

INTERACT guide for facilitating local adaptation to environmental change

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Photo: Kia Krarup Hansen, reindeer pasture analysis in Cherski, Republic of Sakha Yakutia, Russia.

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INTERACT Guide for Facilitating Local Adaptation to Environmental Change

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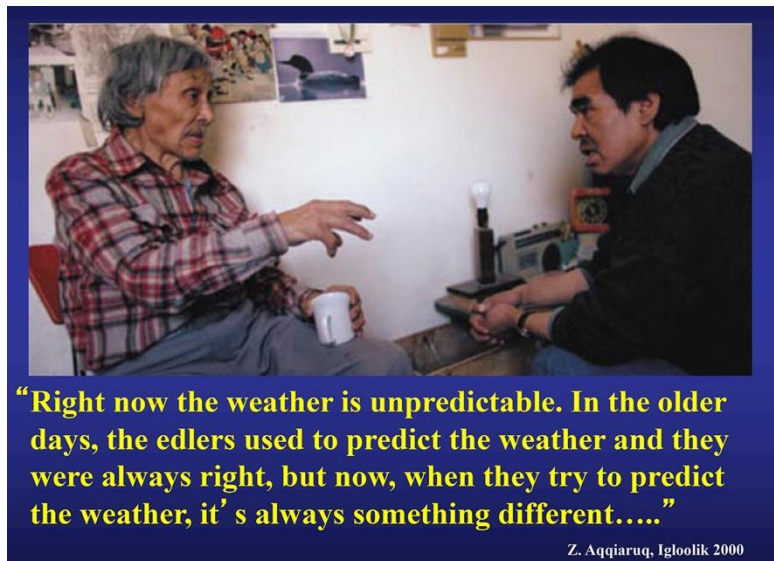
Picture by: Arctic Photos/ Tarja Länsman. In Gáldoaivi reindeer herding district, Northern Finland.

Front page picture by: Kia Krarup Hansen. Picture from EALÁT workshop in 2012 in Kolymskoe.

Publishable Executive Summary

Indigenous peoples in the circumpolar North are threatened by multiple environmental and social changes that affect the sustainability of traditional family-based nomadic use of natural resources. These impacts are exacerbated by indigenous peoples' lack of voice in governance strategies, research activities, management and adaptation responses. Indigenous reindeer herders have been facing increasing encroachments from other forms of land use, such as forestry, strictly protected areas and tourism, that change the vegetation. Added to these impacts are climate changes that will create challenges for reindeer herding in the future. *"...Remember, it is not us reindeer herders who have been the cause of climate change. The reindeer know what paths to take. Many people have lost their connection with nature, but the animals maintain this connection and that is why we follow the reindeer."* Senior reindeer herder Vassily Vassilievich Nomchaivyn of brigade nr 4 in Kanchalan, Chukotka AO EALAT Reindeer herders Vulnerability network study.

The aim of this work is to develop a guide for INTERACT research stations and indigenous and local communities to facilitate and strengthen cooperation on adaptation research related to Arctic change and integrated local observation systems. We aim to reinforce the cooperation through enhancing the mutual understanding of different knowledge systems and perspectives and to the best of our ability explain and increase the value of Indigenous knowledge. The main message will be that we need to work together.



Our work is based on the comparison and analyse of respective case studies and how the cooperation is implemented in case study locations but also in other locations where researchers and Indigenous peoples cooperate. These topics are discussed through the case studies and especially the local meetings where both sides have shared their experiences about the existing cooperation. We will raise some key concepts that are essential in development of the cooperation and making partnerships. We found out some well working examples of different types and levels of cooperation. There definitely will be room for improvement in the research stations and the cooperation models they have with the Indigenous peoples and local communities around. We for example found that some research topics are important for the research stations themselves are not exactly those that serve the Indigenous peoples, local communities and local livelihoods the best. Some types of cooperation are already implemented in respective locations and research stations but there could be so much more cooperation that would benefit the Indigenous peoples and local communities. What that could be? That is something that needs to be asked from the people themselves. Indigenous peoples need to be included in the processes from the beginning.

While the number of scientific articles about vegetation and snow change involving the three research stations are vast, they are lacking Indigenous peoples' traditional knowledge in the studies' design, data

collection or discussion. Furthermore, ethical guidelines, systems for including Indigenous knowledge and organized cooperation between reindeer herders and researchers are lacking at the Kevo station. Yet reindeer herders believe it is important to increase cooperation because the herders “have so much knowledge on the environment since they spend so much time out there.” Embracing “two ways of knowing and a co-production of knowledge” would ensure the needs of the local reindeer herders would be met. Such information and scientific knowledge are important for reindeer herders to adapt to on-going and future environmental changes.

Traditional knowledge is based on experience and is knowledge that is accumulated in people's memory and actions over multiple generation For example article 26 of the Declaration on Science and the Use of Scientific Knowledge in World Conference on Science (UNESCO 2000) states: *“that traditional and local knowledge systems, as dynamic expressions of perceiving and understanding the world, can make, and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge”*

Indigenous Peoples traditional knowledge is actually validated in the same way that scientific knowledge is found valid through trial and error. The mainstream community has today begun to demand the implementation of this traditional knowledge, and institutions such as the United Nations require and encourage that traditional knowledge be embedded into scientific research of the natural environment. We recommend all research stations to use Indigenous Peoples’ needs and traditional knowledge in the planning of their work, in the design, collection and validation of data used, and in the discussion of the main findings. It is almost impossible to try to cooperate and fulfill a research project together with the scientists and traditional knowledge holders such as reindeer herders who are in the front line of the climate change effects in their daily working life if both sides are not seated at the table and their knowledge through their voices is not heard.

This is a guide on how to manage cooperation between local communities and scientists and how to consider and respect the ethical considerations in co-production of knowledge.

1. Introduction

INTERACT is an infrastructure project under the auspices of SCANNET, a circumarctic network of currently 88 terrestrial field bases in northern Europe, Russia, US, Canada, Greenland, Iceland, the Faroe Islands and Scotland as well as stations in northern alpine areas. INTERACT specifically seeks to build capacity for research and monitoring in the European Arctic and beyond, and is offering access to numerous research stations through its *Transnational Access* program. This EU Horizon 2020 project has a main objective to build capacity for identifying, understanding, predicting and responding to diverse environmental changes throughout the wide environmental and land-use envelopes of the Arctic. This is necessary because the Arctic is so vast and so sparsely populated that environmental observing capacity is limited compared to most other latitudes.

International Centre for Reindeer Husbandry (ICR) is responsible for Work Package 9 in the INTERACT project, together with a range of partners. The main deliverable in the project is this guidebook. The overall aim for this book is to provide guidelines for cooperation between station managers, researchers and the local community. Increased dialogue between the research community and the local community in a two-way communication on equal terms, will lead to better mutual understanding and information sharing. The cooperation between the research stations and the local communities shall provide information on what is needed to adapt to changes and how to develop integrated local monitoring strategy. Our first chapter will introduce the reader to the main concepts and the thinking behind the work. Robert Corell, Karin Lochte and Michaela Stith will set the base to the guide with their articles. Chapter 2. *Recommendations for developing cooperation: The guidelines* will frame the guidelines through our recommendations to research entities working with the Indigenous peoples. In chapter 3. *Examples of cooperation models in Integrated observation systems* we have gathered some examples that we see as good examples of cooperation models in integrated observation systems. There will also be a chapter about SAON (Sustaining Arctic Observing Networks) by Jan Rene Larsen & Thorsteinn Gunnarsson.

In work package 9 there are three case studies located at:

- the Arctic station in Qeqertarsuaq in Disco Bay in Greenland together with Aarhus university lead the first case study about adapting to climate change and ensuring sustainable use of living resources
- the Kevo station in Northernmost Finland, research station owned by the university of Turku having ICR as a leading partner about adapting reindeer husbandry to vegetation change and snow cover changes
- the Kajbasovo Station in Siberia, Russia led by Tomsk State University with a focus on forestry, hunting and fishing tourism, agriculture and potential new land uses in a warmer climate.

More detailed description of the case studies in chapter 4. *Case studies of varying interactions between stations, people and decision makers*. These texts are from the case study reports. Chapter 5. *Making partnerships between research entities and Indigenous peoples and local communities* analyse the current cooperation models that the case study research stations have with the Indigenous communities and local people around. In chapter 6. *Adaptation and Responding to change* the focus is in the changes that the case studies have expressed. We end our work for the Lessons learned and raise some important aspects to take into account before concluding the whole guide “book” to our suggestions for the future.

In this project we have had a strong focus on Indigenous peoples who, in most of the case studies, are the local people around the research stations. Kevo research station is located in Utsjoki municipality where the majority of the local people are Sámi. In Qeqertarsuaq the majority are the Inuit. The Indigenous peoples in the Arctic have lived there for thousands of years. Managing to survive such harsh climatic conditions, and

managing to adapt to earlier changes is not done without a well-founded knowledge base within the people in the Arctic.

Traditional knowledge can be found in all indigenous communities, and it is knowledge created out of local living conditions and passes on from generation to generation (Nordin-Jonsson 2011). The Permanent participants in the Arctic Council have agreed on a working definition on Traditional knowledge “Traditional Knowledge is a systematic way of thinking and knowing that is elaborated and applied to phenomena across biological, physical, cultural and linguistic systems. Traditional knowledge is owned by the holders of that knowledge, often collectively, and is uniquely expressed and transmitted through indigenous languages. It is a body of knowledge generated through cultural practices, lived experience including extensive and multigenerational observations, lessons and skills. It has been developed and verified over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed from generation to generation” (Ottawa Traditional Knowledge Principles).

Traditional knowledge is often defined from the theoretical framework of Traditional ecological knowledge. *“a cumulative body of knowledge, practice and belief, evolving by adaptive process and handed down through generations by cultural transmissions, about the relationship of living beings (including humans) with one another and with the environment”* (Berkes et al. 2000: 1252).

There is a common feature within these definitions, that IK is transferred from one generation to another generation. IK is practical knowledge that is connected culturally and locally. Some aspects of traditional Sami reindeer herding knowledge can be held to correspond with scientific knowledge; others differ from it or go beyond the subject area with which western scientific knowledge has been occupied. However, all these aspects concern the siida members' efforts to continuously form and realize an acting siida. (Sara 2009)

The rapid changes in the Arctic puts an enormous pressure on the people living in the Arctic, and for the people to adapt and to build resilience to these changes, access to the best available knowledge for the local communities is needed. Indigenous Peoples with their indigenous knowledge have been able to adapt to changes and build robust and resilient societies in the Arctic. Indigenous peoples have managed to adapt to earlier climate changes, but now and in the future Arctic can experience more extreme climatic shifts and changes that are never experienced before. Globalization process is changing the Arctic, for instance the increasing development of extractive industries and increasing human activity. For the people in the Arctic communities to be able to adapt to changes, the communities need to be a part and benefit from the globalization processes.

1.1 International Network for Terrestrial Research and Monitoring in the Arctic *An Overview of Work Package 9 of the INTERACT's EU/EC Horizon 2020 Program*

Prof. Dr. Robert W. Corell

Adjunct Professor, University of Miami (US); Professor/II at the University of the Arctic and its International Centre for Reindeer Husbandry (Norway); Principal and Board of the Global Environment and Technology Foundation and its Lead at its Center for Energy and Climate Solutions (US); Board of Trustees Member, Bermuda Institute of Ocean Sciences (Bermuda) and Director and Co-Founder, The Rising Seas Institute (US)

The Challenges facing the INTERACT's Work Package 9: The Earth has entered an era of transformative change in which human actions have joined biogeophysical forces as drivers of change on local and global scales. The world of the future will differ markedly from the world humankind has known in recent decades. Global forces are generating far-reaching changes in the Arctic, which in turn, have intensified both the scale and pace of global changes. Efforts to address Arctic issues constructively must recognize these developments as a point of departure. Human actions on a global scale are increasing the complexity and volatility of the Earth's systems, which have unparalleled consequences for the circumpolar high north across a full range of economic, social and environmental issues in the Arctic region. *"The rapidly changing Arctic will have profound environmental, social, cultural, economic, and geopolitical effects that extend well beyond the region. Warmer temperatures and melting ice create rising seas and increasingly strong and unpredictable storms around the globe, and pose new ecological risks to local livelihoods. Less ice for longer periods each year brings the promise of new transportation routes and access to natural resources, but the opportunities do not come without challenges. This will mean more traffic in a region lacking infrastructure, environmental safety measures, and widespread search and rescue capabilities"*.

A Summary of INTERACT's Work Package 9 Program: The INTERACT's Work Package 9 (WP) Team focused on expanding and extending, both scientific and indigenous knowledge concerning the drivers that affect changes across the circumpolar Arctic regions and the way those changes profoundly affect, for example, the increases in the extremes of the northern hemisphere's weather, terrestrial and oceanic ecosystems of importance to societies, and the rising of the seas from glacial melting. Further, the Work Package 9 Team outlined and sought to frame programmatic strategies and operational actions that would enhance a deeper scientific understanding and more explicitly, the indigenous knowledge, for the laboratories and research centers in the INTERACT network. This was viewed as essential in order to provide key elements in a process that fosters a dialogue between local communities, researchers and INTERACT station managers that:

1. **Enabled** adaptation actions,
2. **Identified** the explicitly the data and information needed to implement adaptation actions and
3. **Supported** the development of an integrated data observations and monitoring system enables end-users to have access to high quality data that enable INTERACT's laboratories and research centers to provide important societal benefits.

More directly, the Work Package 9 Team's work plan focused on identifying those key elements of an integrated data and information observation system that would enable local communities, in concert with INTERACT laboratories and research centers, to more effectively respond to the environmental and socio-economic challenges of the present and those projected for the future, though participation in SAON and other Arctic-focused observational data and assessment venues. To facilitate implementing these issues, the WP9 Team focused on developing this *"Guide Book"*, designed specifically for the INTERACT research stations, the research station managers and their affected communities so that the INTERACT network can facilitate the use of the observations, data and information, in order to support the scientific and indigenous partners research and their programs. In order to support local communities in their efforts to develop

adaptation and coping practices that addresses the transformative change across the circumpolar the Arctic. Work Package 9 has been led by the International Centre for Reindeer Husbandry. The Work Package 9 Team has explicitly sought to engage more effectively with the INTERACT’s programs, particularly among the Arctic indigenous peoples and their communities.

The NEW ARCTIC Affecting INTERACT’s Research stations

The global scale of change and the role therein, suggest that a “*New Arctic*” is emerging which leads to new opportunities and challenges for “*Navigating this New Arctic*”. The interconnectedness of the Arctic and global interactions are increasingly nested in a global socio-economic and geopolitical framework where global issues affect the Arctic, and conversely, the Arctic is increasingly affecting the global earth system. In a context of “*Navigating this New Arctic*”, The over two do Arctic Ministers Science recently concluded that there are four themes which can provide the foundation for implementing the Arctic-Focused research, education and adaptation priorities. The second Arctic Science Ministerial (ASM2) took place in Berlin, Germany on the 25-26 October 2018. The main goal of the ASM2 is to further co-operation in arctic science, by addressing challenges and creating joint action (UARctic 2018).



The Ministerial focused on “*the full range of economic, social and environmental issues for the development of the Arctic region*”, where these four “*Points at Issue*” emerged:

- **The Changing Climate** is the transformative theme that interconnects the systems within the Arctic to Planet Earth.
- **Socio-Economic Changes** across the Arctic that have global-scale implications.
- **Geopolitical Realities, Governance Issues and Treaties** will increasingly have implications for Arctic and its global connectivity.
- **Environmental Change, Challenges Human Health and the Societal Well-being** across the Arctic and from drivers of change from with global environmental and socio-economic systems.

Further and more directly, the Arctic Science Ministerial concluded that by focusing on the following three major programmatic priorities, there is an increased potential to facilitate sustainable socio-economic development, environmental stewardship, and the health and well-being of indigenous and other residents of the Arctic region:

- **Arctic Observational Capabilities:** A commitment to strengthening, integrating and develop a sustaining Arctic observational capability and system,

- **Enhance Knowledge of Change:** An understanding the dynamics of the range of changes that impact the Arctic cultures and peoples, and
- **Building Adaptive Capacities:** To assess vulnerabilities, to increase the resilience of Arctic environments and societies and to develop effective adaptive capacities for the peoples of the Arctic region.

The Key Questions for the INTERACT’s Work Package 9: The Work Package 9 focused in questions such as: What are the essential research and assessment steps needed for the INTERACT’s Work Package 9 Team to expand and extend knowledge of the drivers that addresses change across the circumpolar Arctic regions? What frames programmatic strategies and operational actions that will develop a deeper scientific understanding, and more explicitly the indigenous knowledge of the Arctic region? What role is the essential role that the research stations within the INTERACT network that fosters a constructive dialogue between local communities, researchers and INTERACT station managers?

The Elements of Work Package 9:

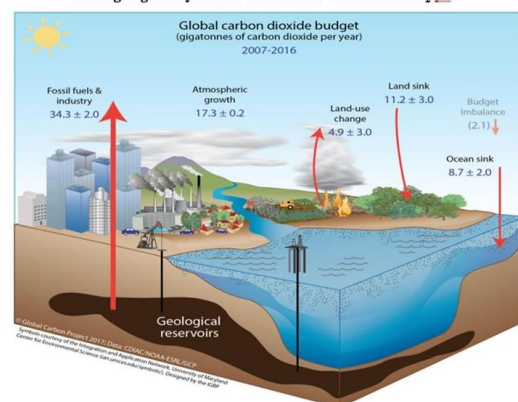
The programmatic elements that could help focus the results and adaptation strategies of the Working Package 9 Team are nested in these four “Points at Issue”. These emerged during both the Arctic Science Ministerial Meetings in 2016 and in 2018. They were enhanced by other studies and assessments. For example, the Arctic Council’s programs to address the needs and interest of Arctic inhabitants covers a wide array of foci, from mental and physical health and well-being, to sustainable development, local engagement, education, youth and gender equality. The four “Points at Issue” are:

1. **The Changing Climate**
2. **Socio-Economic Change**
3. **Geopolitical Realities, Governance Issues and Treaties**
4. **Environmental Change, Challenges Human Health and the Societal Well-being**

First: Addressing the Changing Climate Issues: There are three questions concerning changing climate that were central to the Work Package 9 Team, driven by the reality that changing climate is a transformative theme that interconnects systems within the Arctic to Planet Earth, including:

- **Natural and Human Process Interactions:** How have natural processes and human actions affected the global carbon cycle on land, in the atmosphere, in the ocean and ecosystems?
- **Socioeconomic Trends:** How have socioeconomic trends affected atmospheric levels of the primary carbon-containing gases, carbon dioxide (CO₂) and methane (CH₄), across the Arctic?
- **Climate Change Issues:** How have species, ecosystems, natural resources, and human systems been impacted by increasing greenhouse gas (GHG) concentrations, associated changes in climate, and carbon management decisions and practices, including drivers such as “Black Carbon” and “Arctic amplification” feedbacks?

