Statement for the 2018 Arctic Observing Summit

A collaborative, community-based Arctic observing network to address coastal exposure to climate risks in Alaska's North Slope

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Acknowledging that knowledge about cost-effective methods for collaborative decision support research is incomplete (e.g. DeLorme et al. 2016), documenting stakeholder interaction to provide a window into the decision support research process (e.g. Lathrop et al. 2012, 2014, 2017; Stephens et al. 2015; DeLorme et al. 2016; DeLorme et al. 2017) and analyzing the process in terms of likeliness of decision support outcomes (e.g. Ford et al. 2013; Wall et al. 2017) is the state-of-the-art. Applying effective stakeholder interaction design with local Arctic communities including the semi-directive interview (cf. Huntington 1998), Brady's recent doctoral research was an effort to link local communities in Alaska's North Slope to the Arctic observing network (AON) via a coastal exposure to climate risk web map developed in collaboration with the North Slope Borough and its residents (Brady 2018; NSF # 1523191). The research was a "bottom-up," ecosystem services approach to AON design (cf. Eicken et al. 2009, 2016a; ADI 2012) that included community mapping workshops with subsistence hunters and other stakeholders to identify coastal exposure risks using hard copy maps, and a web map usability workshop with North Slope land use managers. Figure 1 below illustrates the sustained collaborative research design to evaluate stakeholder exposure risk priorities and usability perceptions. The dissertation identified links to the AON by comparing the collaborative web map research process and product to AON design approaches (cf. ADI 2012), U.S. federal observing activities (cf. Jeffries et al. 2007), and AON societal benefit areas (cf. IDA 2017). In addition to identifying coastal places needing environmental monitoring to support sustainable subsistence and industrial land uses, the collaborative research process and product have the potential to link local community stakeholders and land use decision makers to the AON via the North Slope Borough's official land use web map. The next step in this sustained collaborative research is to share the current findings with the AON research community to begin to establish the local community-AON link in practice.

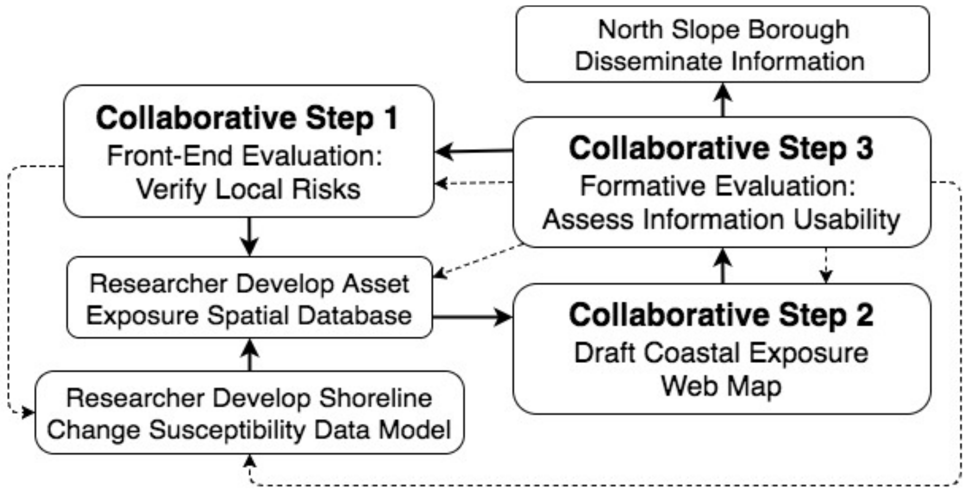

Figure 1. Collaborative Coastal Exposure Web Map Research Process (Brady 2018)
The research design included three collaborative research steps, two non-collaborative research tasks before Step 2, and one North Slope Borough non-collaborative information dissemination task after Step 3.The solid arrows indicate the direction of successive research steps, which are in an infinite loop, and dotted arrows indicate feedback direction from study participants during evaluation steps 1 and 3. Each collaborative step was designed with attention to effective participatory methods. The dissertation analyzed the web map research process and product to identify links to the Arctic observing network.

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IMPACT ASSESSMENT ON A LONG-TERM INVESTMENT ON ARCTIC OBSERVATIONS (IMOBAR)

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Abstract
The goal of IMOBAR is to provide to policy makers with evidence to support long-term investments in Arctic observing systems and thereby inform the decision-making process. The main output of IMOBAR will be an evaluation of the costs and societal benefits of Arctic observing systems by analysing the value chain of a selected number of essential variables.

Introduction
During the last decades Arctic observation and monitoring programmes and EU funded initiatives have underpinned our improved understanding of the Arctic environment. On the other hand, due to the complexity of the interactions and difficulties in observing remote areas, our understanding of the Arctic system and its interaction with the rest of the globe is incomplete.

The observational systems (OS) deployed in the Arctic, together with the contribution from Arctic communities, help to measure elements, such as snow, permafrost, sea-ice, glaciers, fisheries and contaminants. Each of the observations and their related OS are used to produce multiple products and services that contribute to the prevention of disasters, the improvement of natural resources management or the sustainability of biodiversity.

Investments to sustain Arctic observing systems should be justified by stakeholder needs and the costs of investments can be compared with the societal benefits arising from the provision of environmental observations.

