important innovation in natural resource governance under conditions of change, uncertainty and complexity” [25]. While the lessons learned from this rapidly expanding body of scholarship and applied work are numerous; the following discussion focuses on three key considerations. These considerations offer touchstones for applying adaptive co-management for climate change adaptation in the Barents Region, as well as for others contemplating its broader transferability.

4.1. Have Realistic Expectations of Adaptive Co-Management.

Adaptive co-management is associated with considerable expectations of increasing the robustness of social-ecological systems [30] and orienting them toward sustainable trajectories [6]. It builds upon the largely positive expectations associated with co-management such as enhanced decision-making in terms of efficiency, effectiveness and equity; enhanced legitimization [50]; sharing power, linking organizations vertically and horizontally, reducing transactions costs, and resolving conflicts [34]. Of particular value for policy makers concerned with adaptation, adaptive co-management may enable learning through cooperative networks over the mid to long term; lower transaction costs over the long term; and, facilitate risk sharing [29].

At the same time, caution has been expressed about co-management and adaptive co-management. In regards to the former, Fennell *et al.* [33] summarize examples from the co-management literature where compliance has not increased and conflict worsened, failed to promote more equity or efficiency, and contributed to greater marginalization with reduced power sharing. Nadasdy [51] has strongly argued that if adaptive co-management and the ‘gospel of resilience’ are to be taken seriously the socio-political context in which they are embedded need to be critically questioned. In their investigation examining if adaptive co-management is ethical using the case of Cambodia, Fennell, Plummer and Marschke [33] found that “...adaptive co-management, without ethics, may simply be window dressing for well-established dilemmas of power and ultimately livelihoods”. Berkes [26] observes that learning does not always lead to adaptation. Finally, consideration of larger governance forces and system dynamics are required for small scale initiatives.

The latter point emphasizes the challenges adaptive co-management confronts in reference to multi-level governance. While adaptive co-management typically concentrates on the local or regional level and emphasizes linkages to actors both horizontally and vertically, it may be overcome by international forces. Changing policy requirements under the European Union for slaughter facilities is a good example in the Barents Region of how governance processes at larger scales may cascade to lower scales as reindeer herders now need to either travel further or ship their reindeer. Another example is that of the isolated Pomors fishing villages on the Western coast of the White Sea, where local sustainable fishing practices have been jeopardized by federal laws aimed at promoting industrial fishing and increasing tourism in the region [52]. Consideration of scale and interdependence is thus of particular importance in the Barents Region.

The systematic review by Plummer *et al.* [27] confirmed the presence of a diverse range of real and possible outcomes from adaptive co-management and that it may or may not lead to success. The

Niagara case offers an illustrative example of some initial collaborative outcomes from a nascent adaptive co-management process, however the longer-term adaptation outcomes are not yet known. It is important when undertaking adaptive co-management to recognize that it "...is not a governance panacea and will not be appropriate in all places" [29].

4.2. Tailor Adaptive Co-Management to the Particular Context to Enhance Adaptability.

The potential of adaptive co-management to enhance social-ecological resilience makes it an attractive approach to apply in different places and circumstances. However, determining if adaptive co-management is appropriate in the Barents Region requires careful forethought. Ready-made governance formulas do not exist and approaches such as adaptive co-management need to be "... tailor-made to fit the contexts of particular cases" [25].

The issue of "fit" is of particular concern when transferring an approach such as adaptive co-management to different places and situations. The problem of fit contends "...that the effectiveness and the robustness of social institutions are functions of the fit between the institutions themselves and the biophysical and social domains in which they operate" (53, as cited in [54]). Plummer and Hashimoto [55] have thus argued that "situated thinking" is required when transferring adaptive co-management and have illustrated how different it can be uniquely manifest in different places using the examples of a recreational fishery in Canada and a Shell fishery in Japan. The specific activities to implement adaptive co-management in the Niagara case, therefore, will be unique to that region; however, the processes for identifying 'fit' may be transferable.

An appropriate starting point is to carefully think about the Barents Region as a setting for adaptive co-management. More specifically, attention should be directed at the attributes of the problem (resource) and social context as well as its embeddedness [56]. As Honadle [56] observes, "the centrality of a resource to the local lifestyle can either complicate or simplify efforts at policy change". Reindeer herding in the Barents Region illustrates deep embeddedness, with high degrees of dependence (materially and psychologically) and fluidity. Furberg *et al.* describe the relationship between traditional reindeer herding groups and their livelihoods as "a tightly intertwined human-environmental system in which indigenous people interact closely with an ecosystem upon which they depend for their way of life" [57]. In the context of a changing climate, reindeer herders expressed worry over dissonance between traditional knowledge and changing conditions, and mental stress and despair about the future for the next generations and the potential loss of a way of life [57]. Consideration of such interdependence is thus of particular importance in the Barents Region.