Changes in the Global Carbon Cycle caused by Human Activities
Averaged globally for the decade 2007–2016 in GtCO₂/yr



Source: Global Carbon Project and from CDIAC, NOAA-ESRL, Le Quéré et al 2017, Global Carbon Budget 2017

Second: Addressing Socio-Economic Change Issues. There are new and transformative geopolitical issues and challenges that affect regional development, particularly from the increasing desire of nations to further develop Arctic natural resources: *“The development of natural resources in the rapidly changing Arctic that will have profound environmental, social, cultural, economic and geopolitical consequences that extend well beyond the rising temperatures and melting sea ice”* (See for example Stephen, K. 2018). The interconnectedness of the Arctic and global interactions of these increasingly nested global socio-economic and geopolitical realities makes these realities global that directly affects the Arctic. Conversely, the Arctic is increasingly changing the global earth system. The realities of the scale of these changes are such that there is a *“New Arctic”*. It is further nested in an emerging *“Global Knowledge Revolution”* (University World News 2014) that is already affecting economic, social and environmental changes of unprecedented importance to Arctic societies, business and governance and the need for enhanced scientific and indigenous knowledge.

Third: Addressing Geopolitical Realities, Governance Issues and Treaty Considerations.

Many territorial claims are still unresolved. The Arctic has become a highly dynamic socio-economic and interconnected ecological and governance system, with needs to understand more fully as there are new emerging unpredictable Arctic territorial claims that are also drivers of socio-economic and geopolitical change, including:

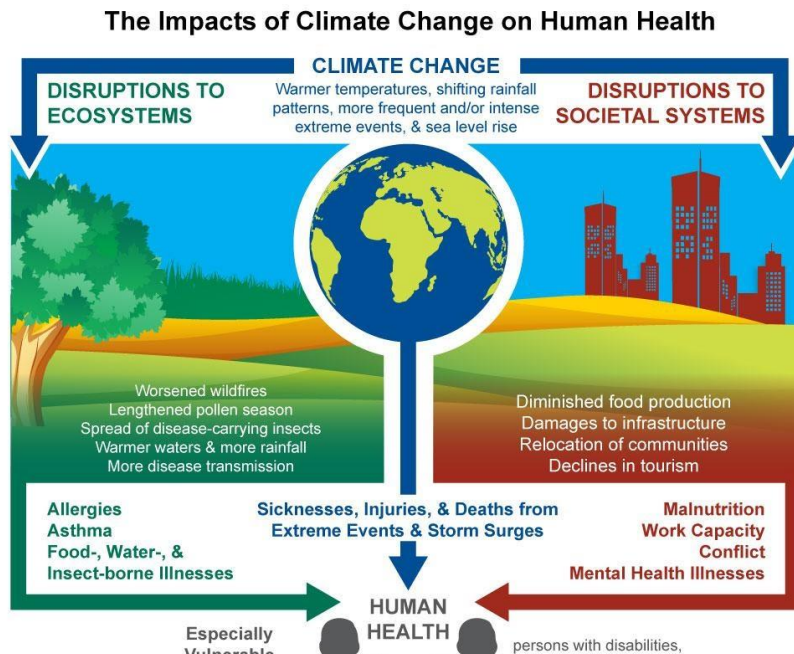
- **Stakeholders land claims are a profoundly important reality** for the indigenous cultures and peoples of the circumpolar Arctic:
- **Effective governance issues are emerging realities**, such as the international waters in the central Arctic Ocean:
- **New Arctic governance mechanisms will be essential** to effectively manage the regional and global Arctic governance challenges.

Addressing the Changes in these Three Sectors
These Interactions are the Challenge of the 21st Century



Fourth: Addressing Environmental Change, Challenges Human Health and Societal Well-being. Arctic ecosystems are undergoing rapid changes as a result of global climate change, with significant implications for the livelihoods of Arctic peoples. who live in a mixed economy based on various forms of income and widespread subsistence harvesting of fish and game, perceive and experience climate change as embedded among numerous other factors affecting subsistence patterns and practices. Changing lifestyles, decreasing interest by younger generations in pursuing subsistence livelihoods, and economic challenges are greatly affecting contemporary subsistence patterns and practices in rural Alaska. Observations of climate change are perceived, experienced, and articulated to researchers through a broader lens of these linked lifestyle and cultural shifts. Therefore, it can be argued that to properly assess and understand the impacts of climate change on the subsistence practices in Arctic communities, it is essential to consider the total environment

of change that is dramatically shaping the relationship between people, communities, and their surrounding environments.



The Key Components of the INTERACT’s Work Package 9

The preceding section is designed to provide a foundation that identifies those key elements of an integrated data and information observation system that will enable local communities, in concert with INTERACT laboratories and research centers, to more effectively respond to the environmental and socio-economic challenges of present and those projected for the future, including producing the Guide Book.

The foundational strategy to guide the development of the INTERACT Guide Book is founded on an *“evidence-based”* strategy that focuses on a *“use-inspired”* research and assessment program in the INTERACT centers and laboratories that is designed to contribute directly to a deepened understanding of the basic elements of the Earth System relevant in the Arctic and other reaches of the “High North”. Further and of substantial importance that the programs of the INTERACT research stations are designed to enhance and facilitate policy development, decision-making capabilities and well-being of the local communities and their cultures.

Therefore, the preceding section sought to outlines the key information deemed essential for the Work Package 9 work plan:

1. **Develop an INTERACT Guide Book:** The Guide Book designed for scientists, research station managers, insightful indigenous leaders and local communities that will enable them to develop a deeper mutual understanding of how to work together and facilitate the development of an integrated local scientific and indigenous knowledge observation system that focuses on the present and predicted local environmental change. The guide book will include a general section on key steps in the process for facilitating a dialogue between local indigenous communities, researchers and station managers that identifies strategies and practices to implement local adaptation actions. It

will be based on the essential information that is needed to adapt and how such actions can lead to integrated local research and education program that supports the observation, data and information monitoring strategy. It is intended that the INTERACT Guide Book will be used to develop, in a standardized format, the three Work Package 9 Case Studies, i.e., at the Arctic Station, West Greenland, the Kevo Station, Finland and the Kajbasovo Research Station, Siberia, Russia.

2. **Develop an Integrated Observation and Monitoring Strategy to Support Adaptation:** Adaptation requires a wide and diverse scientific and indigenous knowledge base derived from multiple players, from INTERACT research stations, local communities (including resource users, NGO's and local decision makers) and from other sources (satellites and other remote sensing systems, community-based observations, IPCC, Arctic Council and other national and international assessments), including focusing on:
 - a. **Identify current and projected environmental changes** perceived as important for developing present and future adaptation strategies.
 - b. **Observe, explain and predict changes** to the natural environment and the drivers of change.
 - c. **Scientific contributions are particularly important** for monitoring and research requiring specialized technology and analytical tools.
 - d. **Develop and implement integrated knowledge** pools and local observing systems feeding into local, national and regional decision-making structures, thus enabling adaptation to change.

An Aspirational Goal: The development of an integrated local observing system will enable communities to monitor how well the local communities have adapted and learn from and improve the database from which refined predictions can be made. Although each community will have specific adaptation needs and decision-making structures, each can learn about approaches from other communities.

Summary: The material outlined herein is designed to set the stage for Work Package 9's contribution to the overall goal of INTERACT to: *“Enhance an understanding of Arctic biogeophysical terrestrial system by enhancing the interactions between the observing and process-based communities and among various disciplines and domains”*. The internet and its many tools/apps provide an unprecedented power of observation and interpretation of changes in the Arctic environment and ecosystem services. Environmental governance has the potential to be significantly transformed by Smart Earth technologies, which deploy enhanced environmental monitoring via combinations of information and communication technologies (ICT), conventional monitoring technologies (e.g. remote sensing), and Internet of Things (IoT) applications (e.g. Environmental Sensor Networks (ESNs)). (Bakker & Ritts 2018.) It is in this context, that this work (WP9) is designed to improve the well-being of Arctic inhabitants and aiding the people and their cultures to adapt to local and global environmental changes. Most importantly, INTERACT through this EU/EC project will importantly entrain and provide an educational base for next generation of environmental scientists and indigenous partner experts to provide information to local and high-level regional organizations and decision-makers. The scale and complexity of the Arctic system will require international cooperation to identify, understand, predict and manage environmental change, an enabling capability of the INTERACT Network.

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1.2 Arctic Science Cooperation - The Outcome and the Consequences of the second Arctic Science Ministerial meeting

Prof. Dr. Karin Lochte

Vice-President of Scientific Committee on Antarctic Research, board member of the International Arctic Science Committee, Former Chair of the European Climate Research Alliance

A temperature rise of 1.5°C or 2°C globally means an average increase of 3-4°C in the Arctic, which can be even higher locally. This will make a dramatic difference to the Arctic and would speed up sea ice loss, melting of the Greenland Ice Sheet and thaw of permafrost regions. It is clear from the pace and scale of change that the Arctic requires our utmost attention. In fact, the Arctic is a warning for the rest of the world. In the face of these changes, we must act now. We require new ways to join forces for effectively planning, funding and implementing research. Moreover, we need to co-design the research with Arctic peoples in order to address the risks in the regions and develop adaptation strategies.

The first White House Arctic Science Ministerial in 2016 brought Arctic research concerns to the forefront of worldwide attention. It became clear that all nations must work together to confront and combat Arctic change by the best science available. The USA's initiative was taken up by the European Union and Germany, who held the second Arctic Science Ministerial (ASM2) in Berlin on 25th and 26th October 2018.

The Major Outcome of ASM2: At the ASM2, science ministers or secretaries of state of 30 countries, six Indigenous organizations, ten international organizations and 280 scientists came together with the aim to promote cooperation in Arctic science by addressing challenges and joint actions. It highlighted the need for a greater sense of urgency among decision-makers regarding the globally important changes taking place in the Arctic. The discussions concentrated on three major scientific themes that not only concern deterioration of the environment but also look at changes in society, economy and technology:

Theme 1. Strengthening, Integrating and Sustaining Arctic Observations, Facilitating Access to Arctic Data, and Sharing Arctic Research Infrastructure

Theme 2. Understanding Regional and Global Dynamics of Arctic Change

Theme 3. Assessing Vulnerability and Building Resilience of Arctic Environments and Societies

All participating scientists and politicians agreed that better Arctic observations were needed as we do not yet have the appropriate data to better understand and predict Arctic changes. Therefore, observing systems, including community-based observations, need to be improved and maintained on a long-term basis and require adequate and sustained financial support. First steps to develop strategic international observation and data frameworks are made by the Sustaining Arctic Observing Networks (SAON). As was shown by EU projects, SAON observations can provide the basis for large economic benefits (The second Arctic Science Ministerial 2018). It is important that Arctic observation systems are developed jointly with relevant stakeholders and rights-holders who embrace open data sharing. The vast and inhospitable regions of the Arctic also require new technologies for observations and improving the safety of people in remote settlements. Furthermore, new ways should be developed among countries and research institutions to share expensive infrastructure.

Understanding linkages between Arctic changes, mid-latitudes and the global climate system are critical as many millions of people world-wide are potentially impacted by sea level rise and extreme weather events.

Some large projects are already underway or are planned to improve the understanding of Arctic climate processes and narrow errors of predictions. In the MOSAiC flagship project, the research icebreaker Polarstern has overwintered in the central Arctic Ocean frozen in the sea ice to provide much needed winter data and improve understanding of physical and biological sea ice related processes. A similar flagship project is being planned for a terrestrial observation under the name of T-MOSAiC. As substantial ecosystem changes are happening, the adaptation potential of marine and terrestrial ecosystems must be understood. In this context, projects led by Indigenous scientists and supported by grants would help to highlight Indigenous knowledge in understanding regional Arctic changes and link it to international research.

A healthy environment is the basis for life in the Arctic, but the present changes are large and detrimental. Major issues are pollution mainly coming from mid-latitudes, food security, health and negative impacts from economic development. As some regions are more subject to negative developments than others, regional hot spots of risks need to be identified and protected. Also, areas of specific ecosystem value – like last ice areas that are retreats for arctic species – should become protected areas. Key components for sustainable development are education and capacity building. At ASM2, for instance, an international effort was suggested to set up an international mobility programme for young scientists to learn from different cultures. Furthermore, people outside the Arctic should learn about Arctic issues (Arctic literacy) as Arctic changes will have world-wide effects.

Details of the ASM2, the Joint Statement of Ministers, the Conference Report and the Scientific Forum that discussed the above themes can be viewed under <http://www.arcticsscienceministerial.org/en/>. In order to advance the many themes of the ASM2, a Forum of Arctic Science Funders was recommended by the Joint Statement of Ministers: *“We therefore recommend exploring the possible call of a forum of Arctic science funders to discuss strategies for supporting the research that is necessary to achieve the goals agreed at this Ministerial meeting.”* (Arctic Science Ministerial 2018.) This Forum is now starting to discuss how to underpin activities of common interest.

Consequences for future actions

It is of utmost importance to anticipate changes in the Arctic, their direction and dynamics, rather than just respond to them. It provides the basis for timely adaptations, both in the Arctic regions and outside. Already a great deal of research is carried out in the Arctic by many nations. Therefore, substantial progress can be achieved through improved international scientific cooperation including traditional knowledge and contributions from non-Arctic states. Better coordination of observation systems and data exchange, as discussed under Theme 1 of ASM2, is particularly needed. Suggestions for coordinated observing strategies were developed by SAON but, so far, implementation has been hampered by lack of sustained funding for the network and respective nations’ insufficient commitments to support internationally agreed observations long-term. However, some positive developments can be found in the Horizon 2020 call of the European Commission, “Supporting the implementation of GEOSS in the Arctic in collaboration with Copernicus.” The Forum of Arctic Science Funders’ ongoing discussions may also help to improve coordinated Arctic observations. It would be up to the scientific community to propose a well-balanced Arctic observation strategy initiative to the Arctic Science Funders.

Installation and operation of research infrastructures in the Arctic is expensive and cannot be afforded by many nations that wish to contribute their expertise. Some activities are now underway to open the use of Arctic infrastructures for external users. INTERACT offers access to many Arctic research stations and has built up a network of terrestrial field stations all around the Arctic. The possibility to work in field stations through the Transnational Access Programme not only offers excellent support for field work, but also deepens international collaboration. Moreover, the ARICE programme tries to provide Europe with better

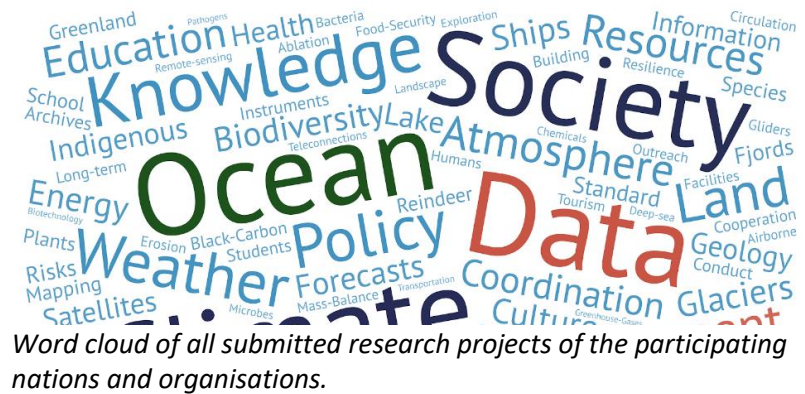
capacities for marine-based research in the ice-covered Arctic Ocean in order to establish an International Arctic Research Icebreaker Consortium that shares and jointly funds ship time for scientists from all nations. In the EU, approaches that provide access to research infrastructure for high-quality research projects and share the financial burden already exist, and these could be applied more widely. It does not cost much extra funding but would require a common agreement on procedures.

Development of novel technologies was only briefly touched upon in the ASM2, but it is obvious that progress depends largely on the type of technology. These range from new sensor systems for observatories to autonomous measuring systems, better satellite coverage of the Arctic regions, improved communication systems for remote settlements, telemedicine and environmentally friendly energy supply. Since only few customers use such systems, industry is reluctant to invest in development of new technology. Therefore, novel technologies must be supported by government funding. Scientists can be instrumental here by better aligning necessary engineering research internationally with the aim to speed up development of new technologies.

We know that the changes happening in the Arctic are massive and felt in the daily lives of Arctic peoples. They affect people's cultures and livelihoods. Societal and economic changes are sometimes more disruptive for local people than climate change. The equitable involvement of Indigenous knowledge from planning to implementation of research is needed for meaningful collaboration with international science. To bring different types of knowledge together and to address regional concerns, regional knowledge hubs for exchange of Indigenous knowledge and inclusion of Indigenous knowledge holders as first-class partners are suggested. Research plans led by local and Indigenous communities could be a focus of the Forum of Arctic Science Funders. This should also include support for Arctic peoples' capacity-building, science education and international exchange.

The initiatives and discussions of ASM2 will be continued in the third Arctic Science Ministerial (ASM3). The progress made by the international community since ASM2 will be assessed and new agreements will be forged. ASM3 will be held in Tokyo, Japan on the 21st and 22nd of November 2020 and will be co-hosted by Iceland.

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1.3 Defining Indigenous Peoples' Traditional Knowledge in the context of the Arctic Council

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Summary

Indigenous knowledge – often interchanged with “traditional knowledge” and mistakenly combined with “local knowledge” – is an intergenerationally exchanged, place-based, systemic way of knowing that emphasizes the ways Indigenous Peoples relate to other people and the environment. While traditional knowledge is an integral component of Indigenous knowledge, it has been attributed to non-Indigenous peoples and may only refer to inherited knowledge. The term “Indigenous knowledge” recognizes that Indigenous Peoples constantly produce and reform what they know (Johnson N. et al. 2016, 7).

Researchers recognize the importance of traditional and Indigenous knowledge in monitoring environmental change, but many researchers struggle to work with Indigenous knowledge-holders in a way that does not compare or incorporate Indigenous knowledge with science. This chapter aims to contextualize the definition of Indigenous knowledge for Arctic-based scientists and station-managers who may not be familiar with the concept.

Beyond this chapter, it is essential to work under the direction of Indigenous Peoples and institutions when dealing with Indigenous knowledge.