IMOBAR addresses these challenges through a systematic analysis and the assessment of benefits and co-benefits of Arctic observations, compared to investment and management costs. It provides elements of a "business case" for sustaining in the long-term Arctic observations, to support the decision-making process. IMOBAR is a collaboration between the Joint Research Centre (JRC) and the Directorate General for Research and Innovation (DG RTD). It also involves external expertise in estimating the societal benefits from observing systems.

The results of the impact assessment study will be published and presented to the next Arctic Science Ministerial that will be co-hosted by the European Commission, Finland and Germany on 25-26 October 2018 in Berlin. The report will promote and justify ongoing and future investments in observational systems in the Arctic.

Methodology
The study builds on existing initiatives and studies aiming at identifying key Arctic change variables and research or operational activities. In particular, IMOBAR leverages relevant EU funded projects from the 7th Framework Programme and Horizon 2020 as

well as major international initiatives such as Sustaining Arctic Observing Networks (SAON). The study uses the value tree framework methodology, proposed by the Science and Technology Policy Institute, which links in a structured way the assessment and evaluation of the qualitative benefits across a set of Arctic Societal Benefit Areas deriving from specific observational data streams and systems[1].

In practice, IMOBAR employs a mix of desk research and expert elicitation. Desk research constitutes a sound starting point and a fundamental basis in order to understand the current regarding what type of observational systems exist within the Arctic territory, what are the variables they are measuring, what type of data they collect, what type of services and products do they offer to the society, how are they financed and what are their costs.

A two-day workshop was held in Brussels on 21-22 November 2017 in close collaboration with JRC and DG RTD, bringing together experts on observations, Arctic stakeholders and users of Arctic observations. The outcome of the workshop provided a list of emerging sectors foreseen to benefit from Arctic observations in next 20 years and matrices of observational data streams, systems and societal benefit areas, for existing and emerging sectors that should be priorities in the quantitative analysis of costs and benefits.

Based on the output of the workshop, a set of key activities that may benefit from the observational network have been selected and their observational impacts will be estimated in greater detail, also by performing monetary evaluation of benefits.

The results will be published in a report evaluating observing system costs and societal benefits.

Conclusions

Costs of observing systems in the Arctic are estimated using information from observational providers, by adjusting global and regional estimates from other studies or by multiplying costs of single observational platforms by the number of observations in the Arctic. The analysis addresses parameters necessary for the short and medium term forecasting and long-term monitoring of environmental modification due to climate change, considering local, regional and global dimensions. The analysis of benefits concentrates on a representative subset of activities in the Arctic. In particular, products and services related to permafrost, sea ice, sea level rise, biodiversity and the human dimension are analysed in order to evaluate tangible and non-tangible societal benefits arising from observational systems supporting those activities.

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Pikialasorsuaq Commission: People of the Ice-Bridge
Inuit Led Monitoring of the Pikialasorsuaq

Observations in the Arctic serve many purposes, from understanding unique Arctic ecosystems to modelling change to predict the future and inform decision making. Inuit knowledge is based on long time observations of Inuit Nunaat (homeland) to better understand the environment and anticipate change. Inuit have the longest temporal and spatial monitoring records in the Arctic and much of this is contained in the oral histories and emerging and evolving Inuit knowledge.

Why is the Pikialasorsuaq Important?

Shared by Canada and Greenland, this is the world's largest Arctic polynya (an area of year-round open water). The Pikialasorsuaq is an Arctic oasis and the most biologically productive region north of the Arctic Circle, providing critical habitat for migratory species (e.g. seabirds, narwhal, arctic cod, and seals) that Inuit depend on.

The polynya is formed by an ice bridge, connecting Ellesmere Island to Northwest Greenland that served as a migration corridor for humans for thousands of years. The northern ice bridge has become less reliable – in warmer years, the polynya fills with ice and, now, does not always form in critical winter months. The consequences of these changes, linked to larger climatic shifts observable in many parts of the Arctic, are not known. And, no management structures or policies presently exist for Inuit and international management of this region.

What is Being Done?

The Pikialasorsuaq Commission was established in 2016 to conduct consultations as to how and when Inuit have travelled and occupied the area, what resources they have harvested and how they would like to protect and manage it into the future given the increased activity through the area. Led by ICC Chair, Okalik Eegeesiak (the International Commissioner); former Nunavut Premier, Eva Aariak (Canadian Commissioner); and, former Greenland Premier, Kuupik Kleist (Greenland Commissioner). People of the Ice Bridge: The Future of the Pikialasorsuaq makes three recommendations:

1. Establish a **management regime led by Inuit representatives** from communities in the Pikialasorsuaq region.

2. In consultation with communities adjacent to the Pikialasorsuaq, **identify a protected area comprised of the polynya itself and a larger management zone** that reflects the connection between communities, their natural resources and the polynya. These areas would be monitored and managed by Inuit in agreement with all parties and formally recognized by governments.

3. **Establish a free travel zone** for Inuit across the Pikialasorsuaq region.

The Next Steps.

The Commission is undertaking ongoing engagement with Inuit to listen to how they want to manage the future of the Pikialasorsuaq and what each organization and community's respective roles should be. Diplomatic efforts by Canada with Denmark and Greenland are underway to discuss instruments, such as the Boundary Waters Treaty and the International Joint Commission, to achieve the recommended objectives.