4.3. Concentrate on Conditions for Success.

While it has been repeatedly stressed that adaptive co-management is not a governance panacea, there is a considerable opportunity to increase the likelihood of 'success' with adaptive co-management in the Barents Region by learning from existing scholarship and experiences with adaptive co-management. Table 1 summarizes ten conditions for successful adaptive co-management. These conditions were arrived at by Armitage *et al.* [29] through their analysis of case-based evidenced. They note that variation should be anticipated in these conditions depending on the particular system. However, these conditions should be present to some degree. Building upon existing

institutions and approaches and cultivating these conditions are important considerations in the Barents Region.

Table 1. Ten conditions for successful adaptive co-management (adapted from [29]).

Condition	Explanation
1. A resource system which is well defined	Resource systems with a moderately immobile stock of resources are less likely to cause institutional conflicts and challenges, and more likely to create an environment which enables learning.
2. Focusing on small-scale resource use	Smaller-scale systems reduce the amount of competition, institutional challenges, and organisation layers, whereas larger-scale resource contexts often worsen challenges.
3. Clear and recognizable social entities with common interests	It is difficult to build linkages and trust with stakeholders when they have a narrow conception of “place”. Non-local economic and/or political powers often undermine efforts by local/regional organisations to attain higher quality outcomes.
4. Resources of concern should have well-defined and reasonable property rights	Long-term learning and innovation in governance are better facilitated when clear rights, incentives, and improved access security are present. Additionally, these rights must be directly tied to stakeholder responsibilities.
5. Stakeholder access to adaptable tools and measures for management	Stakeholders participating in ACM processes need to have the ability to test and apply a wide range of management tools and measures (including regulations, licensing and quota setting, education schemes, <i>etc.</i>) in order that they may achieve their desired outcomes.
6. Long-term commitment supporting institution-building processes	Acceptance of the long-term nature of institution-building processes by stakeholders increases the likelihood of success. Long-term commitment has the potential to provide stability during periods of major change and stresses that arise within or outside of the system.
7. Resources, capacity building, and facilitation of training for stakeholders at all levels	It is difficult to possess all the resources needed for ACM. Locally, stakeholders need resources to facilitate collaboration and share decision making powers. Regionally and nationally, stakeholders also need the proper resources to be successful.
8. Key individuals (leaders) who are ready to champion the process	Key individuals are necessary to keep a collaboration focus, and create learning and reflection opportunities. Additionally, individuals with a long-term connection are often better at conflict resolution.
9. Participants who are willing to share and draw upon different knowledge sources and systems	All knowledge types should be included in problem identification, analysis, and solution. Emphasis is usually placed on the differences in knowledge systems; however, the opposite should occur in order to be successful. Contributions by different knowledge types (<i>i.e.</i> , formal, expert, and non-expert knowledge) should be acknowledged and valued by all stakeholders.
10. Explicit support of collaborative management efforts by national and regional policy	Support from all different levels of stakeholders enhances success. Support can be in the form of different levels of government desiring to work together, and diffusing functions and responsibilities across levels. Consistent support across these levels, and encouragement to devolve power to local actors also enhances success.

5. Conclusions

Opportunities and challenges will emerge from climate change in the Barents Region. Responses that realize the former and minimize the latter are highly desirable and it is anticipated that approaches stressing cooperation and adaptation will be key. Finding approaches sensitive to the special context of this area and its people as well as fitting institutions to ecological systems is critical.

This paper advances adaptive co-management as a possible governance approach for climate change adaptation in the Barents Region. The general concept of adaptive co-management was set forth, an example of how this approach has been applied in the Niagara Region of Canada was described, and some key considerations prior to undertaking such an approach were highlighted. In regards to the latter, the application of adaptive co-management will be enhanced with forethought given to having realistic expectations, sensitivity about the situation/fit, and emphasizing conditions for success. Future efforts towards research and practice may use these key considerations as touchstones for applying adaptive co-management for climate change adaptation in the Barents Region.

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Conflict of Interest

The authors declare no conflict of interest.

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