Attempts to define Indigenous Knowledge in the Arctic

The multitude of terms and definitions related to Indigenous and traditional knowledge causes confusion about the meaning behind the words. For the purposes of this chapter, it is important to highlight that Indigenous knowledge is 1) inherited, owned and generated by the holders of that knowledge and 2) place-based, varying depending on the setting. The context-specific characteristic of Indigenous knowledge necessitates that anyone wishing to engage with Indigenous knowledge should also be actively engaged with the Indigenous people who inherit, own and generate that knowledge in the region.

Various Arctic institutions have developed definitions for Indigenous and traditional knowledge. The only definition developed in an international, intercultural Arctic context is in the *Ottawa Principles on Traditional Knowledge*, developed by the six Permanent Participant organizations that represent Indigenous Peoples in the Arctic Council (the world’s leading intergovernmental forum for Arctic cooperation):

Traditional Knowledge is a systematic way of thinking and knowing that is elaborated and applied to phenomena across biological, physical, cultural and linguistic systems. Traditional Knowledge is owned by the holders of that knowledge, often collectively, and is uniquely expressed and transmitted through Indigenous languages. It is a body of knowledge generated through cultural practices, lived experiences including extensive and multigenerational observations, lessons and skills. It has been developed and verified over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation. (2015)

Since 2015, most Permanent Participants have taken an institutional standpoint preferring the term “Indigenous Knowledge” to “Traditional Knowledge.” This change seems to have begun in 2013, when the Arctic Council used the term “traditional and local knowledge (TLK)” in a Ministerial Declaration for the first time since its founding in 1996. The Arctic Council began to use “TLK” as its default term to “Support the use of consistent terminology regarding traditional and local knowledge throughout the work of the Arctic

Council” – a recommendation suggested by the Arctic Council’s Sustainable Development Working Group (2015).

Unfortunately, lumped terms like “traditional and local knowledge” or “local and Indigenous knowledge” unfairly equate Indigenous Peoples’ knowledge to knowledge that is 1) held by locals who are integrated into mainstream knowledge systems and 2) propagated by industrial associations, schools and other generally respected institutions. Some organizations even conflate traditional knowledge and local knowledge, attributing traditional knowledge to “local communities” (Arctic Centre, n.d.). Therefore, the Arctic Council began to use the term “traditional knowledge and local knowledge” (TKLK) in 2019.

In practice, many Permanent Participants define Indigenous Knowledge with the same wording agreed in the Ottawa Traditional Knowledge Principles; the terminology has shifted primarily to emphasize Indigenous Peoples’ ownership of their own knowledge systems.

Nuances in terminology and definitions

Different Indigenous institutions retain varying positions on the definitions and terminology. In its report “Application of Indigenous Knowledge in the Arctic Council,” Inuit Circumpolar Council offered this expanded definition:

[Indigenous knowledge] has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation. Under this definition, IK goes beyond observations and ecological knowledge, offering a unique ‘way of knowing’ to identify and apply to research needs which will ultimately inform decision makers.

Of course, Indigenous Peoples should retain the ability to coin their knowledge systems. The Saami Council, for example, prefers to use their own language to describe their way of knowing: “Árbediehtu.” Other Indigenous institutions prefer “Traditional Knowledge” because the term is more familiar to elders and emphasizes intergenerational, inherited knowledge.

Sometimes Indigenous Peoples themselves use the term “local knowledge” to refer to their knowledge systems, usually when most local people are Indigenous (as in Greenland). However, this choice should be distinguished from a non-Indigenous, institutional decision to use the term “local knowledge,” which may dilute Indigenous participation in knowledge co-production and other research activities.

Key elements of Indigenous Knowledge

Among Arctic Peoples, there are common pillars of agreement in the definition of Indigenous Knowledge. The following points were adapted from the resulting report of the UArctic Congress 2018 panel entitled “Education and training in the Arctic: Identifying education and training needs for Arctic Indigenous Peoples,” in which representatives from all Permanent Participants offered key elements of Indigenous knowledge.

Box 1. Panelists’ key elements of Indigenous knowledge (Arctic Council Indigenous Peoples’ Secretariat 2018)

- Indigenous knowledge is a systematic way of knowing.
- Indigenous knowledge is paramount to Indigenous world views; it emphasizes ways Indigenous peoples relate to other people and the environment.

- Indigenous knowledge is passed down through generations and relies on communication with elders.
- Indigenous knowledge is not static; Indigenous peoples are constantly producing and reforming Indigenous knowledge systems.
- Indigenous knowledge is place-based and varies depending on the setting.
- Indigenous knowledge holders experience a common fight to bring their world views and understanding back to their peoples.
- Indigenous knowledge is rooted in use of land but opposes conquest of land.
- The Permanent Participants referred to the holistic definition of traditional knowledge – which is integral to Indigenous knowledge – in the Ottawa Traditional Knowledge Principles.

Conclusion

Indigenous knowledge – often interchanged with “traditional knowledge” and mistakenly combined with “local knowledge” – is an intergenerationally exchanged, place-based, systemic way of knowing that emphasizes the ways Indigenous Peoples relate to other people and the environment. In the Arctic context, the Permanent Participants of the Arctic Council have been central to the development of an internationally accepted definition of Arctic Indigenous Peoples’ knowledge systems.

The difficulty in assigning one definition or term is that Indigenous knowledge systems constantly evolve around the location where that knowledge is held. Consider that over 500,000 Indigenous people live in the Arctic, comprising many different ethnicities and communicating in up to 80 languages – each of which is inherently linked to its own Indigenous knowledge system. Permanent Participants represent non-monolithic Peoples with varying perspectives on how their knowledge systems should be used, shared and communicated. Therefore, it is essential to work under the direction of Indigenous Peoples and institutions when dealing with Indigenous knowledge.

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2. Recommendations for developing cooperation – The guidelines

2.1 Recommendations for researchers, station managers, Indigenous peoples and local communities

Based on the overall work and findings of Work Package 9, the project team has developed the following recommendations (in no particular order):

- I. **Acknowledge** the continuing contribution of Indigenous peoples, local communities, and their knowledge systems to research in the Arctic.
- II. **Note** that without the inclusion of the knowledge of Indigenous peoples and local communities in the scientific process, there is a danger that conclusions are biased, and that society at large is bereft of the best available knowledge for decisions affecting all.
- III. **Acknowledge** positive contributions of science to Indigenous peoples and local communities, while also **note** that there is much potential for increasing mutually beneficial research cooperation.
- IV. **Underline** the need for sustainable science; that is, science that builds relevant knowledge and capacity locally for Indigenous peoples and local communities, as opposed to research driven merely by institutional agendas, economic pressures, individual career goals, or research shopping.
- V. **Recommend** that any research undertaken on, with, or concerning Indigenous peoples and local communities, and any collaboration with them, is based on the principles of Free, Prior and Informed Consent (FPIC), following the Nuremberg Code and the UN Declaration on the Rights of Indigenous Peoples.
- VI. **Welcome** a common Code of Ethics for research on, with and concerning Indigenous peoples, developed in partnership with Indigenous peoples and building on FPIC.
- VII. **Recommend** that some minimum requirements be established for research conducted in and around Indigenous peoples and local communities, or in other ways relating to them, such as competence training regarding FPIC, local languages, colonial histories, consequences of assimilation past and present, as well as relationship building, dialogue and co-production of knowledge within Indigenous and local communities.
- VIII. **Recommend** that research stations are ambitious in their levels of cooperation with Indigenous peoples and local communities; for example in co-production of knowledge, project conception, planning, design, research question formation, implementation, data collection and validation, analysis, discussion and conclusion drawing, as well as outreach. This type of cooperation should be inspired by best practices, actively engaging Indigenous peoples' traditional knowledge and languages, as well as local knowledge.
- IX. **Recommend** that Indigenous peoples' traditional knowledge be included on all levels where co-production of knowledge is used. Without Indigenous peoples' involvement in the development of research design and research questions, the conclusion might have been biased.
- X. **Recommend** research stations to hold consultations and include Indigenous peoples and local communities from the early phases of project development.
- XI. **Encourage** research stations to actively build contact with Indigenous peoples and local communities independent of currently ongoing research activities, and by various ways and means creating mutual understanding, in order to build long-term relationships that could subsequently be mobilized for research collaborations.
- XII. **Encourage** research stations, Indigenous peoples and local communities to experiment with different approaches and settings to get people to talk with each other.
- XIII. **Recommend** active involvement and encouragement of youth from Indigenous peoples and local communities.

- XIV. **Recommend** research stations to co-produce adaptation plans for environmental and climatic changes with Indigenous peoples and local communities that may advance the design of future integrated observation systems.
- XV. **Recommend** research stations, Indigenous peoples and local communities to work together to realize integrated observation systems, where local observations, traditional Indigenous knowledge and local knowledge is used in a co-production with scientific knowledge, in order to improve our holistic and common understanding of environmental change.
- XVI. **Recommend** that traditional Indigenous knowledge be offered more space in science; having both scientists and Indigenous knowledge holders – those living on the frontlines of environmental change – at the table is a prerequisite for real cooperation in research projects. Furthermore, this involvement of Indigenous peoples in the development of research design and research questions is necessary to avoid biased conclusions.



Reindeer herder with a heard in Gáldoavi, Ohcejohka. (Arctic Photos/Tarja Länsman).

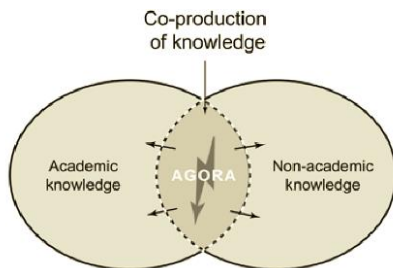
2.2 Co-production of knowledge

Co-production of knowledge – Build-up a guide/course for research in Arctic communities

In the rapidly changing Arctic, research is trying to understand and explain the global phenomena of climate change. This research also needs to be relevant for the local communities. The communities in the Arctic will experience rapid changes and those who will experience the most extreme changes will need access to the knowledge gathered about and around them, so that they can adapt to the rapid changes (Eira, 2012).

But how to involve the local communities in science, and how to inform these communities when the challenges they face are mostly caused by others? How to provide the information and knowledge to communities so they grasp the opportunities that arise from changes in the Arctic?

Co-production of knowledge will benefit local communities and the scientific community, and the end product will be sustainable science (Eira 2012). Local communities



involved in the production of knowledge can influence the methods design and research questions, making the research more relevant for the communities. Making more relevant and useful research should encourage scientists. Co-production of knowledge will also benefit scientists, as the scientific community could gain access to data that is not usually accessible. Another relevant factor is that co-production can provide different angles to approach issues and phenomena that contribute to robust results. The IASSA Principles

(1992) recommend that efforts should be made to incorporate local and traditional knowledge and experience, as well as to acknowledge the principle of cultural property.

Co-production of knowledge

Research that is relevant and benefits the local communities needs to involve the communities. This can be done through co-production of knowledge between the local communities and the scientific community (Eira *et al.*, 2013, Eira *et al.*, 2018). Co-production of knowledge is an activity related to the production of new or updated content through interaction/collaboration between two or more actors. It is a process where people intentionally try to collaborate to develop a more collective wisdom, which can become a basis for making the quality of life better. The parties or actors produce new knowledge together, on equal terms:

“We propose that co-production should be viewed as an exploratory space that brings together different values and social relations and a generative process that produces new interactions and forms of knowledge and that can lead in turn to meaningful ways of shaping and taking part in health care” (Filipe M. 2017).



Observing snow and ice. Photo: ICR

Co-production of knowledge is the production of knowledge happening in the sphere where the academic knowledge and other knowledge systems meet. Described in figure 1 (Phol *et al.* 2010). Another definition of co-production of knowledge is “simultaneous production of knowledge and social order” (Guston 2001: 401).

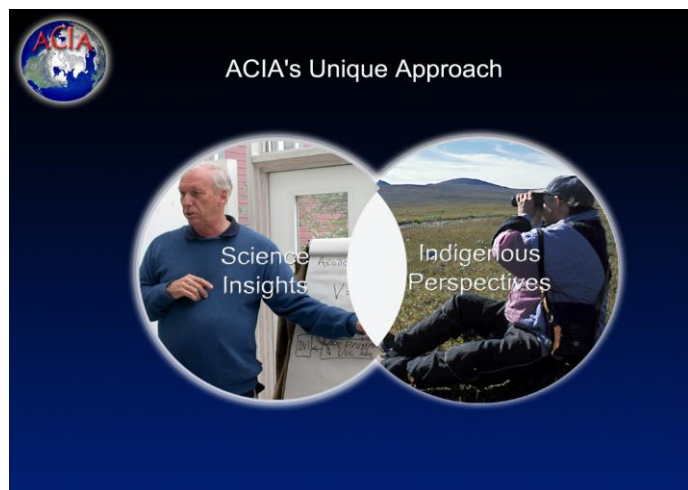
Co-production of knowledge processes need to address methodology, theory and use of the co-produced knowledge in practice.

“Sustainable development requires production of knowledge that strikes a balance between scientific and other forms of knowledge” (Pohl et. al. 2010: 267). The extraction and use of natural resources must be balanced with the integrity and stability of the natural system. Co-production of knowledge is a way to produce the best available knowledge.

Co-management is a related process in which authorities share power with communities and scientists, with each given specific rights and responsibilities relating to information and decision-making (OECD Glossary, 1998). Co-management builds adaptive capacity at multiple levels by fostering shared understanding, increased dialogue and interaction. Co-management provides emerging networks that give rise to new social practices and interactions, allowing greater ability to cope with variability and building longer term adaptive responses that minimize risk and uncertainty (Armitage et. al. 2011).

Why co-production of knowledge?

- So that they manage to adapt
- Manage to grasp the options given by these changes, but also handle the difficulties
- The knowledge is constructed and verified by people living in Arctic
- Better chance for use of the science
- Building capacity



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2.3 Current principles and international guidelines to cooperate with Indigenous peoples

The International Centre for Reindeer Husbandry (ICR) has its developed own Ethical Guidelines. According to the guidelines traditional knowledge has equal value to scientific knowledge. There it is also noted the need to develop additional guidelines tailored to each partnership: *“TK is more than a source of empire for researchers. TK carriers shall play a central part in shaping projects and shall be involved as equal partners in consultation and decision-making.”* This guideline supports the need to create such guidelines where the scientific community and local community meet, their knowledge plays an equal role and their cooperation can be developed. ICR will develop new guidelines regarding Arctic Indigenous peoples' food systems.

Considering the further development of the Arctic Science Cooperation Agreement (2017) and the outcome of the recent 2nd Arctic Science Ministerial Meeting in Berlin in fall 2018, there is a strong need for new guidelines outlining 1) how researchers should operate in Indigenous peoples' territories and 2) how cooperation between researchers and local communities can be developed.

Various other guidelines exist, such as: The Global Environment Facility, “Principles and Guidelines for Engagement with Indigenous peoples” (2012); United Nations Development Group, “Guidelines on Indigenous Peoples' Issues” (2009); UNESCO, “UNESCO Policy on Engaging with Indigenous Peoples” and “UNESCO's Engagement with Indigenous Peoples” (2018). A 2016 report from Parks Canada, *Working together with Indigenous Peoples: “PARKS” Guiding principles*, articulated in “Promising Pathways,” “to promote relationship building with Indigenous partners. These principles have since been adapted for use as an evaluation tool by Parks Canada team members and have replaced national indicators on Indigenous relations.” The Akwé: Kon Voluntary Guidelines provide a collaborative framework ensuring the full involvement of Indigenous and local communities assessing the cultural, environmental and social impacts of proposed developments on sacred sites, lands and waters traditionally occupied by Indigenous peoples and local communities (Secretariat of the Convention on Biological Diversity 2004).

All the research activity must be based on FPIC. It is a principle protected by international human rights standards that clearly acknowledge Indigenous peoples' right to self-determination, stating that “all peoples have the right to freely pursue their economic, social and cultural development.” The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), the Convention on Biological Diversity and the International Labour Organization Convention 169 (ILO 169) all uphold FPIC.

International recognition of Indigenous peoples' rights also helped the work on Indigenous ethical guidelines to move forward (Juutilainen 2017). For example, UNESCO's Universal Declaration on Bioethics and Human Rights' (2005) gave specific attention to Indigenous peoples' interests in research affecting them, as well as communities' roles in providing consent for such activities. UNDRIP also highlights Indigenous peoples' collective right to exercise control over expressions of their cultural heritage and intellectual property. Article 31 states, "Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences..." (UN 2007).

In Canada the processes of developing guidelines and protocols for ethical codes of conduct for researchers coming into their communities has been on-going for the last few decades since the early dialogue began with the rise of Indigenous resistance in the early 1970s (Juutilainen & Heikkilä 2016). Some examples of developments at the community level guiding the cooperation between the Indigenous community, researchers and academic institutions; to approve and monitor research conducted in Indigenous communities include: the Kahnawake Schools Diabetes Prevention Project which adopted the KSDPP Code of Research Ethics (KSDPP 1997), Principles and guidelines for researchers conducting research with Mi'kmaq people (Mi'kmaq Ethics Watch 2020), Six Nations of the Grand River policy and process for approving and monitoring research conducted in the community (Six Nations Ethics Committee 2015), the Inuit Tapiriit Kanatami "Negotiating Research Relationships with Inuit Communities (Inuit Tapiriit Kanatami 2007), "Ethics in First Nations Research" by the Assembly of First Nations (AFN 2009). "Ethical guidelines for research" by The Royal Commission on Aboriginal Peoples was the first national level government research project to develop ethical guidelines specific to Indigenous research (RCAP 1996). (Juutilainen & Heikkilä 2016.)

Canada seems to be a leading country in the work of creating and implementing guidelines for cooperating and working with Indigenous peoples. Take, for example, *Draft Principles that Guide the Province of British Columbia's Relationship with Indigenous Peoples*; Ontario Human Rights Commission's report "To Dream Together: Indigenous Peoples and Human Rights Dialogue Report" (2018); and Canada's Ministry of Health and Long-Term Care, *Relationship with Indigenous Communities Guideline* (2018). There is also clear guidance on the definitions and terminology of Indigenous Peoples in Canada; Indigenous Corporate Training Inc. created a new guidebook "Indigenous Peoples: A Guide to Terminology. Usage Tips and Definitions (2019)."

The most advanced aspects in Canadian context are the protocols for entering Indigenous communities and territories to conduct research. All research there requires licenses or ethical approval. Polar Knowledge has a *Checklist for Conducting Research in Canada's North: Conducting Traditional Knowledge Research in the Gwich'in Settlement Area - A Guide for Researchers* (2011). This work is led by Gwich'in Tribal Council and their traditional knowledge policy (Gwich'in Tribal Council, 2004). There are also research licenses for conducting research in both the Northwest Territories and Yukon. In comparison, there are no such protocols nor even checklists for researchers and students in Sápmi.