The Commission is working on the next steps towards the establishment of a marine indigenous protected area, an "Inuit Management Authority". The Pikialasorsuaq itself is approximately 85000 km^2 and is integral to a much broader ecosystem including Talurutiup Imanga (Lancaster Sound) and Melville Bay.

Coordination of research and monitoring efforts are also continuing with scientific partners. Scientific interest in the North Water is very high with significant research investments by Canadian and European institutions. A workshop in May 2018 will consider the visions of key partners of the Commission recommendations.

Community-based monitoring infrastructures for pan-Arctic observing: Policy-regulatory, technological, social, and economic dimensions

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Introduction:

This statement draws on contributions from community-based and community-led monitoring (CBM/CLM)[1] practitioners during workshops held in Fairbanks, Alaska, (May 2017; Fidel et al. 2017) and Québec City (December 2017; report forthcoming) that were supported by and contributed to the Integrated Arctic Observing System (INTAROS; see also AOS statement by Stein Sandven). Participants represented twenty North American CBM programs and several participants from Europe also contributed based on their experience with Arctic CBM programs.

Rapid environmental and social change and the need for development, risk management, and diversified and robust local and regional economies in the Arctic form the backdrop for Arctic community engagement in CBM. There is a sense of "urgency to the situation, a climate crisis" (Fairbanks workshop – henceforth "FB"), and a need to understand, document and communicate changes that are occurring to improve decision-making.

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[1]Without attempting to offer a catch-all definition, CBM programs are monitoring programs based in communities with significant community involvement; CBL programs are community-initiated and led. We use CBM to refer to both types of programs in this statement.

The value of CBM to Arctic residents is greater when they are meaningfully engaged in the entire process from program design to implementation, interpretation, and use of observations (Quebec workshop – henceforth "QC"). Robust engagement increases the likelihood that monitoring will respond to local information needs (e.g., "Is my food safe to eat?") and/or monitor something of cultural or economic value to communities (FB & QC). The latter often benefit from contributions by Indigenous knowledge holders based on an alignment with their values and activities. Programs that monitor health, status, trends, migration, and other attributes of animal and plant populations, particularly populations with a high subsistence or economic value, fall in this category. CBM programs that focus on social, cultural, and human health monitoring, although less visible within the Arctic observing community, are also important to communities (FB & QC). Such programs may collect information, for example, about Indigenous language learning and transmission or the frequency and quality of land-based experience as one determinant of human health and well-being (QC).

Workshop participants discussed several topics relevant to the "business case" theme of AOS 2018, including sustainability, contributions of CBM programs to decision-making, and challenges and opportunities for data management and networking of CBM programs. Below, we introduce discussion points that emerge from four "infrastructures" underlying successful CBM programs: policy/regulatory, technological, social, and economic dimensions.

(1) Policy-regulatory: How can the Arctic observing community support development of adaptive governance mechanisms that utilize CBM data and information in a timely manner?

"The gap between information and action needs to be shortened. Information is needed to make choices; information needs to be in the hands of people who are adapting" (FB).

Governance systems play a significant role in shaping the form and function of CBM programs (Wilson et al. 2018). For information generated through CBM programs to have a greater social impact, there needs to be an uptake by decision-making bodies at relevant scales, which may include local, regional, national, or international scales (or multiple scales, depending on the focus of monitoring) (FB). This essential link between CBM and governance reflects the policy and regulatory infrastructure that underlies CBM.

Non-residents of the Arctic often decide science priorities used to inform policy, and therefore these priorities may not be aligned with community concerns and cannot inform local decision-making. (Well-functioning co-management boards are a notable exception, as they can provide institutional support for prioritizing community perspectives). Resource management agencies need to incorporate community observations into management decisions (FB). Use of CBM information by decision-makers will improve well-being, help sustain community interest and ensure that monitoring is meaningful for Arctic residents (FB & QC).

CBM can shorten the time from observation to decision in local decision-making (Berkes and Armitage 2010; Danielsen et al. 2010) and provides information for sustainable management adapted to local realities. Regulations pertaining to wildlife management, for example, are not able to keep up with the rapid environmental changes occurring across the Arctic (FB), including changes in species distribution (Pecl et al. 2017; Post et al. 2013). CBM programs that provide opportunity for interpretation by community members also enhance the quality of knowledge available for decision-making.

Our work indicates that policy and regulatory infrastructures need to adapt to shorten the time between observation and decision. This would facilitate rapid adjustments in quotas and other management tools to "real word" situations, as provided through CBM. A discussion to address this issue could encompass implications for income generation in small, rural communities or benefits for larger-scale sustainability planning and coordination at the pan-Arctic level, with the potential to significantly improve the "business case" for investments in monitoring.

(2) Technological: How can the Arctic observing community support coordination and networking of CBM data platforms?

"We need to take the relatively little information we have and pull it together to see the big picture." (FB)

We observe a flourishing of investment in and attention to technological infrastructure for CBM data. At QC, four programs described emerging platforms capable of storing and sharing CBM data at different scales (SIKU, SmartICE, eNuk, and the Mackenzie Data Stream). Two other initiatives, the Geomatics and Cartographic Research and Information Centre and the Exchange for Local Observations and Knowledge of the Arctic (ELOKA), adapt open source software to meet data and information management needs of community partners. The goals of all of these platforms differ – some are intended to be program specific, while others aim to host data contributed by diverse CBM programs. At QC, CBM programs agreed that additional coordination and networking would be beneficial to minimize the risk of effort duplication and to develop opportunities for cross-fertilization and interoperability between platforms.