In the Canadian context, principles of ownership, control, access, and possession (OCAP), is self-determination applied to research. OCAP is a political response to persistent colonial approaches to research and information management (Snarch 2004). The principles of OCAP inform the development of national ethics policies in Canada and guide researchers working with First Nations, Inuit and Metis communities (CIHR 2007; Juutilainen 2017, 29). The RCAP and OCAP guidelines are widely known among Indigenous scholars and have served as important protocols for researchers working with Indigenous communities (Juutilainen & Heikkilä 2016).

The main principles for developing ethical guidelines and policies for Indigenous research worldwide are directly linked to self-determination. In a Maori context, the ethical guidelines framework has layers based on progressive expectations of behavior, recognizing minimum standards and best practice approaches for

different types of research with Maori. The praxis provides a space for cross-cutting concepts that relate to (Hudson et al. 2016; Juutilainen 2017):

- a) Principles of the treaty of Waitangi: Partnership, Participation, Protection
- b) Actions implied by the treaty of Waitangi: Rights, Roles and Responsibilities
- c) Risk, Benefits and Outcomes of Research
- d) Maori values of Whakapono (faith), Tumanko (aspirations) Aroha (awareness)

The “Proposal for Ethical Guidelines for Sámi Health Research and Research on Sámi Human Biological Material” (Kvernmo et al. 2018) offers an overview of principles to ensure that research is considered safe from a cultural perspective, that it is respectful and responsible, of good quality, and useful to the Sámi communities as well as individuals. The guidelines intend to establish that research on the Sámi population and local Sámi communities, or their biological material, takes into account and respects the diversity and distinctive character that distinguishes Sámi culture and the Sámi communities, and ensures full equality and reciprocity throughout the research process.

The Finnish Sámi Parliament has a procedure for seeking the FPIC of their Sámi constituency in research projects dealing with cultural heritage, traditional knowledge and other activities that have or may have an impact on this heritage and knowledge. The procedure aims to guarantee that the Indigenous rights of the Sámi are realized, promote the preservation of Sámi cultural heritage and traditional knowledge, and safeguard the self-determination of Sámi over this heritage and knowledge. Based both on FPIC and the Akwé: Kon Guidelines, the procedure was adopted in 2016 and the English version in 2019 (Sámi Parliament in Finland).

The Sámi and indigenous studies at the universities of Lapland, Oulu and Helsinki, as well as representatives of three key Sámi institutions, the Sámi Parliament, the Sámi Museum Siida and the Sámi Regional Education Center have started cooperating in the spring of 2018 to establish ethical principles for research on the Sámi by setting up a preparatory working group. The aim of the working group is to create research ethics guidelines that will help researchers conduct research on the Sámi on a sustainable basis. (University of Lapland 2020.)

Some documents specifically cover Indigenous Peoples’ knowledge and research in the Arctic. The *Ottawa Traditional Knowledge Principles* (2015) were created by six international Indigenous organizations, called Permanent Participants, to provide guidance for the use of their knowledge systems in the Arctic Council.

The United States’ Arctic Research and Policy Act of 1984 (ARPA) provides for a comprehensive national policy dealing with American research needs and objectives in the Arctic. The ARPA establishes an Arctic Research Commission (ARC) and an Interagency Arctic Research Policy Committee (IARPC) under the National Science Foundation to help implement the Act. IARPC was formally created by Executive Order 12501. Its activities are coordinated by the National Science Foundation (NSF), with the Director of the NSF as chair.

Research Principles by IASSA (International Arctic Social Sciences Association) were adopted in 1992 at the General Assembly convened in Copenhagen May 23, 1998, during the Third International Congress of Arctic Social Sciences (ICASS III).

These Principles have been formulated to provide guidelines for all researchers working in the North in the social, natural and health sciences, and in the humanities. These principles are intended to promote mutual respect, communication and partnerships between researchers and northern residents. This statement is not intended to replace other national, professional or local guidelines. It is understood that there must be continuing assessment of the principles. All scientific investigations in the North should be assessed in terms of their potential human impact and interest. Social science

research, particularly studies of human subjects, requires special consideration, as do studies of land and resources that have economic, cultural, social and spiritual value to Native people (IASSA, 1992).

Each project involving traditional knowledge will have its own context, so it's not possible to develop guidelines that cover every possible situation in every community. Also, each culture's uniqueness makes it impossible to develop general guidelines for the traditional knowledge of all cultures (Nordin-Jonsson 2011).

3. Examples of cooperation models in Integrated observation systems

A good way to develop local collaborations for local adaptation is to learn from ongoing projects where integration of Indigenous knowledge and traditional science has been successful. Some examples are given below.

3.1 The Sustaining Arctic Observing Networks (SAON)

Jan Rene Larsen, Thorsteinn Gunnarsson

Climate and environmental change, loss of biodiversity and environmental contamination in the Arctic have far-reaching implications for the entire planet. Recent Arctic trends of variables such as ocean and atmospheric temperature, sea ice loss and acidification suggest that the severity of climate change in the Arctic and its impacts are projected to dramatically progress in the near future. Because of these changes, Arctic nations and their people are faced with significant environmental, economic and societal challenges. Global issues such as sea level rise due to Greenland Ice Sheet melt, changing mid-latitude weather patterns due to destabilization of Arctic atmospheric circulation, and diminishing fisheries due to warming and acidifying Arctic waters are some of the leading issues threatening residents in and outside of the Arctic. Due to the global consequences associated with Arctic change, the broader global community must engage to most effectively monitor and understand the environmental change, its effects and implications for the social and human dimension.

The Sustaining Arctic Observing Networks (SAON) is a joint initiative of the Arctic Council and the International Arctic Science Committee (IASC) that aims to strengthen multinational engagement in pan-Arctic observing and monitoring of Arctic environmental change. The SAON process was established in 2011 at the Seventh Ministerial Meeting of the Arctic Council (AC) via the Nuuk Declaration and engages 17 countries in the effort to maximize Arctic observing capabilities. This declaration recognizes the “importance of the Sustaining Arctic Observing Networks (SAON) process as a major legacy of the International Polar Year for enhancing scientific observations and data-sharing.”

In the statement from the 2nd Arctic Science Ministerial (Joint Statement of Ministers 2018), ministers confirm their intent to promote the sharing of research infrastructure and observing systems. They intend to “expand the cooperation in this area by progressively moving from the design to the deployment phase of an integrated Arctic observing system which also supports and includes community-based observatories, in cooperation with the Sustaining Arctic Observing Networks (SAON).”

1. SAON Vision and Mission

SAON's vision is to foster a connected, collaborative, and comprehensive long-term pan-Arctic Observing System that serves societal needs. SAON's mission is to facilitate, coordinate, and advocate for the pan-Arctic Observing System and to mobilize the support needed to sustain it.

SAON itself does not undertake research, science planning, policymaking, observations, data archiving, or funding of these efforts. SAON encourages and promotes collaboration among existing networks/sites/systems and data centers, the organizations that support them, or appropriate decision-makers within these areas. SAON promotes contributions of all types of observations including *in situ*, remotely sensed, and community-based observations, and values both research and operational Arctic observations. The SAON initiative works with counterparts in the Antarctic, global, and national observation

communities, where appropriate. It utilizes Indigenous and local knowledge guided by ethical use and honoring the proprietary rights of data contributors.

2. Goals and implementation

A SAON strategy was approved in January 2018 (SAON 2020a) and identifies three overarching goals:

- Create a roadmap to a well-integrated Arctic Observing System;
- Promote free and ethically open access to all Arctic observational data; and
- Ensure sustainability of Arctic observing.

2.1 Goal: Create a roadmap to a well-integrated Arctic Observing System

In cooperation with the Science and Technology Policy Institute (STPI), SAON has developed the International Arctic Observations Assessment Framework (SAON 2017), which uses Societal Benefit Areas (SBAs) to identify key components of a comprehensive overviewing system. A total of 12 SBAs are incorporated into the SAON roadmap: Disaster Preparedness, Environmental Quality, Food Security, Fundamental Understanding of Arctic Systems, Human Health, Infrastructure and Operations, Marine and Coastal Ecosystems and Processes, Natural Resources, Resilient Communities, Sociocultural Services, Terrestrial and Freshwater Ecosystems and Processes, Weather and Climate.

SAON will play an important role in identifying internationally endorsed key products, services, and research outcomes of observations that contribute achieving these benefits. A major activity associated with this work is to organize inventories of existing Arctic observational assets: programmes, projects, networks and platforms (SAON 2020b). SAON believes that such an inventory is central to developing a roadmap for a well-integrated Arctic observation that is responsive to SBAs. This roadmap will also be used by SAON to identify funding sources to support infrastructure required for 1) sustaining or supplementing observational capabilities and 2) upgrading existing observing capabilities with innovative technologies that can enhance observational capacity.

2.2 Goal: Promote free and ethically open access to all Arctic observational data

SAON aims to promote free and open access to ethically-collected data (IASC 2013). A review of relevant Arctic data management efforts and results have guided the SAON vision for an open, interconnected, international system for sharing data across disciplines, domains, and cultures. Requirements and characteristics of such a system include, but are not limited to:

- a distributed design that connects different data repositories and other resources;
- linked catalogues fostering ‘single window’ search;
- data as a responsive, “live” service rather than simple download approach;
- access to “big data” and powerful analytical tools (e.g. cloud platforms);
- inclusive of Indigenous knowledge, and local perspectives and information.

In recognizing the elements of the envisioned system and the key challenges identified by the community, SAON focuses on improving connections and cooperation between actors and users. This is achieved by working with the global Arctic data community, including data providers, data scientists, funders, users and beneficiaries within society.

2.3 Goal: Ensure sustainability of Arctic observing

SAON believes that goals 1 and 2 can only be achieved if Arctic observations and data sharing are supported by all relevant stakeholders over the long term. To ensure sustainability, SAON will develop a strategy for long-term financial commitment in Arctic observations and apply it to lobby funding agencies and states.

2.4 Implementation

SAON implementation is achieved through two committees: The Committee on Observations and Networks (CON) and the Arctic Data Committee (ADC). The CON aims to promote and facilitate international collaboration towards a pan-Arctic Observing System (Goal 1). The ADC aims to promote and facilitate international collaboration to establish free, ethically open, sustained, and timely access to Arctic data through easily accessible and interoperable systems (Goal 2). The Plan for SAON Implementation (SAON 2020a) describes how the Committees and the SAON Board will work together to achieve its objectives.

3. The role of Arctic Indigenous Peoples and local communities in Arctic observing

In the discussion about SAON, it has been argued that global systems and organisations have the same scope and, also, Arctic observations should be organised within the framework of these. The discussion recognizes there are certain specific challenges in the Arctic – which will justify that there is something Arctic-specific – but many of the variables are globally important. Therefore, it is argued that these should be managed globally with the Arctic as a region under a global system.

The response from Arctic Indigenous Peoples, Indigenous organizations, and local communities is that they often have very clear ideas about how research and monitoring in the Arctic should be conducted. These are formulated for instance in the Canadian *National Inuit Strategy on Research* (Inuit Tapiriit Kanatami 2018), which can be applicable to Arctic Indigenous Peoples in general: 1) Advance Indigenous governance in research; 2) Enhance the ethical conduct of research; 3) Align funding with Indigenous research priorities; 4) Ensure Indigenous access, ownership, and control over data and information; and 5) Build (Indigenous) capacity in Arctic research.

It is important to note that research and monitoring activities in the Arctic are a tool for creating social equity, and one of SAON's roles can be viewed as ensuring that it is used as such.

4. SAON Membership and Partners

It is understood that addressing SAON goals requires the expertise and cooperation of a wide range of stakeholders and knowledge systems. Effective implementation of SAON requires partnerships. Such partnerships include existing observing networks (like INTERACT), collaborations with policymakers at all levels, Arctic Indigenous Peoples' organizations, academia, civil society and the private sector, as well as engagement from other multilateral/international groups (SAON 2020c).

With the Arctic Council as one of its parents, the eight Arctic States (Canada, Denmark, Iceland, Finland, Norway, Russia, Sweden and USA) and Permanent Participant organizations are born members of SAON. The support of IASC has ensured that a number of non-Arctic countries also are members of SAON: China, France, Germany, Italy, Japan, Korea, Poland, Spain, UK. This inherently means that SAON maintains strong connections to national level priorities and activities of its member countries.

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IASC 2013.

The concepts 'ethically collected' and 'ethically free' is discussed in *International Arctic Science Committee, 2013. Statement of Principles and Practices for Arctic Data Management:*

<https://www.iasc.info/data-observations/iasc-data-statement>

SAON 2020c.

Non-Arctic states and international and regional organisations that want to contribute to the implementation of SAON goals and objectives are welcome to join SAON. A list of partners is found here: <https://www.arcticobserving.org/partners>

Inuit Tapiriit Kanatami 2018.

Inuit Tapiriit Kanatami (The National Representational Organization Protecting and Advancing the Rights and Interests of Inuit in Canada). *National Inuit Strategy on Research:*

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3.2 Models of integrated observation systems: some examples raised by the editors

Circumpolar Local Environmental Observer (CLEO)

Arctic and sub-Arctic environment, climate and biodiversity is changing in ways unprecedented in our long histories in the north, challenging traditional ways of life, well-being, food security, and constituting a legitimate concern for the future of traditional Indigenous livelihoods, especially among Indigenous youth. CLEO is a project developed by the Alaska Native Health Consortium, Alaska, for Indigenous communities to observe sudden environmental changes. The Arctic Council Arctic Contaminant Action Programme (ACAP) Working Group hosts CLEO activities to increase knowledge about environmental changes in the Arctic. The project established a reindeer herders' CLEO Arctic Council hub in Guovdageaidnu, has organized community-based workshops on environmental changes, and engages the local Saami High School and Reindeer Herding School in environmental monitoring. The reindeer herders involved in the project observe snow changes. Therefore, CLEO provides a tool and method for participatory collection of environmental observations and communication of environmental concerns. It is a potential tool for stations to co-produce knowledge with Indigenous communities.

The GLOBIO3 model

Land use conflicts arise between the global demand for energy and resources and the traditional management of land and renewable resources by Indigenous peoples and other local people. The GLOBIO3 biodiversity model is a tool to assess the integrated impact of human-induced pressures on the environment (Alkemade et al. 2009). It incorporates the impact of five different pressures: land use change, infrastructure development, fragmentation, nitrogen deposition and climate change. Not only can the relative contribution of each pressure be assessed, but so can the overall integrated impact of all pressures. The model can assess past, present and future biodiversity at different scales and is known for its use in the *Global Biodiversity Outlooks* carried out by the CBD and the Global Environment Outlooks for UNEP.

By using local data and local expertise, GLOBIO3 can be downscaled for (sub)national implementation. This estimation of biodiversity loss via pressure intensities assessment seems an appropriate approach, since biodiversity is costly to measure in the field and data often are sparse in many areas. The current impact of socio-economic developments in terms of land use change, infrastructural developments and land fragmentation can be assessed based on existing data (van Rooji et al. 2017).

IPY EALÁT Reindeer herders' vulnerability study



In Yamal. Photo: Ellen Inga Turi/ICR.

EALÁT is a Sámi word meaning “something to live on” (especially for reindeer), or “sufficient pasture.” EALÁT is related to the word *eallu* (herd), and both derive from the word *eallin* (life). Pastures are the foundation for reindeer herding, and reindeer are the foundation for the lives of reindeer herding peoples throughout the circumpolar North. EALÁT is also the name given to this IPY project, initiated by the Association of World Reindeer Herders which also developed community-based *siida* monitoring systems for snow. Herders indicate that temperature and precipitation conditions alone are not critical for the reindeer, but that various combinations of these variables lead to different snow structures which make the pastures

more or less available for the reindeer. To investigate this further, a model describing the structure and density of different snow layers was developed and early results are promising, as the model mirrors herders' memories of past winters.

The study (Magga et al. 2009) suggested that, for reindeer herders, “Adaptation to climate change is about building competence locally. One of the challenges for Norwegian climate research is to make a bridge over the gap between researchers at the universities and people outside of the universities.” Between 2007-2011 the EALÁT project made major strides towards this goal by organising 21 community-based workshops in local reindeer herding communities across the circumpolar Arctic, including Norway, Sweden, Finland, northwest Russia, western Siberia, eastern Siberia, southern Siberia, the Russian Far East, as well as the far-north of Canada, spanning the major reindeer herding regions of the world and eight different Arctic reindeer herding peoples.” This is a system in which humans and animals are “coupled” and have developed a high resiliency. A core survival strategy for reindeer herders over time has



In Chukotka. Photo: ICR

always been their knowledge about how to cope in changing natural, social and political environments. Today, climate change and the effects of globalization are accelerating the pace of change dramatically.

SAAMI – Adaptation of Saami people to climate change

The Center for Environmental and Respiratory Health Research (CERH) at the University of Oulu launched a research project focused on identifying ways Saami people can adapt to climate change and what measures would be required. The purpose of the project was to investigate the effects of climate change on the Saami culture from 1960–2018, identify ways for reindeer herding Saami to adapt to climate change, and determine the required actions. The primary material of the project consists of anthropological fieldwork and written sources. Ten different Saami reindeer work models were recognized in the project. These different models provide different starting points for adapting to climate change, and the diversity of the models may increase in the future. Information produced in the course of the project will benefit decisionmakers, the scientific community and Saami people themselves. “Climate change will have a comprehensive impact on Saami people’s life, because Saami culture and language, as well as Saami people’s health and way of life are closely linked with nature that is undergoing rapid change. Therefore, the Saami are particularly vulnerable to the effects of climate change,” says the project leader, Professor Jouni Jaakkola. (SAAMI 2020.)

Community-based Monitoring

"The Community-based Monitoring Handbook has been written to enhance the role of community-based observations in current and emerging research projects in the Arctic. The main principles of community-based monitoring activities, such as inclusiveness, respect for and recognition of knowledge-holder rights and beneficence, are the same across disciplines and geographical areas. Thus, this information could be applied to broader monitoring efforts and non-Arctic regions (Gofman 2010)

An Atlas of Community-Based Monitoring in a Changing Arctic Program (see Johnson et al. 2016, 14) has been developed under the direction of the Inuit Circumpolar Council in partnership with Brown University, the Exchange for Local Observations and Knowledge of the Arctic (ELOKA), and Inuit Tapiriit Kanatami's Inuit Qaujisarvingat: Inuit Knowledge Centre. Additionally, a number of institutions are collaborating as "content partners" by assisting with identification of CBM and Indigenous Knowledge (IK) initiatives. Content partners include the European Commission through their "Study on Arctic Lay and Traditional Knowledge: Community-based Monitoring Programmes in the EU Arctic," implemented by the Nordic Agency for Development and Ecology (NORDECO). Additionally, the Alaska Ocean Observing System (AOOS) and Alaska Sea Grant are assisting with identification of CBM initiatives in Alaska. Arctic communities are actively involved with observing social and environmental change; this atlas was designed to showcase the many community-based monitoring (CBM) and Indigenous Knowledge (IK) initiatives across the circumpolar region. *"Arctic Indigenous communities have been observing the environment for millennia, drawing on their own knowledge systems and ways of engaging with the land, water, sea ice, snow, plants, and animals. Drawing on Indigenous Knowledge, communities identify meaningful indicators that enable community members to track ecosystem dynamics and monitor stasis and change. Non-Indigenous Arctic residents also engage directly with the environment through fishing, hunting, and travelling on the land, and can offer their own observations of environmental phenomena. As a response to increasing social and environmental change in the Arctic, many communities are initiating or participating in more formal approaches to monitoring of observed changes. These community-based monitoring initiatives, which may draw on Indigenous Knowledge and scientific approaches to monitoring, track many different phenomena, including sea ice, snow cover, weather, biodiversity, and water quality. The information gathered serves as an important resource for local and sometimes regional or national decision-making."* (ARCTICCBM 2012.)

Ocean Data Foundation's the Ocean Data Platform

The Ocean Data Foundation seeks *to improve knowledge and understanding of the ocean, to give it the best chance of reaching a state of health, abundance and sustainable use*. It seeks to make available ocean data, and making it available in a user-friendly, standardized and interoperable format. The Foundation stated the: *One of the biggest challenges facing global marine research is lack of knowledge. Compared to the innovation and research done on land, data-driven marine research is far behind. In fact, nobody knows how much data is available about the oceans today. There are a number of smaller data initiatives and platforms in the world today, but no all-encompassing platform combining it all. The Ocean Data Platform is an initiative to address this.* (See: Ocean Data Foundation 2020 & RevOcean 2020.)

More observational systems:

U.S. Integrated Ocean Observing System Program and its U.S. IOOS Coastal and Ocean Modelling Testbed (COMT). the goals of which are *"To use applied research and development to accelerate the transition of scientific and technical advances from the coastal ocean modelling research community to improved operational ocean products and services"* (See more IOOS 2020 and Wilkin et al. 2017.)

Group on Earth Observations (GEO): GEO is an intergovernmental partnership that improves the availability, access and use of Earth observations for a sustainable planet. GEO is leading the Global Earth Observation System of Systems (GEOSS) to better integrate observing systems and share data by connecting existing infrastructures using common standards. (See more at: GEO 2020.)

The Gateway to the Arctic Ocean Observation Program: by Alfred Wegener Institute (AWI). The mooring is part of one of the Alfred Wegener Institute's most important long-term projects. Since 1997 AWI oceanographers have been monitoring the pulse of the Atlantic current system in the Fram Strait, the region between Svalbard and the northeast coast of Greenland. "There are three reasons why the Fram Strait is so important to us. Firstly, it represents one of the two gateways through which water and heat from the Atlantic Ocean are transported to the Arctic Ocean, which contributes to the melting of sea ice.

4. Case studies of varying interactions between stations, people and decision makers

Three WP9 case studies were conducted at INTERACT research stations in Finland, Greenland and Siberia, Russia. They are characterized by contrasting northern environments, ecosystem types, primary impact factors and economies. Each research station was given a specific task to collaborate with local communities. In this guide, the case studies are analyzed by what types of cooperation they have with the Indigenous and local communities, how they have created the partnerships and what could possibly be done differently. In addition, adaptation actions that can be based on local observations and scientific understanding are discussed. Ultimately, the case studies describe how communities, in cooperation with research stations and researchers, can address the impacts of changes to their natural environment and local livelihoods.

The case studies are:

1. Adapting to climate change and ensuring sustainable use of living resources (marine and terrestrial). Location: Arctic Station, West Greenland. Leading Partner: Aarhus University.
2. Adapting reindeer husbandry to vegetation change and snow cover changes. Location: Kevo Station, Finland. Leading partner: ICR.
3. Forestry, hunting and fishing tourism, agriculture and potential new land uses in a warmer climate. Location: Kajbasovo Station, Siberia. Leading partner: Tomsk State University.

In most of the case studies, the local people around the stations were primarily Indigenous. Kevo Station is in Utsjoki Municipality, where most local people are Sámi. In Qeqertarsuaq, around Arctic Station, the majority are Inuit.



Map showing reindeer husbandry areas in the world. Case study locations: Qeqertarsuaq (Kalaallit Nunaat/Greenland), Ohcejohka (Sápmi, Finland) and Kajbasovo (Tomsk region, Russia) marked with a red circle on the map.

4.1 Hunting and fishing in West Greenland: Sustainable use of living resources and adaptation to climate change

Elmer Topp-Jørgensen, M. Sc. & Morten Rasch, PhD

INTERACT facilitated a process to develop cooperation between Arctic Station (University of Copenhagen) and the local community of Qeqertarsuaq in central West Greenland. Arctic Station was established in the early 1900s and situated just a few hundred meters outside the town of Qeqertarsuaq. The station has had ties to the local community in the form of support functions for station management and facility maintenance (e.g. ship operations, facility maintenance and field assistance). Through a consultation

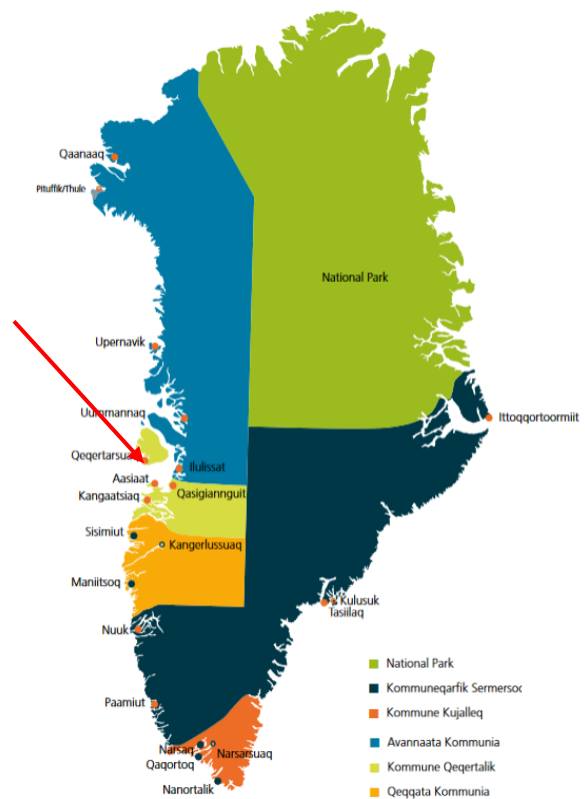
process, Arctic Station and local partners discussed and developed ideas for cooperation spanning from scientist-driven initiatives to community-driven initiatives and education and outreach activities. This case study presents different phases in the stepwise approach to cooperation development, along with different ideas for cooperation that were discussed in the process. Agile cooperation that allows for changes in agreed cooperation initiatives is considered important to adapt to changes in the station's and community's interests. Regular contact and integration of cooperation tasks in the local station manager's job description is important to sustain an agile and positive dialogue between the station and the local community.

Living resources are central to the economy and local livelihoods in Qeqertarsuaq. Harvest quotas are set by the government administration in Nuuk more than 550 km away based on the advice given by the Greenland Institute of Natural Resources, also based in Nuuk. The institute also works with international organisations when setting quotas for many marine mammals and fish species.

Local administrations in Kommune Qeqertalik can implement additional restrictions to the harvest and decide on quota share between occupational and spare time hunters for some species. Thus, the possibility of influencing the harvest system is indirect. It provides information on status and trends of harvested species, and changes in physical properties and ecosystem dynamics are the only way Qeqertarsuaq can influence decision-making in relation to living resources.

The aim of the case study is therefore to identify options for collaboration between Qeqertarsuaq and Arctic Station that can increase awareness and knowledge of ecosystem change and climate change effects and connect the local knowledge with the conventional scientific knowledge generated at the research station.

Local staff is essential for the run and safe operation of the station and its facilities, and local people possess a unique knowledge about local climate and ecosystem status and trends. Located just outside Qeqertarsuaq town, Arctic Station is committed to engage with the local community to harvest mutual benefits. While Arctic Station for years has worked with the local community of Qeqertarsuaq, there is also a potential for strengthening this cooperation by ensuring a continuous dialogue with the local community to discuss and adapt ongoing initiatives and new cooperation ideas in informal and agile collaboration. WP9 facilitated an open dialogue to discuss initial ideas of how to cooperate. The results of this dialogue are currently being implemented at Arctic Station to ensure regular contact with the local community and an open and engaging dialogue.



Municipalities in Greenland – Kommune Qeqertalik indicated with red arrow.

Human dimension

The earliest signs of human presence on the island and around the present town Qeqertarsuaq date back to the Saqqaq culture, the archaeological designation of the earliest Palaeo-Eskimo culture of West and Southeast Greenland, roughly 2,500-800 BC. The town Qeqertarsuaq was founded in 1773. The town today has about 845 inhabitants and supports a local administration office under the municipality offices in Asiaat on the southern coast of the bay (c. 65 km away). The town has a supermarket, several shops, hospital, garage and workshops, fishing industry, church and power station.

Dog sleds are still used for hunting and fishing in the winter but recent decades have seen a sharp decline in the local dog population due to more unpredictable sea ice conditions and increased use of snowmobiles.

Main livelihoods

The majority of the workforce are employed in the public administration and service sector with almost 200 employees (out of c. 845 inhabitants). The second most important sector are fisheries and hunting with about 80 professional fishermen/hunters. Third is the trade sector with almost 50 employees.



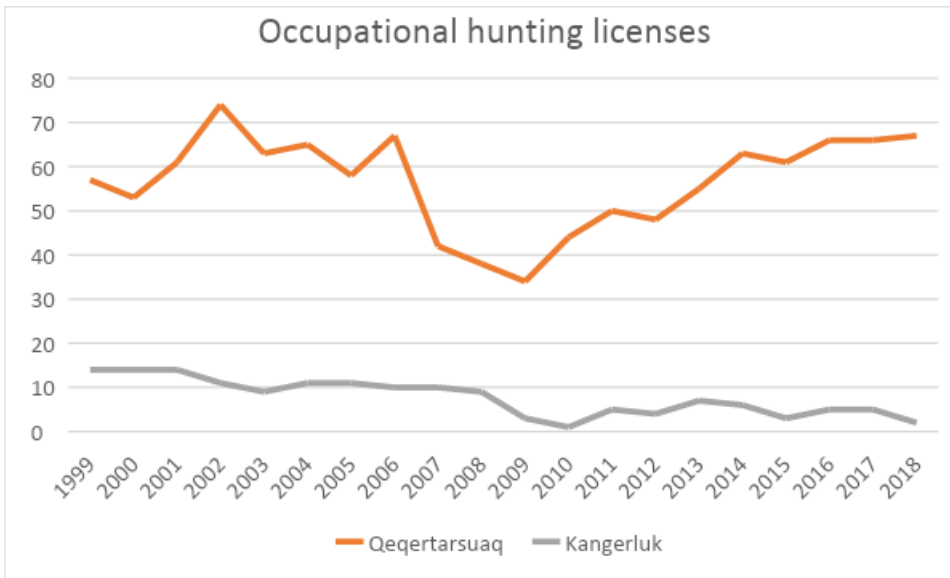
Dinghies and dog sleds are used for fishing and hunting in Qeqertarsuaq (Morten Rasch).

Living resources

The most economically important living resources in Disko Bay are northern shrimp (*Pandalus borealis*), snow crab (*Chionoecetes opilio*), Atlantic cod (*Gadus morhua*), Greenland halibut (*Reinhardtius hippoglossoides*), scallop (*Clamys atlantica*) and lumpsucker (*Cyclopterus lumpus*). These species are harvested by both local fishermen and an external fishing fleet.

Species of importance to local consumption includes Atlantic cod, Greenland halibut, seals, whales, capelin (*Mallotus villosus*), Arctic char (*Salvelinus alpinus*), red fish (*Sebastes mentella*), spotted wolf fish (*Anahichas minor*) and sea birds like king and common eider (*Somateria Spectabilis* and *S. molissima*), and thick-billed murre (*Uria lomvia*).

The number of occupational fishermen/hunters experienced a dip around 2010 but numbers bounced back to year 2000 level. However, in the smaller Kangerluk settlement the number of occupational hunters has remained low since c. 2010. Sustainable use of living resources and adaptation to climate change continues to be of importance to the local economy and livelihood strategies.



The development of occupational hunting licenses from Qeqertarsuaq and the smaller Kangerluk settlements.

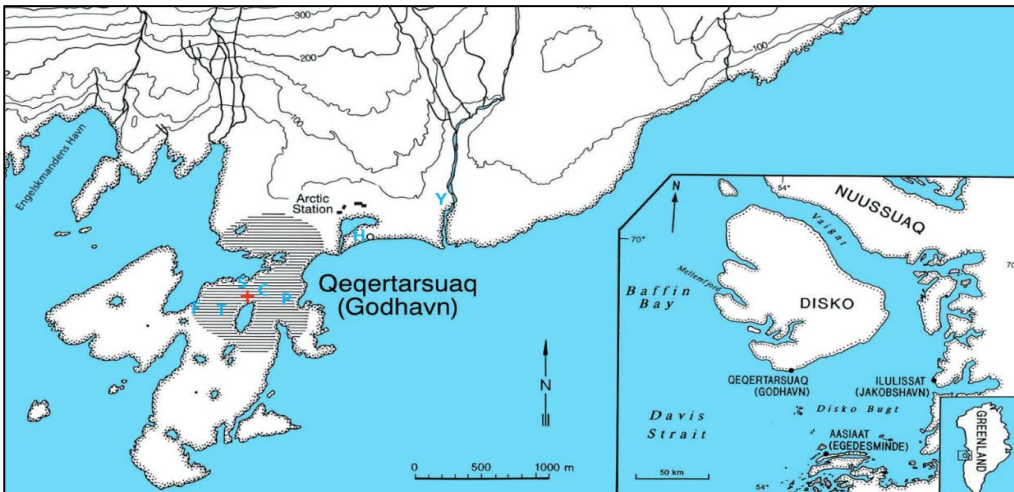


Fishing and tourism industry are of importance to Qeqertarsuaq (Morten Rasch).

There’s also small-scale tourism activity in the area including a few businesses offering accommodation (hotel, guesthouses and a campsite). Transportation is mainly by boat and helicopter, and there are some tourist activities for the visitors: dog sledding, a cruise ship in the summer. The increasing number of tourists to Ilulissat has yet to spill over into Qeqertarsuaq.

Arctic Station

Arctic Station is situated in Qeqertarsuaq, Greenland with a population of 845 (in 2013), plus 35 in the remote Kangerluk settlement. The majority of the people are Inuit.



Location of Qeqertarsuaq and Arctic Station (Source: University of Copenhagen)

Arctic Station is the oldest year-round operated research station in the Arctic. It was established in 1906 on the south coast of the island Qeqertarsuaq (69°15'N, 53°34'W) next to the town Qeqertarsuaq in an area of West Greenland with the greatest variation in the environment. Since 1953, the station has been operated by the University of Copenhagen with a full-time station manager and local staff. The station has room for 26 visitors and supports a laboratory, an extensive library, herbarium, garage and workshop. The station is a platform for research and monitoring projects (natural, social and humanities sciences), university courses and courses by the Greenland school authorities. The station is managed by a board (7 employees from University of Copenhagen, Denmark) and the daily operation is taken care of by a scientific leader (living at the station) and support staff (for cleaning, maintenance, research ship operations, etc.).



The Arctic Station (Morten Rasch).

4.2 Reindeer herding in Finland: Adapting reindeer husbandry to vegetation change and snow cover changes

Rosa-Máren Magga, MA

Otso Suominen, PhD contributed a text about Kevo Research Station

In this case study, ICR together with INTERACT facilitated a process to develop cooperation between Kevo research station and the local Indigenous community of Ohcejohka (Utsjoki in Finnish) in the northernmost part of Finland. Sámi and Finnish people live in Ohcejohka and Sámi people are the majority. Ohcejohka's population was 1,235 in 2019. One of the largest and most important economies and livelihoods is reindeer husbandry, which is an Indigenous economy. The reindeer are privately owned in Ohcejohka, mostly by the Sámi people. There are two reindeer herding cooperatives and districts in Ohcejohka municipality: *Gáldoaivi* and *Baišduottar*. Baišduottar has 104 reindeer owners and the highest allowed number of reindeers is 6300; Gáldoaivi has 86 reindeer owners and the highest allowed number of reindeers is 5300. The number of *siidas* in each cooperative is up to 8 winter *siidas* in Gáldoaivi and 8 in Baišduottar. The work is planned and compiled by the respective cooperatives' seasonal work, as the fall and winter until April is the busiest season in the Ohcejohka area.



Reindeer corral in Skállovárri in Gáldoaivi reindeer herding district in Ohcejohka municipality. (Arctic Photos/ Tarja Länsman).

The work started by identifying important actors in the field and inviting them to the local meeting. This case study began with a workshop at Kevo Station in Finland. The task force had its first meeting to get to know the station on February 28, 2019 and held its meeting with local people at Kevo Station on June 17, 2019 with nine local and invited representatives.

Topic-wise, our fieldwork consisted of research ethics, guidelines, traditional Indigenous knowledge combined with science, climate change adaptation and cooperation in a broader sense. The focus area was adapting reindeer husbandry to vegetation- and snow cover changes. The aim of this case study was to improve cooperation between the local reindeer herder community and Kevo Station to identify relevant environmental changes, including vegetation- and snow cover changes; to identify their effects on the environment and local people; and to connect the local knowledge – which is here mostly the traditional



Rástegáísá fell. This East-Finmark's highest peak, 1066 m above sea level, can be spotted on the way to Ohcejohka. Picture: Svein D. Mathiesen/ICR

Indigenous knowledge – to the scientific knowledge generated at the Kevo research station.

Reindeer husbandry in Ohcejohka is based on Indigenous knowledge about reindeer and pastures. Throughout generations, reindeer herders have accumulated unique knowledge about the natural environment in which they live. Traditional knowledge is based on experience and is knowledge that is accumulated in people's memory and actions over multiple generations. Therefore, it is knowledge that is actually validated in the same way that scientific knowledge is found valid: through trial and error.

Today, mainstream society has begun to demand the implementation of traditional knowledge. Institutions such as the United

Nations require and encourage that traditional knowledge be embedded into scientific research of the natural environment. Yet, there is still a wall between the science community and local communities, as well as the Indigenous knowledge system.