Technology and Internet access remains uneven across the Arctic, with high levels of inequality in access persisting in many regions. Government investment in technological infrastructure needs to prioritize addressing these inequities. In addition, communities are increasingly concerned about maintaining control over and managing data at the local level, and are interested in developing capacity to host data through long-term local repositories. These community interests should be prioritized as part of technological infrastructure development for CBM.

We suggest a conversation at AOS about the need for greater coordination and networking among data platforms that host CBM data and how these systems are situated within the broader data ecosystem (Chandler et al. 2016). These infrastructures need to be able to support locally and regionally specific needs, diverse indicators, and ethics considerations that are determined by community members; they will therefore need to be highly flexible. While technology infrastructures are useful tools for data management, visualization, and sharing, we perceive a risk that these infrastructures may divert attention and funding away from the underlying CBM programs (Brammer et al. 2016). It may be useful to view technology as only one component of the infrastructures necessary for robust and effective Arctic observing systems, and to allocate resources accordingly.

(3) Social: How can the Arctic observing community better understand and support social learning and knowledge transmission that happens around CBM programs at the community level?

Research points to the important role of social learning (learning by social groups that results in changes at the group level) in supporting resilience in social-ecological systems (de Kraker 2017). Social learning can occur informally or can be supported more deliberately through design of formal learning opportunities. Within CBM programs, practitioners suggest that social systems for distribution of resources and information within communities play an important role facilitating use of observations locally. This might be considered part of the social infrastructure that underlies successful programs.

CBM programs build on and contribute to this social infrastructure in several ways. For example, programs may explicitly utilize popular knowledge transmission mechanisms, such as community radio, videos and Facebook (Mustonen et al. 2018). They may design data collection around activities that are already transpiring, such as routine hunting trips. Some CBM programs support opportunities for formal social learning through culture camps, elder-youth connection programs, training, and mentorship of youth to learn land- and sea-based skills. For example, the Western Beluga Health Monitoring Program in the Inuvialuit Settlement Region works with residents to collect samples at beluga harvest camps (QC). In this way, formal programs reinforce social values, such as language and Indigenous knowledge transmission (see also: Johnson 2016).

The informal and formal context of social learning as it occurs around CBM programs has yet to be studied, however (Funder et al. 2013). In addition, we are not aware of any studies done to evaluate the effectiveness of CBM programs from a community perspective. "North-North" exchanges between CBM practitioners from different communities or regions also promote social learning that can strengthen effectiveness of monitoring (Mustonen et al. 2018). We propose a discussion at the Arctic Observing Summit 2018 of the role of social learning in enhancing societal benefits of CBM programs, and of the ways that the Arctic observing community can support research on social learning.

(4) Economic: How can CBM contribute to community economic development?

A critical element of CBM program sustainability and impact is economic benefit for Arctic residents. Community-led economic development and diversification is a priority shared by many Arctic communities (Arctic Council 2016). In many cases, improved livelihoods, including economic development, is the motivation for becoming active in CBM programs. Employment opportunities from research may also contribute significantly to household economies in some Arctic communities (Carr et al. 2013). Some CBM programs employ coordinators and data collectors; motivation to participate can be at least somewhat influenced by compensation (FB & QC). Programs such as SmartICE are developing as social enterprises that regard research funding alone as unsustainable for long-term monitoring and instead are prioritizing building connections to and addressing the needs of the private sector with community knowledge and expertise, while at the same time fulfilling community information needs. Such an approach also builds the business case for the creation of professional monitoring positions based in Arctic communities.

We propose a discussion at AOS focused on ways to foster CBM contributions to community economic development. It would be helpful to collect examples of programs that do this well, and to identify innovations that could be tested. These might include: linking CBM to environmental and social certification processes for products such as fish, meat, fur, and handicrafts, or connecting CBM to tourism offerings, for example by enabling communities to engage tourists in observing and monitoring activities. Such innovations might further improve the "business case" for investments in monitoring.

Concluding comments: CBM infrastructures for a pan-Arctic observing system

The points introduced above represent diverse components of infrastructure, extending beyond science and technology, that underlie successful CBM programs. Many Arctic communities see the need for CBM programs that prioritize community information needs; these are diverse and encompass not only natural systems but also social, economic, policy, and regulatory systems, and the interactions of all of the above (see Pulsifer et al. 2011). Communities also see value in coordinating and contributing data and information at different scales, provided that infrastructure and capacity are in place to maintain local control over data, including data use to inform decisions. This requires investment in network building for CBM programs that begins by facilitating community-to-community linkages while also exploring other possible network formations. Additional networking could facilitate information sharing, promote utilization of CBM information in decision-making, and help avoid duplication of effort in technological development.

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The basin concept in arrangement of conditions of science-based life of Russian Arctic indigenous people.

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The article deals with the application of the basin concept for monitoring communities and the arrangement of conditions of science-based life of Russian Arctic Indigenous people. Accommodate Russian Arctic Indigenous people’s point of view there is the description of organization of science-based work in compilation of native languages hydronyms manual based on hydrographic zoning of the Russian Arctic in the article.