There is a need for more scientists who are also traditional Indigenous knowledge holders; this is one example of how scientific and traditional knowledge can work together. These academics work according to their scientific principles and rules but with their Indigenous world view in the background. Another example is involving local people and their knowledge in research, like Indigenous informants and their knowledge systems.

Moreover, the outcomes of the research projects done on topics related to Indigenous peoples should be practical results for the local communities. Scientists, Indigenous communities and local authorities are all aiming to result in district plans/regional plans for adaptation and mitigation of climate change. More cooperation is needed to include the needs of the local communities and Indigenous peoples in this work.

If research stations and the local communities work together in a meaningful way, all the partners can benefit. The results will matter and the process can truly be called cooperation. The stations can give back, benefit the communities and engage in two-sided information-sharing and relationships. A new study (Norström et al. 2020) emphasizes this: "Research practice, funding agencies and global science organizations suggest that research aimed at addressing sustainability challenges is most effective when 'co-produced' by academics and non-academics."

Main economies

Currently, one in ten of the jobs in the River Ohcejohka are in primary production, and three out of four are in the public or private sector. (Utsjoki municipality 2020.) The most important livelihoods of Ohcejohka are border trade (retail trade), reindeer husbandry, traditional means of livelihoods/subsistence livelihoods (*luontaitaloudus* in Finnish) and tourism. The tourism has been developing the past decades especially around the Deatnu river salmon fishing but due to the new regulations in past years with the effects on that and the views on salmon population, the municipality has started to market the municipality in new ways.

Reindeer husbandry

Sara (2009) explains the Sami concept of reindeer herding *siida* as following: *“The siida is a Sami local community that has existed from time immemorial. The reindeer herding siida has formed as an adaptation of ancient siida principles to large-scale nomadic reindeer herding. It is the prerequisite and basic organizational unit for carrying out large-scale herding. The main elements of the siida are the individuals (in Sami siida olbmot); the husbandry units (baikedoalut); the collective and the herding unit (siidadoallu); the siida territory, resources, and infrastructure (orohagat/siidavuoddu); and the semi-nomadic or nomadic lifestyle in accordance with the flow of the seasons (johtaladdan).”* (Sara 2009.)



Photo: ICR

The Finnish legislation does not recognize the Sámi *siidas* as self-governing bodies in reindeer husbandry. In Finland, reindeer husbandry is governed through reindeer herding cooperatives (*paliskunnat*). Norway legally acknowledged the Sámi *siida* in 2007, recognizing the *siida* as the basic reindeer herding institution regarding land rights, organization, and daily herding management (Sara 2009). However, Norwegian national authorities continue to regulate reindeer husbandry and construct the reindeer herding districts without due regard to the Sámi’s traditional reindeer herding and knowledge today. Traditional reindeer husbandry must live and thrive alongside the regulated reindeer herding model that is based on the national authorities’ regulations and agricultural models. These differences cause challenges and conflicts in many areas, but many Sámi herders continue to hold their traditional knowledge on which husbandry is based. *Siidas* and their continued use maintain this knowledge.

Kevo Station

Kevo Station is situated in the municipality of Ohcejohka, in Sápmi, Northern Finland. In collaboration with the Forest and Park Service and Finnish Forest Research Institute, Kevo established a tree-line arboretum for the study of the different tree species of the circumpolar forest line area in the 1970s. Kevo Subarctic Research Institute of the University of Turku runs a research station in Ohcejohka at the northernmost tip of Finland only about a hundred kilometers from the coast of the Arctic Ocean (69° 45' N, 27° 01' E). The station was founded in 1958 and lies about 60 km north of the continuous pine forest line in Ohcejohka river valley (tributary to Deatnu river) right next to Kevo Strict Nature Reserve by Lake Kevo.

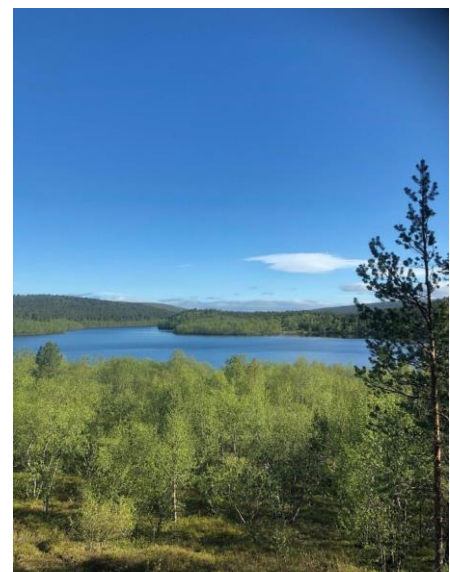
Station is open year-round, but the kitchen only offers meals (full board) outside the main field season (May-September) for larger groups. There are eight permanent staff members and some seasonal workers at the station. Most of the research and teaching activities are conducted by people employed in their own institutions outside Kevo Subarctic Research Institute. The station provides laboratories, workshops, a canteen, a lecture hall, accommodation buildings and saunas as well as boats, ATVs, snowmobiles and cars for transportation. The station offers facilities for teaching, symposia and other scientific meetings. The station has capacity to accommodate about 50 guests (some more in summertime) at a time. In addition to research, several university and school courses, meetings and workshops are held at the station each year.



Map of the Kevo research station area.

Kevo Station gives access to subarctic research with a wide range of ecosystems from pine stands at low altitudes to low alpine tundra. The ecological, environmental, and geographical research conducted at Kevo is internationally well-known. Kevo represents an important site for long-term ecological and environmental field experiments and environmental monitoring. Manipulative experiments addressing cause-effect relationships of anthropogenic environmental changes and long-term environmental monitoring at Kevo support each other in a unique way. There are long-term field experiments studying the effects of aerial pollutants as well as the impacts of reindeer grazing on ecosystems. The station has treeline arboreta with different origins of arctic treeline species. Kevo gives access to long term data sets: population dynamics on moths, voles, birds of prey, hole-nesting passerines, bats, plant phenology and pollen monitoring as well as meteorological and hydrological data (provided by the Finnish Meteorological Institute and Finnish Environment Institute). There is up to 50-year old biogeographical and physical geographical mapping data available for comparisons with the present situation.

Kevo has taken part in several large international projects. In ecology, Kevo is internationally best known for research on plant-herbivore interactions, initiated by the study of the 1960s autumnal moth (*Epirrita autumnata*) larvae outbreak that led to death of birch forests in large areas. The latest winter moth (*Opeorophtera brumata*) outbreak in 2005-2009 destroyed about 400 square km of the treeline birch forests in Ohcejohka and the station is monitoring the recovery



Lake Kevo in June (Rosa-Mären Magga).

of the ecosystem. Winter moth is a new species in the local ecosystems, and its arrival and first known outbreak is supposed to be a result of the warming climate. In physical geography, Kevo is known for research on *palsa mires*. Modern environmental research on northern environments is often conducted as international co-operation by research groups including members from several institutions and disciplines and studies on multiple sites. In addition to natural sciences there have also been research projects in humanities and social sciences based at Kevo Station. Being situated in the Indigenous Sámi homeland area has attracted studies related to the Sámi people and culture to the station.

The international economic and political interest in arctic areas has grown greatly in recent years most of all due to climate change impacts (both the expected and already realized changes). This interest also steers research interests on northern ecosystems. The long-term data, well-established research tradition, and location in a forest-tundra transition zone where we can see and measure the changes makes Kevo a perfect site for the study of environmental changes in the north.

4.3 Hunting, fishing and conservation in the Russian Taiga

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Tomsk State University*

Focus areas of this case study

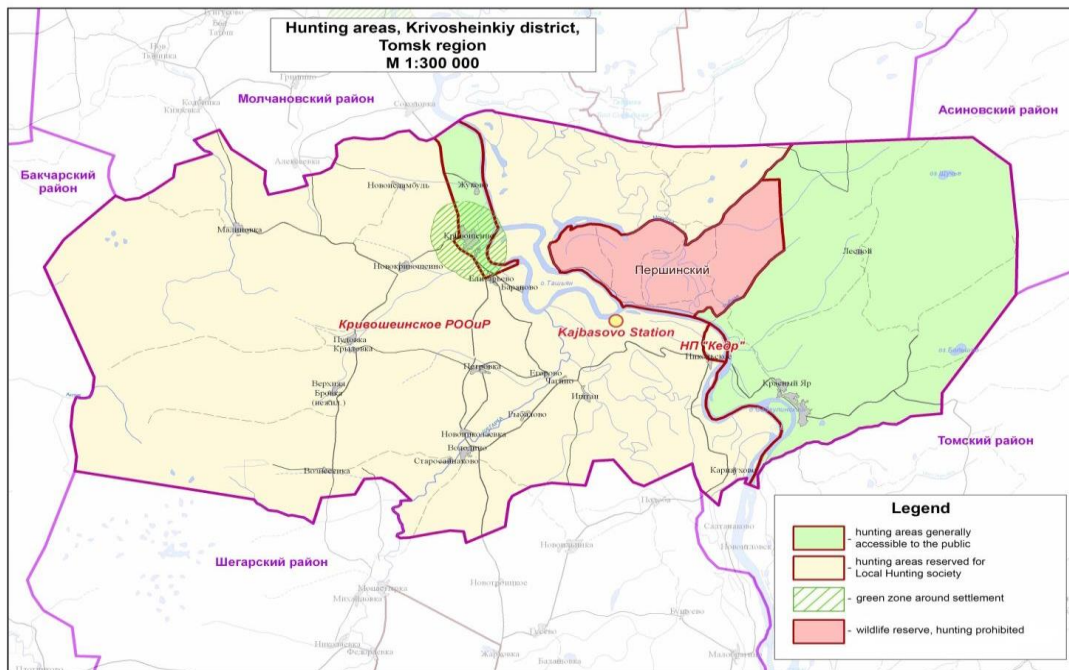
This case study documents the activities of the Kajbasovo Research Station belonging to Tomsk State University in the Middle River Ob Region of Western Siberia. It shows how the station interacts with local communities and authorities to develop research that translates into regulations which enhance the sustainable use of natural resources essential to the wellbeing of local people, while also setting aside officially designated areas to conserve biodiversity. At the same time, station researchers cooperate with local people and authorities to implement projects that address global environmental challenges important to local people in the longer term. Finally, this case study explores ways in which the Kajbasovo Station can enhance its interactions with local communities in the future.

Through cooperation between the Kajbasovo Research Station, local authorities and local communities, scientific research projects could be formulated and implemented on topics of immediate relevance that result in specific regulations. Focuses could include: 1. Stability of fishing resources; 2. Balancing conservation of biodiversity, hunting interests and safety; 3. Dynamics of land-use between agriculture and forestry. Other scientific projects with wider and longer-term relevance could also be initiated and implemented far more successfully based on this collaboration.

The research station is not located near local communities. However, collaboration between the station and local residents could theoretically empower residents to identify areas they can influence through local initiatives. These include inter-settlement cooperation, project formation, and writing official appeals to the District and Regional administrations based on data obtained by environmental scientists. Kajbasovo Station envisions local residents seeing they can change some aspects of their lives and mobilizing the local community. Contact with scientists and discussions about urgent problems they face in everyday life described above (reduction of fish stocks, problems of law enforcement, cultivation of land, cattle breeding, hunting, infrastructure maintenance and development), could allow them to more clearly formulate a request and, possibly, write a grant proposal that would improve the wellbeing of the village (e.g. cleaning

up water supplies, building a bridge, upgrading the roadway, building a culture house and a new school, and organizing care for the public garden or cemetery).

Although the Kajbasovo Research Station was deliberately constructed away from villages and its interactions with local communities are mainly indirect, the station's activities result in significant benefits of direct relevance to local communities and also global interests, for example in researching feedback to climate and needs for conservation. By working closely with the local authorities and gaining their trust and respect, the station's activities can be translated into important regulations that promote sustainable development of natural resources. However, the station is not complacent. It plans to increase and improve its important role within the local communities.



The Krivosheinskiy District hunting grounds.

Examples of important livelihoods

Fishing in the Tomsk Region is practiced a) at an industrial scale by nets in fish farms operated by private consortia or middle-sized companies cooperating with local authorities and b) at a small scale for local residents' private needs (recreational fishing) by rods in the Rivers Ob and Tom (nets are prohibited to conserve biodiversity and fish stocks). The Tomsk Region is the only region in Western Siberia where recreational and industrial sterlet fishing is allowed.

The hunting regime in the Tomsk Region is determined by the federal hunting rules, taking into account regional peculiarities and established by the decree of the Governor of the Tomsk Region No. 89, "On the determination of the types of permitted hunting and hunting parameters in hunting areas on the territory of the Tomsk Region, except for specially protected natural areas of federal significance" (2013).

This decree as well as other rules and regulations apply to the whole Tomsk Region including the Krivosheinskiy District where the Kajbasovo Station is located. Hunting resource limits are different for different districts and depend on the animal populations in each of them. For the Krivosheinskiy District there are the following hunting quotas given for the 2019 hunting season: bear – 49; common badger – 97; moose – 69; Siberian sable – 250. In the 2017 summer season, 4 individual adult bears were observed near Kajbasovo Station. In summer 2018 one adult specimen with 2 babies was observed.

In 2017, 80 secured hunting areas were formed in the Tomsk Region. A large hunting group is the Tomsk Regional Society of Hunters and Fishermen. The area of public lands is more than 30%, but most of these territories are located at a considerable distance from populated areas. It means that the creation of new secured hunting grounds can continue depending on the local population's demands. In Krivosheinskiy District, the main hunting territory allocated to the local branch of Regional Society of Hunters and Fishermen is about 60% of the total allocated hunting area. Another part of the hunting territory is generally accessible to public. Hunting is prohibited on the Protected Reserve "Pershinskiy" which is 10% of the territory of the Krivosheinskiy District.

The gathering and harvesting of berries, mushrooms and pine nuts is practiced by individuals who sell their produce directly and by individuals who work for companies that retail their products. There are few Regional Laws and Governor Decrees that apply to harvesting and gathering wild berries and mushrooms for all the Tomsk Region including the Krivosheinskiy District. Generally, cropping and harvesting are regulated for the sustainable use of natural resources. Every year, the periods of permitted gathering of berries, mushrooms and pine nuts as well as the amount of penalty for breaking the rules for different types of offenders (individuals or enterprises) are established by local administrations.



Gathering and harvesting natural resources is prohibited in the nature reserves, except for the personal use of local people who constantly live there. For example, the yield of cedar (pine) nuts in 2019 in the forests of the Tomsk region is projected at a level above the average; cranberry, lingonberry and blueberry harvest is expected to be average. That forecast was made together by TSU scientists and specialists of the regional administration. According to the forecasts of the Department of Natural Resources and Environmental Protection, the total stock of mushrooms in the Tomsk Region in 2019 will be 86 thousand tons; the stock of lingonberries, blueberries, and cranberries will be more than 25 thousand tons; and cedar (pine) nuts will be about 30 thousand tons.

Kajbasovo Station

The Kajbasovo station is situated in the Tomsk region, more specifically in the Krivosheinskiy District. The Krivosheinskiy District is a set of villages and settlements in the floodplain of the middle course of the River

Ob, about 4,380 km² in size. Its administrative centre lies about 170 km northwest from Tomsk. The population of the area is 12,300 people (2017).

The Kajbasovo Station is within the Krivosheinskiy District of the Tomsk Region and situated in Western Siberia in the Middle River Ob area. The Kajbasovo Station has 28,000 hectares as the main research area and about 0,18 hectares for station infrastructure. These lands were given to Tomsk State University (the station's owner) for an unlimited time by local authorities with approval of the Tomsk Regional Administration.

5. Making partnerships between research entities and Indigenous peoples and local communities

Based on the varying case studies' experiences, chapters 5 concentrates on the process of making partnerships and models of cooperation. This includes the research stations' initial incentives to collaborate, their current models of cooperation, and their considerations when establishing relationships. Their experiences and current models are used as examples and analyzed from an Indigenous perspective. Some suggestions for improvement are given.

Institutions have a central role in 1) building capacity among society to adapt to change, and 2) addressing inevitable socio-economic and ecological trade-offs among adaptation options (Gupta et al. 2010). Institutions can mediate individual and collective responses to changes by providing incentives, where institutions also can create conditions for social learning when individuals or groups share experiences and ideas to resolve complex challenges together (Armitage et al. 2011). With this understanding of institutions' roles in society, Arctic institutions also need to focus on capacity-building among local communities in the Arctic.

5.1 Incentives for collaboration to interact

Why cooperate with local communities? Arctic communities are located in areas that experience the changing environment. The people living in these communities are the first observers of changes in their region and are the people who must adapt to these changes. Changes in the Arctic will have an enormous impact on the people living in the Arctic; changes in nature can cause changes in animal behaviours and patterns; changes in vegetation affect harvests and migrations with animals; changes in ice make movement and travel on ice more dangerous. These are a few examples of changes which people must adapt to, and that affect the local communities. Some communities might have to reorganize their whole economies, livelihoods and subsistence practices because of these changes. This reorganization can come with enormous costs including learning new methods for hunting, gathering and migrating. On the other hand, the changes can provide opportunities for the communities to, for instance, gain access to and provide the global market with their own products.

To sustain long-term cooperation, it is important to consider incentives for all parties involved. Incentives come in many forms and can vary between persons and communities. Without incentives, interest in continuing activities is likely to decrease over time. As incentives change over time and are person/community dependent, sustained dialogue ensures the specific cooperation adapts over time (Topp-Jørgensen & Rasch 2019).

Arctic Station

The local community's rationale to cooperate with Arctic Station is that Qeqertarsuaq citizens can only influence regulations on the use of living resources by providing information to the municipality and government administrations. Therefore, knowledge (both local and scientific) of ecosystem, climate, and societal changes are important. Cooperation with Arctic Station also offers job opportunities as field assistants or managers of the station, its facilities and services. There is also an interest in using Arctic

Station's facilities and knowledge in the local school system and public education. The local community therefore sees many opportunities for cooperation with Arctic Station (Topp-Jørgensen & Rasch 2019).



Dialogue meeting at Arctic Station (Morten Rasch).

According to Topp-Jørgensen & Rasch (2019), the Government of Greenland sent proposed quotas and regulations in a hearing for the quota setting process to municipalities and non-government organisations (e.g.

the fisher and hunter organization KNAPK). The legislation states that regulations should be based on local knowledge. Input to the hearing process based on observations or many people's perceptions is more likely to have an impact on the decision-making process than individual person's opinions. Coupling local knowledge and Arctic Station's scientific knowledge could therefore give the administrative office and citizens of Qeqertarsuaq a powerful voice in the harvest regulation process.