There are seventeen nationalities of indigenous people (Kharlampieva, 2017a) live in Arctic Ocean Basin of Russian Arctic (Arctic Zone of Russian Federation) and there are seven seas on the river network – White Sea, Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea and Bering Sea, the Ob (with the Irtysh), Lena, Yenisei (with the Small Yenisey), Kolyma, Olenek, Pechora, Indigirka, Khatanga (with Kotui), Anadyr and Northern Dvina, the 7 largest lakes - Taimyr, Khantayskoye, Imandra, Pyasino, Labaz, Umbozero, Lama (Atlas of the Arctic, 1982).

In the modern conditions of the arrangement of conditions of science-based life, the role of the indigenous peoples of the Russian Arctic is growing. In the modern conditions of arrangement of scientifically organized life, the role of the indigenous peoples of the Russian Arctic is growing. The application of the the basin concept (Kharlampieva, b 2017) in the arrangement of conditions of science-based life of the indigenous people of Russian Arctic is being considered in the scientific area of the AMAP (SWIPA, 2017) and in the territory of the hydrographic regionalization of the Russian Arctic (Ivanov, Tretyakov, 2015).

The essence of the basin concept in arrangement of conditions of science-based life of Russian Arctic indigenous people is based on knowledge of the history of the emergence of the name of water bodies and life in indigenous territories of indigenous peoples, surface water bodies, river transport systems, and the features of fresh and economic water.

The basin concept as the most understandable and close basis of Russian Arctic Indigenous people participation in theoretical and practical research has a large educational value for the dissemination of traditional and environmental knowledge. Its interdisciplinary nature, covering such disciplines as knowledge of native languages and linguistics, geography, biology, chemistry and hydrology, history, law and ethnography, informatics and cartography is supported and promoted by the scientific and methodological and practical seminar of the Department of Hydrology and Water resources of the AARI.

On the territory of the Arctic zone of the Russian Federation, there are 9 constituent entities of the Russian Federation and more than 110 municipal entities in four federal districts - the North-West, the Siberian, the Urals and the Far East.

In the interest of providing a sustainable monitoring system the role of Indigenous people of Russian Arctic Zone has one of the decisive factors.

In the network of complex development of the Russian Arctic discusses the concept of two directions of the basin concept in arrangement of conditions of science-based life of Russian Arctic indigenous people:

first of all the development of scientific and methodological support for the compilation of a directory of hydronyms in the language of indigenous peoples with a map and accompanying historical, geographical and other information (paper and electronic versions);

secondly studying the issues of training of secondary special education hydrologists in the centers of Russian Arctic Indigenous people residence.

The application of the interdisciplinary branch of science - hydronomy, as an element of toponymy and linguistics, which studies the names of water objects in the system of Arctic indigenous knowledge and hydrology - is the main idea of increased interest of Indigenous people of Russian Arctic (Walgamova et al., 2012). The dictionary of hydronyms is composed of carriers of Nenets, Khanty and Selkup languages by S.I. Valgamova, G.I. Vanuyto, S.I. Irikov, I.S. Hanko, N.M. Yangasova, which included a list of 3000 names of water bodies in their native languages. The names of water objects are included in the book of the Dolgan author AA. Barbolina (Barbolina, 2014).

The urgency of compiling the Directory of Indigenous Peoples of the Arctic is due to a decrease in the interest of indigenous youth in the study of their native language, frequent changes in the boundaries of administrative and territorial units (municipal and regional administrative regions), the emergence of conflicts between indigenous peoples and economic entities in the territories of the traditional type of economic management, causing environmental damage to water bodies in conditions of active economic activity in the mouths of the rivers of the Russian Arctic.

The interdisciplinary nature of the basin principle on the development of a scientific and methodological manual, the organization of work on the compilation of a directory on hydronyms of indigenous peoples of the Russian Arctic includes the general scientific methods of humanitarian (linguistic, ethnographic), public (historical, political and legal, international) and natural sciences (geographical, chemical).

The scientific and practical result will contribute to: the monitoring of water bodies in the Arctic Ocean basin using traditional knowledge of the indigenous peoples of the Russian Arctic; in the history of water areas for navigation and fisheries in the basins of relevant rivers, wetlands of international importance; in the prevention of problem-conflict situations in the allocation of resources and ecosystem services, including primarily water and fishery resources, as well as the burden on the ecosystems of Siberian rivers as a result of their upstream pollution; in the formation of ethical norms in defense of the interests of the indigenous peoples of the Russian Arctic in the field of water resources management in places of active economic activity.

Observance of ethical norms of behavior on compilation of the Directory of Hydronymes of Indigenous Peoples of the Russian Arctic requires compliance with three procedures:

- scientific and practical activities are carried out with the participation of a scientific or indigenous teacher in linguistics, geography, biology, geology, history, law, ecology and water use, hydrology, cartography,
- coordination with the official bodies of the indigenous peoples of the Russian Arctic on the organization of scientific and practical research activities in the territory of a compact residence and the route of conducting a traditional type of management,
- conclusion of a contract for assistance in ensuring the conduct of scientific and practical activities and the safety of researchers in the field.

Practical significance consists of: involving youth in compiling a directory of hydronyms for places of compact residence of indigenous peoples of the Russian Arctic, showing interest in scientific and practical activities to preserve the names of water bodies in their native language, drawing up the history of families living and leading a traditional type of farming in the islands, straits lagoons, bays, seaside, river mouths, large rivers and lakes, small water bodies; to the possession of technical skills in applying names of water bodies to maps and their digital preservation, as well as continuing to involve young people in the training of specialists in secondary specialties in hydrology, ecology and water use.

Moreover, the hydronomic map is the scheme of areas of compact residence of indigenous peoples of the Russian Arctic can be the basis for improving the regional innovation system of state and public control over the conduct of environmental monitoring of the Russian Arctic. Therefore, the scientifically-based organization of the life of the indigenous peoples of the Russian Arctic basin-wide contributes to a combination of public, state, commercial interests, not only in research and development, but also in the decision-making process.

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Arctic Observing Summit 2018

Statement on the Need for the Observing System: Societal Benefits – Long-Term Perspective delivered by EU-PolarNet

The SDGs and the Arctic: The need for polar indicators

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The SDGs and the Arctic: The need for polar indicators

Introduction

Our understanding of the Arctic rests to a great extent on the capacity to build long-term observations series. The overall aim of these scientifically based observations is to reach a sustainable development that counter-acts the troublesome future scenario we foresee today. While major drivers of climate change are found outside the Arctic, there is nevertheless a strong need also for the four million people that live in the Arctic to act responsible in order to create capacity for sustainable development. The UN Sustainable Development Goals (SDGs) offer an important framework for both guiding a sustainable development of the region, as well as for improving existing and developing new observation and monitoring systems for the Arctic. This allows an approach where the challenges, changes and the adaptation potential of societies and the ecological systems can be well monitored.

The 17 goals and 169 targets of the SDGs are set up as an integrated and indivisible concept to enable a global sustainable development (UN, 2015). They are unprecedented in scope and significance (ibid.), however, this global approach has also been criticised as being top-down and too focused on the belief that global problems can be solved on the level of governments and international organisations (Hajer et al., 2015). In order to be relevant to specific contexts, the goals and their targets would need to be scaled down from their global level (Burford et al., 2013).

This especially holds true when applying the SDGs to the Arctic. The SDGs have “not been produced with the Polar Regions in mind” (Sköld et al., 2018), which has led to discrepancies to how well the SDGs, their targets and indicators apply to the High North. Due to this mismatch, it is unlikely that pathways towards implementing the SDGs in the Arctic can effectively be assessed and tracked (ibid.). Sköld et al. (2018:3) thus states that ”[t]here is a dire need for a suite of polar indicators that allow us to cross-reference to the SDGs while having the tool to monitor change in the Polar Regions. Developing such a suite of polar indicators will necessarily inform work on a post-2030 development agenda." Further it is important to find the prerequisites that will enable UN member states to address sustainable development issues in their countries in a way that gives meaning to 'nationally owned development' (Adams, 2015:2).

SDG indicators and the need to put them into context

The 232 indicators of the SDGs can be regarded as a voluntary management tool to comprehend if sustainable development measures prove successful and if the SDGs are on track. While the UN (2017a) has acknowledged that the indicators need to be adjusted to local needs and priorities under involvement of stakeholders, the indicators are still criticized to be of little relevance to local communities (Simon et al., 2016; Sköld et al., 2018). In the Arctic for example, climate change especially affects indigenous peoples whose way of life, culture and identity are closely interwoven with the environment (Adger et al., 2012; Reid et al., 2014). Sustainable development indicators should also monitor the "invisible" losses and changes that are not directly measurable, but play an important role for individuals and communities, such as culture, self-determination and wellbeing (Wolf et al., 2013:549).

Already in the development of the Millennium Development Goals (MDGs), the forerunner of the SDGs, the UN Permanent Forum on Indigenous Issues (UN-PFII) raised its concern that none of the available indicators were appropriate to measure the process of the MDGs in the cultural context of indigenous peoples (UN-PFII, 2006; Burford et al., 2013). Sköld et al. (2018) also point out that in the current SDGs no single indicator focusses on cultural wellbeing or on the retention of ancestral languages. Further, the economic indicators do not pay account to the importance of mixed and subsistence economies, while migration related indicators (10.7.1 and 10.7.2) are not applicable to the rapid population and demographic shifts in the Arctic (ibid). Appropriate, context-relevant indicators are thus needed that integrate "all possible levels of the polar social-ecological systems (including the atmosphere, cryosphere, hydrosphere, biosphere and socio-cultural and politico-economic systems)" (Sköld et al., 2018:4).

Suggested strategy

This statement advocates developing a suite of polar indicators to assess the state of the social-ecological systems in the Arctic, and to create guidelines for sustainable monitoring and regular assessments that track the progress on pathways towards a sustainable development. This would improve disaster preparedness, the adaptive capacity of hard and soft infrastructures, address food, water and energy security, and sustainable economic development (Sköld et al., 2018).

Various efforts are already working towards this goal: The Arctic Council Sustainable Development Working Group for example proposed a suite of Arctic Social Indicators (ASI, 2014) and the US National Oceanic and Atmospheric Administration currently funds a project that looks into possibilities for defining relevant indicators that asses biophysical changes in the Arctic. These projects, however, represent fragmented and disconnected efforts. What is needed is a comprehensive and integrated suite of polar indicators, which includes (1) relevant elements from the biophysical, socio-cultural, and politico-economic environments, and (2) accounts for their often coupled nature (Sköld et al., 2018).