Arctic Station identified three main reasons for building stronger ties with Qeqertarsuaq:

- Need for local support functions (staff needed for run of facility, logistics, field assistants, etc.)
- An obligation to share knowledge generated at the station (both in outreach and educational contexts)
- Interest in coupling local and scientific knowledge (utilising the knowledge embedded in the local community in combination with the scientific knowledge generated at the station)

Arctic Station relies on locals for a variety of tasks at the station (e.g. running the station, gathering data, etc.) and feels an obligation to share knowledge generated at the station with the local community. Additionally, Arctic Station acknowledges the local community's knowledge about physiological and ecological processes are relevant for studying both land and marine ecosystems.

Kevo Station

Incentives to collaborate in INTERACT WP9 case studies include: Kevo Station has been an active part of the local community ever since it was built in 1958. There has been research on locally, economically important animals and plants such as the Atlantic salmon, reindeer, cloudberry, angelica, etc. From the very beginning, the station has been open to social science and humanities research focused on the local community as well as natural sciences. Local people have been employed by the station and these staff members have been an important link between the scientists at the station and the local community. There has been regular cooperation with local schools and the station (students visit the researchers and vice versa). Also, Kevo scientists offer their expertise to local administration e.g. the municipality, Metsähallitus, etc.

From the research station's perspective, one reason to participate is that the university they follow mentions cooperation with local people in their mission. The station's founder, Prof. Paavo Kallio, already believed

research conducted at the station would benefit the local people and society in 1958. Nowadays the station thinks, in addition, that the local community's knowledge can benefit the station's science.

Rationale for engaging with local communities and administrations: One of the four main topics in the University of Turku strategy is making the university "a catalyst for social well-being and the economy." Kevo Station carries this mission out in its local environment. According to the station: "since establishing the station, it was a purpose that also local people would be taken into account in the research that was done in the station" (Saressalo 2017).

The station states that science is for everybody and it's Kevo Station's responsibility to communicate with local communities and administrations. Kevo Station belongs to the Biodiversity Unit of the University of Turku, which focuses on public outreach. The university's three missions are research, education and social impact, making societal impact and interaction of key importance.

Incentives for local communities to participate in research station activities: According a public servant representing Ohcejohka municipality, the municipality doesn't have an adaptation plan for environmental change yet. However, they are welcoming for the ideas and are hoping to include some contribution or at least ideas in their next municipality plan. According to the station staff and municipality representative, Kevo Station itself is important for the municipality. They already cooperate through summer school, school visits and open-door day examples.

Sámi reindeer herding cooperatives including *siidas* observe everyday environmental change. They also want to contribute to science, make direct suggestions about research topics, and advise on methods. When projects/research projects are related to reindeer husbandry, the reindeer herders themselves should always be heard and involved from the beginning of the project (Fishing communities, hunting clubs, the village and Sámi organisations did not participate in the local meeting arranged at Kevo Station).

Kajbasovo Station

Shadyko Morozova et al. (2019) summarized the station's relationship with the local community prior to the start of the case study as "indirect" – through local administrations including leaders of settlements – and "direct" – including interactions with individual members of local communities on an ad hoc basis.

From the station's perspective, contacts with local communities, both indirectly through local administrations and directly through individual contacts are very important and driven by:

- A need for local knowledge on topics relevant to formulating research projects;
- A need for local knowledge on topics relevant to monitoring and formulating conservation strategies; A need for local knowledge on topics relevant for suggesting regulations on hunting, fishing and gathering;
- A need for practical assistance varying from recording environmental characteristics for researchers to construction operations (buildings and roads);
- Local people provide valuable assistance in helping with security issues for both infrastructure and equipment.

The aims of the cooperation from the Kajbasovo research station perspective include the points listed above. In addition, the station implements projects in the field of social sciences and humanities (e.g. anthropology) as well as in the natural sciences and depends on collaboration with local communities for these studies. The station is a convenient place for specialists to make visits to nearby villages to study their lives and socio-economic situations. Anthropologists act as intermediaries between the population from one side and

administrations/legislative bodies from another. Consequently, they work with locals not as objects of research, but as partners in the exchange of knowledge and information. Through representation of local opinions and issues to local authorities, researchers including anthropologists help local peoples exert “soft power” (Shadyko Morozova et al. 2019).

5.2 Current models of cooperation recognized in the case studies

Arctic Station

Arctic Station has a long history of employing local Qeqertarsuaq residents as station staff (e.g. site manager, research vessel captain and staff, cleaning staff, field assistants, etc.) and requiring services from the local community (e.g. facility, vehicle and equipment maintenance tasks). The local school also visits the station on an ad hoc basis and the station has had some contact with the high school in Aasiaat. Much of the cooperation to date has relied on the manager of Arctic Station and this person’s interest/willingness to engage the local community. Recent years have seen shorter employment of station managers (< 3 years), which hampers the possibilities of building strong ties and cooperation with the local community (Topp-Jørgensen & Rasch 2019).

Arctic Station therefore wanted to investigate options for a more formal and sustained cooperation with Qeqertarsuaq. The cooperation should be agile, meaning Arctic Station and Qeqertarsuaq continuously discuss the relevance of existing and new ideas to ensure the cooperation remains relevant to both parties.



When deciding on the type(s) of cooperation, it is important to consider the requirements for human and financial resources. The development of the cooperation may require more resources than what is normally spent on outreach. Cooperation may, however, also make the daily management of the station more efficient, reduce conflicts, and end up being a net benefit for the station (Topp-Jørgensen & Rasch 2019).

Kevo Station

In Ohcejohka, Kevo Station’s current activities in cooperation with local people are:

- Annual open house day: where programs for adults and children are provided. For these events the station has tried to get visiting lecturers to tell about the research they have done on the area.
- Annual visits from the local school (one age class): the 8th grade in Ohcejoganjálmmi school has visited the station to familiarize with the activities for many decades.

- An introduction of the station and its activities is available for visiting groups upon agreement: local companies have brought groups to get to know the station. Also, local schools and kindergartens make visits.
- Summer high school (cooperation with the local high school): a children's university and science camp for children were organized at the station
- A traveling Kevo-exhibition (science and history of the station) was on display at the local community center (Kevo-arktista arkea, June-September 2018, Áilegas center in Ohcejohka)

The municipality and local people cooperate in research and municipality development but there are not formal agreements on these activities.

Collaborative initiatives developed in Kevo Station are mostly science-driven, and some are developed jointly with the municipality. Not many initiatives have been done together with the local community or reindeer herders. Station staff say they have not received direct research requests from reindeer herders or Indigenous people, but many times the needs are similar for both reindeer herders and researchers. Kevo Station is not really focused on reindeer research, as there is a station for that in Kaamanen.

In the case study, it turned out that Ohcejohka municipality has ongoing cooperation with tourism enterprises and reindeer herding cooperatives to plan tourism development and areas. Reindeer herders take part in planning tourism areas so reindeer migration is taken into account. They have received good feedback from the reindeer herding cooperatives for this cooperation model, and particularly for being part of the planning from the beginning. This example could be used at the research station and in research projects too.

Kajbasovo Station

In addition to the detailed work on hunting, fishing and conservation, there are many collaborative projects at Kajbasovo Station. Shadyko Morozova et al. (2019) listed a few examples in the case study that are gathered below. These include collaborative projects with immediate value to local communities and projects that have wider and longer-term relevance.

Following the environmental consequences of land abandonment: Land abandonment and depopulation of the villages is taking place. This has consequences for biodiversity, carbon storage and biospheric feedback. Meetings between local communities, Kajbasovo researchers and international scientists is allowing a chrono-sequence of land recovery to be constructed. Over decades, the multidisciplinary project will document the processes that follow from land abandonment. Such projects lead to an understanding of climate change impacts (e.g. e-carbon cycling and albedo) that add to large-scale international agreements on climate change.

Conserving soils: Conditions of agricultural soil in terms of both fertility and erosion are highly relevant to agricultural activities. Erosion is caused by wind, floods and changes in the river channels, and uncontrolled logging. The station documents and predicts these processes and works with local communities on remedial measures. For example, researchers contribute to social activities, such as involving school children in planting new trees.

Producing honey: TSU researchers work with bee diversity, abundance and activity such as flower preference over a large region, including population sampling in Kajbasovo. They also work on the genetics of bee populations that could be relevant to beekeeping in the Kajbasovo District and advise beekeepers on

security from potential bear encounters (Shaduyko Morozova et al. 2019). Local people from a wide area contribute to this research but, as there is only one beekeeper near Kajbasovo, the cooperation here is limited.

Cooperation with the local authorities started at the station's planning stage. Since then, there has been continuous contact on issues related to the formal legislature for the station, its research and monitoring activities. As the leaders of settlements in the area are represented in the local authorities, local peoples were involved in the development of the station and its activities since the planning phase. In addition, as mentioned above, specific contacts on various issues can arise spontaneously on an ad hoc basis (Shaduyko Morozova et al. 2019).

5.3 Initial contacts and precautions when making partnerships with Indigenous peoples and how to maintain cooperation

Research stations' cooperation with local communities should be developed as part of each station's strategy. Very important in whatever cooperation with Indigenous peoples and local communities is that they are involved in planning, designing and mapping from the very beginning. This requires knowing the communities, understanding their seasonal work schedules and approaching them with respect in a culturally sensitive way.

Arctic Station



'Open House Event' at Arctic Station's field hut outside Qeqertarsuaq – one of the results of the dialogue (Morten Rasch).

Before Arctic Station engages in cooperation with local communities, it is important that the station consider their overall aim in working with the local community (described above and under rationale), potential types of cooperation, and willingness to spend relevant resources (human and/or financial) on sustained cooperation. Time and open, engaging and welcoming dialogue are important to build trust and initiate cooperation. The station should consult the local community to identify potential stakeholders and invite these for a meeting/workshop to discuss opportunities and interests in establishing cooperation. This is an important phase where parties get to know each other more (depending on the previous situation) and build trust (Topp-Jørgensen & Rasch 2019).

It may take several meetings and informal talks to initiate the process and develop a plan for who to invite and how to identify and develop cooperation ideas. While it is okay to have ideas about potential areas of cooperation, it is important to keep an open mind and create an atmosphere of cooperation where

participants feel truly engaged and their ideas and viewpoints are heard and respected (Topp-Jørgensen & Rasch 2019).

All potential partners in a cooperation agreement should be involved from the onset of the development phase. Having influence on the content of cooperation should facilitate a feeling of ownership, true engagement and partnership. Depending the local circumstances (e.g. culture, history of cooperation, size of community, etc.), meetings and workshops about potential cooperation can include a few key partners or be open to the public. If needed, more than one meeting/workshop should be held to agree on a process and develop potential ideas for cooperation. The agenda should provide opportunities for all parties to air their views (Topp-Jørgensen & Rasch 2019).

Kevo Station

The Kevo Station states that station staff often communicate with local actors when station researchers or projects need information from local actors in their work, such as reindeer herding, grazing or fishing. Therefore, issues of cultural sensitivity, Sámi, reindeer herding or local customs are discussed at a practical level. The contacts and local knowledge of the local staff at the station help to contact the local community and maintain the cooperation.



Local meeting at Kevo station in June 2019.

In the case of research directly aimed at local people and communities (primarily socioeconomic and humanities research), it is often the case that researchers are already familiar with local communities and already have their own contacts therein. For example, a study on “Ethical Principles for Sami Health Research in Finland” involved the local person from the very beginning. If necessary, the station also helps and advises humanities scientists to find local contacts for their research.

Kajbasovo Station

Cooperation is developed in various ways in Kajbasovo. Local authorities contact the station and its researchers to ask for specific data and research, observation and monitoring activities related to sustainability of environmental resources, conservation and hazard prevention and mitigation (e.g. floods). Local people contact the station’s researchers on an ad hoc basis. An example is contact to understand changing regulations on fishing and hunting and openly discussing the implications of regulations with someone independent of the authorities. In addition, local peoples contact the station, rather than local authorities, to inform and discuss their views on impacts of resource extraction and use the researchers as mediators. However, it is necessary for social scientists to gain the trust of regional and local authorities in their research activities (as well as the trust of the local communities) and ensure the authorities’ perception of their results is analytical information for decision-making. The station contacts local authorities to seek permissions and collaborates in developing research and monitoring infrastructure and local infrastructure such as roads. Also, station researchers proactively start collaborations with the local authorities and seek permissions to work on endangered species. The station contacts local people to request information, practical help and help with research and monitoring activities. Also, the station proactively seeks to support the security of local people, for example in protection from bear attacks (Shadyko Morozova et al. 2019).

Maintaining contacts

One way to maintain the contacts is to make an agreement. Such agreements should be written so that all parties involved know the preconditions for the project and what will be required, not only of the traditional knowledge holder but also the researcher (Jonsson-Nordin 2011, 107).

Arctic Station

A cooperation agreement according to Topp-Jørgensen & Rasch (2019) between the research station and local communities can include:

- Introductory statements by the station and local community representatives/groups on the intention to cooperate
- Description of cooperation activities
- Plan for evaluation and possibly adaptation of agreed cooperation (including who should call for the meeting and how frequently)

The agreement to enhance cooperation has not been formalized into an agreement document. Currently, the Arctic Station is considering the best options for integrating cooperation in the management of the station (e.g. in strategy documents, public brochures, job descriptions, or similar). Meanwhile existing collaborations continue and new cooperation ideas are being developed. The agreed plan for cooperation should be assessed and evaluated at regular intervals (annually or every 2-5 years) including regular and informal talks to evaluate and adjust the activities at any time (Topp-Jørgensen & Rasch 2019).

Kevo Station

A vague cooperation agreement was negotiated between Kevo Station and the municipality of Ohcejohka on the previous rector's initiative in 2016. According to the station, it was signed by the municipality and the university, not Kevo Station, and it did not bind the parties in any way. The agreement listed potential areas for cooperation from the station's perspective, such as:

- School cooperation e.g. visits from kindergarten to upper secondary school at Kevo Station, visits by staff and researchers at the station, and teaching in schools;
- Arranging the Ohcejohka-Kevo summer high school (Ohcejohka-Geavvu-Geasselogahat);
- Research supporting livelihoods in Ohcejohka (tourism, fishing, reindeer herding);
- EU and other projects benefiting from regional development funding opportunities.

Otherwise, the station does not have any special cooperation agreement with the people of the local communities (reindeer herding cooperatives, Sámi Parliament, etc.).

Kevo Station has agreements with Metsähallitus concerning several separate sites (long-term research projects and structures on state-owned land) and a more general agreement regarding Kevo's research and teaching activities on state-owned land and protected sites in Ohcejohka. Where these targets are located on reindeer pastures and may affect reindeer herding, they have also asked for permission from the reindeer herders from respective herding districts. Metsähallitus contracts are fixed-term contracts and are automatically renewed at certain intervals. A large-scale forest frontier arboretum experiment, established in the 1970s, is the subject of an agreement between the University of Turku, the Natural Resources Center and Metsähallitus. This was renegotiated in 2019.

Kajbasovo Station

In the Kajbasovo case, the only formal agreements for cooperation are those between the local authorities and Tomsk State University for the land and infrastructure and for permissions related to research in protected areas. The main responsibility for financial support is from Tomsk State University. As station activities grow and as the local communities' need for science-based knowledge increases with accelerating environmental change, new agreements may be needed. Still, there will be the problem of developing direct and formal collaboration with local people because they live so far away from the station, they are already represented in the local authorities and there is currently a depopulation of the villages (Shadyko Morozova et al. 2019).

Now and the future

Arctic Station

Suggested cooperation ideas are currently being developed further (and some are already implemented – e.g. the 'Open House Event'). Some ideas require additional resources and thus require applications to be made before they can be implemented (Topp-Jørgensen & Rasch 2019).

Kevo Station

From the station's perspective, they hope that existing cooperation will continue and increase, but there are no clear new concrete openings. The station has previously organized a two-week summer high school where Utsjoki High School (the municipality) was mainly responsible for the activities. However, these summer high schools have not been organized for many years.

What did we find in the local meeting at Kevo Station with the local Indigenous reindeer herders was that the reindeer herders already had a concrete example and call for a cooperation: reindeer herders together with researchers and or research stations could observe the forestation of tundra/growing of bushes and sprouts and analyze results together. This is the reindeer herders' initiative for cooperation and co-research. In general, they must look into building cooperation with the scientists because there are no clear roadmaps yet.

Kajbasovo Station

Activities at Kajbasovo Station date back about 20 years, but the station was formally commissioned only 5 years ago with a major contribution from a group of scientists led by Professor Sergey N. Kirpotin; it is still developing. While its communication lines with the local administration are well developed, its direct lines of communication with local communities (apart from media presentations) are yet to develop substantially. The station will consider developing a communication strategy based on practices elsewhere but only those relevant to the local situation. Example areas where the station could develop further communication include: open days, talks to schools, involvement of schoolchildren in research projects, involvement of local people in undergraduate and post-graduate summer schools, reinstating talks to local communities similar to the practice in the Soviet period, translating into Russian and making available educational resources in English (such as the INTERACT animations), meetings with local people dedicated to specific issues including new co-managed research and monitoring projects, work with SecNet to introduce citizen-science following the examples in Nadym and Scandinavia, initiation and participation of researchers in local cultural events (Shadyko Morozova et al. 2019).

Ways forward

All the models introduced above are, more or less, science-driven and based on the needs of the research stations. Indigenous knowledge is barely mentioned in any of the cooperation or partnership models. We would be happy to see more models of cooperation with research stations that also serve the needs of the Indigenous communities. Of course, these examples were given and developed by the stations. For real meaningful cooperation, inclusion of Indigenous peoples as equal partners as well as valuing Indigenous knowledge is crucial. Otherwise, we can talk only about an illusion of inclusion.

Indigenous communities rarely have been invited as equal partners in research. Therefore it may be necessary to adjust, abandon or invent new methods for knowledge sharing and participation. Collaboration entails respectful exchange – both of perspectives and of responsibilities. Principles such as reciprocity, feedback and giving back are therefore essential to acknowledge (Löf & Stinnerbom 2016, Kuokkanen 2007, Tuhiwai Smith 2012)



EALÁT Information Workshop in Inari in 2008. The participants from Finland – elders, students and politicians. Photo: ICR

The number of scientific articles about vegetation and snow change done in some type of cooperation with Kevo Station or from the area are vast and impressive: Kumpula & Turunen (2018) in Kontula, T. & Raunio, A. (edit.). 2018; Rasmus, Kumpula and Jylhä (2014); Rasmus, Kumpula and Siitari (2014); Turunen et al. (2016); Markkula et al. (2019) and Käyhkö & Horstkotte (2017). Yet none include Indigenous reindeer herders' traditional knowledge in design, collection of data or in results analyses. One article Vuojala-Magga & Turunen (2015) includes interviews with reindeer herders analyzing their past, present and future views on moth behavior and mountain birch growth; it's said they investigate the behavior of the two herbivores by combining Sámi herders' Indigenous knowledge with the results of relevant studies in biology and anthropology. Also, Turunen et al. (2018) includes cooperation with local reindeer herders through questionnaires on reindeer herders' observations about climate change, snow and vegetation changes and autumnal moth destruction in their reindeer herding areas.