When selecting appropriate indicators, it is necessary to compare the amount of data already provided (and their potential use for assessing progress) with the cost of creating the necessary soft infrastructure to collect the relevant data. It is also essential to co-produce the indicators with scientific experts and stake- and right holders respectively and to validate their appropriateness with local communities in the Arctic (Sköld et al., 2018).

Furthermore, these indicators are only useful if the relevant information is collected on sustained, i.e. long-term, basis. This has been a problem for many small-scale research projects, as they typically do not concern themselves with a sustained collection of information beyond the project's duration. This was also a problem with the MDGs where 46% of the data needed were not available for reporting at the end of 2015, and the challenge is apparent for the present UNECE member countries to currently be able to produce data in support of SDG indicators (Road map, 2017).

The way forward

We can conclude that accurate and relevant indicators for the Arctic need to be developed and that sustained and feasible monitoring has to be ensured. This will enable us to observe changes in the complex polar social-ecological systems on a long-term basis and to develop meaningful sustainable development measures based on these observations (Sköld et al., 2018). “Unless, we commit to this [initiative] now, we will miss a unique opportunity to be prepared for the future in the Arctic, to build an informed post-2030 development agenda and to link the SDGs to developments and change in the Arctic region.” (Sköld et al., 2018:4). In developing relevant SDG indicators for the Arctic, we suggest the following steps:

- examination of the existing SDGs indicators' framework and seeing what indicators apply to the Arctic;
- examination of what other indicators for the Polar Regions have been used/proposed in social science projects (e.g. Arctic Social Indicators, Arctic Human Development Report, ECONOR); it would be equally essential to reach out to natural scientists and representatives of indigenous and local communities for their input;
- estimation of how much data is collected for the current indicators. Even if this data is stored in various forms, locations and institutions, such information could be a great starting point to show the present knowledge about Polar Social and Environmental Standards.

Finally, it is important to establish a relation to non-Arctic partners involved in implementing the Agenda 2030, and specifically the use of the SDG indicators. There is a lot to be learned from the work of others, both at regional and national levels, and vice versa the efforts in the Arctic can add significant value to the progress in other regions (a joint discussion has already been established with the Hindu Kush Himalaya Region). This efforts respond to the United Nations, which urges

- “international organizations to base the global review on data produced by national statistical systems and, if specific country data are not available for reliable estimation, to consult with concerned countries to produce and validate modelled estimates before publication”,
- “that communication and coordination among international organizations be enhanced in order to avoid duplicate reports, ensure consistency of data and reduce response burdens on countries”,
- “international organizations to provide the methodologies used to harmonize country data for international comparability and produce estimates through transparent mechanisms” (United Nations, 2017b:3).

Background

This statement is based on the EU-PolarNet White Paper: The Road to the Desired States of Social-Ecological Systems in the Polar Regions (Sköld et al., 2018), which was developed at the EU-PolarNet white paper workshop. The objective of the workshop, which took place in September 2017 in Spain, was to develop five white papers with topics of high interest to the European society. It brought together thoroughly chosen international polar experts including natural and social scientists, representatives of indigenous peoples and business representatives.

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Monitoring Arctic Sustainability: Reinvigorating International Efforts to Develop Arctic Sustainability Indicators.

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The Belmont Forum project *"ASUS: Arctic SUStainability: A Synthesis of Knowledge"* brings together an international team of experts from seven Arctic countries to develop an interdisciplinary synthesis and assess the state of knowledge about Arctic sustainability and sustainable development. A special domain of this ASUS project is "Monitoring of sustainability and sustainable development". The aim of this activity is to assess what has been already done in monitoring Arctic sustainability and sustainable development at different scales, what approaches and methods were implemented to delineate and monitor trends, both positive and negative on the way towards sustainability in the Arctic. The focus on creating knowledge infrastructure for multi-scale socially-oriented observations and assessments of Arctic socio-ecological systems sustainability and resilience in changing natural and living environments is of great importance. A design of the suitable monitoring frameworks of sustainable development and resilience of complex socio-ecological systems is one of the project's goals. In this case sustainable development should be viewed as both the *process* and as an *outcome*.

ASUS monitoring sustainability domain is built on existing knowledge infrastructure by linking with multiple research projects and networks including IPCC, U.S. (*Arctic-FROST*; *Arctic-COAST, NSF AON*); Canadian (*ReSDA, ArcticNet, CACCON*); Nordic (*ARCSUS*, *NCM Arctic Cooperation Programme*), and Russian (*IASOS*), as well as integrative Arctic Council projects (*ASI, AHDR, ARR, AMAP*).

ASUS has been working to synthesize knowledge pertaining to biophysical and social observations under an overarching umbrella of social-ecological monitoring. This transdisciplinary, integrated approach is best suited for understanding and managing coupled human-environmental systems. Many biogeophysical, social and integrative observation systems have been established in various Arctic regions under SAON and other long-term monitoring programs. However, attempts to assimilate social and biogeophysical monitoring frameworks with a focus on sustainability indicators are limited. We will develop principles for an integrated monitoring framework of sustainability indicators by combining existing physical, ecological and social observations and by completing methodological and substantive syntheses of these observations. We will consider data interoperability, accuracy and availability and develop strategies to enhance continuous observations and develop suitable frameworks for incorporating community-based monitoring.

One of the main results of the IPY was the start of the local and regional observing projects and networks. Several of them are focused on the land-based resources and social processes: Traditional Indigenous Land Use Areas in the Nenets Autonomous Okrug (*MODIL-NAO*), Circum-Arctic Rangifer Monitoring and Assessment Network (*CARMA*), Reindeer Herders Vulnerability Network Study (*EALAT*), and Monitoring the Human-Rangifer link (*NOMAD*). Some of them such as Sea Ice Knowledge and Use (*SIKU*), Exchange for Local Observations and Knowledge of the Arctic (*ELOKA*), and the Bering Sea Sub-Network (*BSSN*) are oriented toward the sea, ice, marine and coastal resources. The Community Adaptation and Vulnerability in Arctic Regions (*CAVIAR*) has a number of land-focused case studies of reindeer herding and terrestrial resource use, but also incorporates coastal fisheries and other marine resources. Nevertheless, most of these monitoring networks are concentrated on changes in different components of natural environment and their impacts on indigenous people and only few put primary attention to "socio-economic" factors impacting human capacities (health, demography, education, etc.) and well-being.

A substantial post-IPY progress in social monitoring human conditions resulted in a set of regional and circumpolar studies. We envision using the established indicators framework developed by the Arctic Social Indicators and IASOS projects. ASI indicators measure six domains: (1) Fate control and or the ability to guide one's own destiny; (2) Cultural Wellbeing and Cultural Integrity or belonging to a viable local culture;(3) Contact with nature or interacting closely with the natural world; (4) Material Well-being; (5) Education; (6) Health and Population.Integrated Arctic Socially Observation System (IASOS) network that is developing and practicing the methodology of socially-oriented observations (SOO) is putting main focus on quality of life, human and social capital development in the Arctic.

The Third International Conference on Arctic Research Planning (IASC, 2015) and the IASC/IASSA/Arctic-FROST/ASUS white paper on Arctic sustainability research (see Petrov et al., 2017) identified a number of key priorities for monitoring and understanding sustainability in the Arctic as both a process and an outcome. This study identified a number of priority research themes that respond to key gaps in knowledge, providing valuable and urgently needed contribution to theory and practice. These themes, as relevant to the observation and monitoring, include:

- Continued refinement of integrated sustainability indicators
- Examination of sustainable development as process: analyze success stories and failures, perform longitudinal analysis (both back and forward) of sustainable development
- Investigation of linkages between climate change and sustainable development
- Analysis of the role of institutions in sustainable development
- Examination of sustainable development in urban areas and relationships between rural and urban
- Further analysis of the role of resources, traditional and emerging economies (creative, arts, high tech) as factors and instruments of sustainable development
- Examination of role equity, agency, power and justice along key axes of difference in the Arctic – gender, age and identity.

The research directions advanced by the ASUS and its partners as a part of the ICARP III process have had a substantial follow-up manifested in the new or reinvigorated research activities and projects directly responding to the challenges and needs identified in the ASUS co-sponsored reports. These new efforts will significantly contribute to monitoring of sustainability and sustainable development in the Arctic in the near future.

Among the new monitoring initiatives of Arctic sustainability is the *Arctic Youth and Sustainable Futures* project (NCM). Engaging youth in monitoring Arctic sustainability is critical to explore youth perspectives on this process of establishing a set of sustainability indicators and scenario planning. Involving youth as co-observers and co-researchers in sustainability monitoring process ensures true participation of local young people in both identifying relevant issues and determining appropriate solutions. The project will result in a report to be presented to the Sustainable development Working Group of the Arctic Council.

Another important initiative is the international effort to develop sustainability indicators for Arctic cities under the *PIRE: Promoting Urban Sustainability in the Arctic* (NSF). This project brought together a group of scholars and educators from U.S. and Russia to work on a system of indicators of sustainable development designed to reflect special conditions in Arctic urban areas, especially in Russia. Several workshops have yielded an overall framework for assessing sustainability in urbanized communities, and the work will continue fort the next three years.

The Circum-Arctic Coastal Communities KnOwledge Network (CACCON) has been established to link together various coastal communities with on-going observations that include aspects of resilience, adaptation and sustainability. Coupling with other exiting projects, such as Arctic-COAST, ELOKA and Smart Ice, CACCON is building a community of scholars, community members and Indigenous knowledge holders to provide sustained and comprehensive observations of biogeophysical and social processes on the Arctic coast. CACCON operates as a distributed network of local (community or regional) knowledge centers exchanging information: data, technical capacity, adaptation strategies, or other types of knowledge within the community or with peer communities in the circumpolar north.

ASUS in cooperation with mentioned above initiatives may significantly add to Arctic observing and assessment processes, and will ultimately produce a list of indicators targeting current and near-term priorities for observing networks and systems. It will help to identify societally significant socio-economic environmental variables to improve the capacity of observational networks in the Arctic.

The data from key sustainability monitoring sites will help to identify main indicators for on-going observations at the local scale. Such network of key sustainability monitoring sites is now under discussion within the ASUS project. It is envisioned to include here such monitoring sites as: in Russia (Evenkia, Murmansk region, Yakutia and Chukotka); in the USA (North Slope and Bering Strait regions), in Greenland (Nuuk and Kujalleq), in Canada (Yukon, NWT and Nunatsiavut), and in Norway (Finnmark).

The synthesis of local and regional observation frameworks will be critical in developing the instruments for socially significant observations at the national. circumpolar and global scales.

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