Outside the case studies in this work package, the editors recognize SAON (Sustaining Arctic Observing Networks) as a good example in current models of cooperation. In SAON's Strategy 2018-2028 they state that "SAON aims to promote Arctic observing and to mobilize the support needed to achieve full implementation and sustain operations on time scales of decades and beyond." (SAON 2020a.) The work of SAON is introduced in the chapter 3 together with other examples of cooperation models in integrated observation systems.

6. Adaptation and responding to change

Reindeer husbandry, among other Indigenous economies, is facing many changes. These include climate, vegetation, snow cover as well as social changes. “Indigenous reindeer herding in the circumpolar North is threatened by multiple drivers of environmental and social changes that affect the sustainability of traditional family-based nomadic use of pastures. These impacts are exacerbated by Indigenous peoples’ lack of voice in governance strategies, management and adaptation responses” (Eira et al. 2018).

As the Earth’s climate warms, also the northern regions experience changes. While the globally averaged temperature data show a warming of 0.85°C degrees from 1880 to 2012, the northern circumpolar region has warmed approximately twice as much (Käyhkö & Horstkotte 2017). In Finland, for example, the respective warming was 2.3°C and, during winter months, almost five degrees (Mikkonen et al. 2015). Increases in precipitation accompanied by swift changes in winter temperatures are expected to create climate challenges for reindeer herding in the future due to changes in snow cover over reindeer pastures. On the Norwegian side, spring temperature increased by about 3°C from 1922 to 2018. The increase in air temperature above Sámi reindeer pastures is already affecting snow cover. Future climate scenarios indicate that mean winter temperatures may increase by as much as 7 to 8°C over the next 100 years in the Sámi reindeer herders’ pasturelands (Eira et al. 2018). As a result of climate change, coniferous trees are predicted to invade new areas, while coniferous forests are moving further north and up the fell slopes (Kontula, T. & Raunio, A. 2018, 262).



Photo: ICR

Adaptation and adaptation knowledge

We have good knowledge of how to live in a changing environment. The word “stability” is foreign in the Sámi language. Our quest for adaptation strategies is therefore not associated with “stability” in any form, but instead focuses on continuous adaptation to change.

Johan Mathis Turi, Chairman of the International Center for Reindeer Husbandry (ICR), Tromsø, UN Environmental Day, June 2007 (Reinert, Aslaksen, Eira, Mathiesen et al. 2009)

Adaptation is the process in which living organisms or communities change slightly over time to be able to continue to exist in a particular environment or socioeconomical change. Adaptation to cumulative and interacting changes takes place at various societal scales by actors, sectors, and local governments and takes different forms depending on multiple factors, such as institutional capacity, access to knowledge and human and economic resources. Such adaptation takes place with or without national guidelines. Adaptation is either a reactive or a proactive (planned) response to combined effects of change in biophysical and socio-economic conditions. Climate change is not the only or most salient driver of change in the region; it interacts with socio-economic, political and cultural changes and provides both opportunities and challenges for

people (Indigenous and non-Indigenous) living and operating in the Barents area. Adaptation emerges as a process that interacts with society at large (Hovelsrud et al. 2017).

Adaptation requires a wide and diverse knowledge base with multiple players. Local communities and scientists can work together to:

- Identify current and projected environmental changes perceived as important to present and future adaptation strategies.
- Observe, explain and predict changes to the natural environment and the drivers of change. Scientific contributions are particularly important for monitoring and research that require specialized technology and analytical tools.
- Develop and implement integrated knowledge pools and local observing systems that feed into local, national and regional decision-making structures, thus enabling adaptation to change.

The development of such integrated local observing systems will enable communities to monitor how well the local communities have adapted and improve the database from which refined predictions can be made. Although each community will have specific adaptation needs and decision-making structures, each can learn about approaches from other communities.



Photo: ICR

According to IPCC AR5 WG II - Polar Regions Chapter (Larsen et al. 2014 p28.4), Human Adaptation Protection of grazing land will be the most important adaptive strategy for reindeer herders under climate change (Larsen et al. 2015). Developing adaptation strategies using all available knowledge will ensure a more holistic approach; one that offers security and a more predictable future for Indigenous societies in the Barents area. Thus, engaging Indigenous communities and including their traditional knowledge in planning for adaptation action in the Barents area is essential. Universities and colleges in the Barents area should develop a joint collaboration model for adaptation training, based on traditional and scientific knowledge. The University of the Arctic could provide the network and platform for such a collaboration. In this respect, it is very important that the flow of information and insights within Indigenous peoples' communities is increased in the direction of both scientific study and policy implementation (Degteva et al. 2017).

6.1 Identifying the changes

Arctic Station

Topp-Jørgensen & Rasch (2019) describe the changes in Qeqertarsuaq as follows:

- Harvest of living resources impact species abundances.
- Climate change is influencing species distributions and abundances.

- Sea ice conditions and snowmobile use drives a change in hunting and fishing practices away from the traditional dog sled to snowmobiles and dinghies.
- Local fishermen fear that bottom trawling may damage benthic ecosystems.
- Exploration for oil (last offshore drilling took place in 2011) and lost fishing gear constitute potential pollution risks for the fragile arctic environment.
- Administrative changes (reducing the number of municipalities in Greenland from 18 to four (recently changed to five)) lead to a decrease in public jobs in Qeqertarsuaq when municipal administration offices were moved to Ilulissat and later Aasiaat, thus affecting local employment opportunities.
- General urbanization leading to movement of people towards larger towns (increased with the decrease in employment opportunities described above).
- Potential development in the tourism or oil industry (the latter seems unlikely at present).

Kevo Station

The reindeer herders around Kevo Station mentioned many environmental and socioeconomic changes, including land use changes unrelated to climate change. The winter has become shorter from both ends: the fall is longer and the spring starts earlier. It is nearly impossible to forecast and predict the weather. In winter the lakes freeze slower and later. By Christmas, there is barely a “real” winter nowadays. Also, what is prominent is rain in the winter, which makes the pastures and grazing for the reindeer very difficult. From the Gáldoaivi reindeer herder collective’s perspective, “Now the situation here in Ohcejohka is that winter is getting shorter both from the beginning and at the end of the winter and it is nearly impossible to forecast and predict the weather. In winter the lakes get ice slower and later.



In Yamal. Photo: ICR

The closer to the Arctic sea you are, the more likely there are rains in the winter and ice layers on the ground. Spring comes earlier.” But the worst is still yet to come: “We have not seen the change to the worst of climate change on reindeer conditions yet.”

Sámi reindeer husbandry has faced increasing encroachments from other forms of land use, such as forestry, strictly protected areas and tourism, changing the vegetation not in favor of Sámi reindeer husbandry. Research shows the negative impacts of human activity and infrastructure on the reindeer

pastures, habitat selection, physical conditions, etc. (Skarin and Åhman 2014; Jaakola, L. 2014; Kumpula, J. et al. 2007; Anttonen, M. et al. 2011; Rytönen, A-M. et al. 2013; Kitti et al. 2006). This is a threat for the Sámi reindeer husbandry in Ohcejohka too, as the local herders highlight the other land use as the biggest threat to them. According to Vuojala-Magga & Turunen (2015) – five years ago and currently – there are no other major land uses competing with reindeer herding in the Gáldoaivi and Baišduottar cooperatives, but there is a threat that mining activities will start in the future, as licenses have been granted to companies for test drilling. In the Sámi herding area, special attention should be paid to safeguarding reindeer husbandry against encroachment by other land uses (Vuojala-Magga & Turunen 2015). Here tourism and strictly protected areas are probably not taken into account.

Reindeer herders also mentioned they remember how the environment has changed a lot in such a short period: “Moss and roots growing fast, covering and killing lichen. What comes to the treeline in tundra, sprouts have grown which causes the treeline to move up and the tundra area gets smaller.” Another Gáldoaivi reindeer herder adds up: “Autumnal moth is not a threat for the reindeer husbandry. A real threat – which has increased in the past 5 years – is other land use which leaves a huge number of tracks and marks on the grazing land. I see it important to increase the cooperation between reindeer herders and the researchers because the herders hold up so much knowledge on the environment since they spend so much time out there.”

The research station sees tree lines moving in a different light: climate change is mainly thought to impair the quality of habitats, but it can also have positive effects. For example, increasing tree growth will of course benefit tree-type habitats and treeless habitats will suffer accordingly (Kontula, T. & Raunio, A. 2018).

Another challenge is the increased traffic of tourism on the land in the summer, especially ATVs. Hunting licenses to hunt moose for non-local inhabitants, increased use of dogs for hunting, as well as increased number of illicit routes in forest and tundra affect the grazing lands. Reindeer have started to avoid these moose hunting areas. Monitoring and observing these illicit routes in the fell area is very difficult. They can report these routes to the municipality and Metsähallitus, but who is eventually responsible for these and how they can be tackled? One solution that was talked about in the local meeting was, in cooperation with the research station, satellite data could be used in this research.

Kajbasovo Station

In Kajbasovo, the process of changing the land use system began in Soviet times in the beginning of the 1970s. Government policy was aimed at enlarging settlements. In small villages, for example, schools were closed and their inhabitants were simply forced to move to larger settlements. As a result, hundreds of small villages along the River Ob were abandoned and eventually disappeared. When people left, the vast areas of the floodplain of the Ob and its tributaries were no longer used as hayfields and pastures by families, and some areas of the floodplain began to be covered by shrubs and trees.

An even more fundamental change in the land use system occurred after the collapse of the Soviet Union in 1989-1991. Before this time, the Soviet Union’s large collective farms fulfilled the Government’s plan for agricultural production and even townspeople were involved in haymaking in the floodplain, including students and research workers (the so-called city assistance to the village). According to official statistics, research and observation by scientists at the Kajbasovo Station, about 20% of former hayfields and pasture areas in the Krivosheinskiy District are abandoned now. The local ecosystem changes caused by social and political factors in the station’s research area are now becoming the topics of research projects (Shaduyko Morozova et al. 2019).

Other changes mentioned in the Kajbasovo case study relate to fish stocks, sustainable fishing, beaver and bear population changes and impacts. These are direct impacts of changes in the local economies and livelihoods which relate to the land abandonment described above.

6.2 Contacting the partners of collaboration

Arctic Station

The manager of Arctic Station approached the local municipality office to express interest in exploring the potential for increased collaboration with Qeqertarsuaq and to discuss relevant stakeholders that could be involved in potential cooperation. Arctic Station and INTERACT drafted an invitation for an open meeting in Qeqertarsuaq to explore local interest and ideas that could be explored further. The invitation was translated into Greenlandic with the help of the local administration office and thereafter sent to relevant stakeholders, posted on notice boards in town and posted on the community's Facebook page. Key stakeholders were also approached individually to explain the purpose with the event and provide an invitation. (Topp-Jørgensen & Rasch 2019.)



Notice board in Qeqertarsuaq (Morten Rasch).

Kevo Station

In the Kevo case study, ICR contacted the local reindeer herding cooperatives and discussed the best timing for the local reindeer herders. There are two reindeer herding cooperatives in Utsjoki municipality: Gáldoaivi and Baišduottar. The work was planned and compiled by respecting their seasonal work, as the fall and winter until April is the busiest season in the Utsjoki area and the fishing season starts in June. The municipality was of course seen as an important participant. After talking with different researchers, ICR also decided to invite a research ethics researcher to the meeting because guidelines were on the agenda.

Kajbasovo station

According to Shaduyko Morozova et al. 2019, the Kajbasovo Station is not situated in or near a village or community. Additionally, Indigenous peoples are integrated into the settlements and do not have their own councils. This limits the direct contacts between the station and local communities. However, the station interacts with the communities through contact with local administrations that include settlement leaders with local community representatives on an ad hoc basis. The local stakeholders are the Department of Natural Resources and Environmental Protection of the Regional Administration in Tomsk Oblast, the Regional Committee for Environmental Protection and Nature Management, Tomsk Regional Public Organization "Tomsk Regional Society of Hunters and Fishermen," Tomsk State University, Institute of Soil Science and Agrochemistry of the Siberian Branch of the Russian Academy of Science, Novosibirsk, Forest Institute of Siberian Branch of the Russian Academy of Science in Krasnoyarsk, private farmers, state collective farmers, and National-Cultural Associations (Northern Indigenous Peoples) (Shaduyko Morozova et al. 2019).

6.3 Decision-making processes related to local socioeconomic factors

Arctic Station

Living resources in Greenland are managed within a frame of laws (i.e. fisheries law and hunting law) with species-specific executive orders describing management regulations and procedures. For species with restrictions, quotas and hunting/fishing season length regulate harvest levels. Population-specific harvest levels and the most hunted species are determined for commercial fisheries by the Department of Fisheries and Hunting in Nuuk – more than 500 km from Qeqertarsuaq (Topp-Jørgensen & Rasch 2019).

Harvest levels are proposed by the department based on advice from the Greenland Institute of Natural Resources and/or international advisory organisations (e.g. North Atlantic Marine Mammals Commission – NAMMCO, International Whaling Commission – IWC, North Atlantic Fisheries Organisation – NAFO, Northeast Atlantic Fisheries Organisation – NEAFC). Proposed quotas/harvest seasons are sent out for hearing in the Hunting Council and in relevant stakeholder organisations (e.g. municipalities and Greenland's Fisheries and Hunting Organisation - KNAPK). Both municipalities and stakeholder organisations may include local communities' views in their responses to proposed quotas/harvest seasons. This means that the people in Qeqertarsuaq can influence their local catch levels of regulated species through their input to the municipality or to the fisheries and hunting organisations. Since the introduction of quotas, there have been several examples where communities were able to increase their permitted harvest levels after their quotas were used before the end of the hunting period by contacting the minister directly or doing so through the press (Topp-Jørgensen & Rasch 2019).

In 2009, the Department of Fisheries and Hunting initiated a project (PISUNA) to develop community-based monitoring of living resources. PISUNA has been in operation in a few Greenlandic communities (including the Disko Bay area), but the department finds it difficult to use this information when compared to advice from the Greenland Institute of Natural Resources based on conventional scientific methodologies. Hence, local communities often feel that decisions regarding use of the natural resources are taken far away from the resource users and sometimes do not reflect local perceptions (Topp-Jørgensen & Rasch 2019).

In Greenland, municipalities make some decisions related to some living resources. This includes possibilities to further restrict harvest activities or distribute quotas between settlements within a management area and between occupational hunters and leisure hunters. The hunting law also makes provisions for local management of living resources. Today this is to some extent implemented in an area in Southwest Greenland (Ivittuut), where local people make minimum count surveys used by the department to set quotas. Within the current management regime, Qeqertarsuaq and Arctic Station can therefore only influence decision-making by documenting and communicating local changes with the regulations proposed by local and national decision-making entities (Topp-Jørgensen & Rasch 2019).

Kevo Station

Findings from the Kevo case study are that, from reindeer herders' point of view, some of the changes affecting their livelihood are other land users, illicit trails and paths crossing the grazing lands. They can contact the municipality but observing and monitoring is difficult. These are Metsähallitus responsibilities. From herders' perspective: a real threat – which has increased in the past 5 years – is other land use that leaves a huge number of tracks and marks on the grazing land. For them it is crucial to increase cooperation between reindeer herders and researchers because the herders have so much knowledge on the environment from spending so much time out there.

Reindeer herders also wish to continue good cooperation with the municipality on the land use plan. They are willing to enhance or improve their cooperation with Metsähallitus and the Finnish wildlife agency to better plan land use. Reindeer herders say they receive inadequate support; the municipality, Metsähallitus and the state make their own plans and businesses. Herders have very little resources to work with governance issues and they have tried to find cooperation partners to work with that can support them, economically too. Even though reindeer husbandry is one of the biggest economies in Ohcejohka municipality, they still face some challenges. Yet reindeer herders feel that it is difficult to get their voice included in some municipalities, and they thank the municipality for good cooperation.

According to local experiences in Ohcejohka, a lot of pressure for the municipality comes from the south (governmental administrative hub). Very often the rest of the country believes nature in Northern Finland should be kept as big an area as possible without people. But the people up there are connected to, use and live in nature. The local view on nature is that they use it in a sustainable way. Ohcejohka municipality supports reindeer herding, for example, by telling the other authorities that hunting is disturbing reindeer husbandry. They also oppose the extractive industries and big power plants in grazing lands. However, land use is still a main issue for reindeer husbandry. One upcoming change people notice is tourism's increase in Ohcejohka. Reindeer herders, cooperatives, and the concept of sustainable development are always included in negotiations with the municipality from the beginning.

Metsähallitus manages most of the land in the Sámi Homeland area in Finland. There are agreements regarding Metsähallitus forestry, forest management and related activities. For example, the Sámi Parliament, reindeer herding cooperatives in the area, the Skolt village and Metsähallitus have an agreement on forest management instructions and procedures. In the Sámi Homeland region, there are more specific local agreements regarding state lands and agreements about reindeer herding with reindeer herding cooperatives (Metsähallitus 2020b).



Bridge in Ohcejohka on the river Deatnu. Photo: Svein Mathiesen/ICR.

Deatnu river fishing rights faced changes in 2017 due to the renewed Deatnu River fishing agreement. As Aslak Holmberg (2018) writes, fishing in Deatnu is regulated by a bilateral agreement between the states of Finland and Norway. In the summer of 2017, new fishing regulations were imposed on Deatnu despite strong Sámi opposition. New regulations limit traditional Sámi net-fishing most strongly, while lighter limitations were set

for tourist fishing. Moreover, a new group of fishing rights holders – “non-local cabin owners” – was created. According to fish biologists, new restrictions were made to strengthen the salmon populations of the river. But based on the estimates of stock status in the major tributaries of Máskejohka, Veahčajohka and Ohcejohka, the stocks were doing well with the previous level of fishing pressure. So, traditional fishing was strongly restricted in these tributaries as well. The main reason why Sámi oppose the new regulations is that traditional Saami fishing rights are limited most; at the same time, the regulations deny some Sámi their right to practice traditional fishing methods completely. Moreover, the Saami were excluded from effective participation in the negotiations, which resulted in a neglect of traditional knowledge in the agreement (Holmberg 2018, 2).

Kajbasovo Station

The activities of hunters and fishermen are not just related to market conditions. Their activities are also influenced by the type of control and the severity of sanctions for violations, and these play a significant role in environmental management. Control influences local residents' ways of life and economies in remote areas more than the market, particularly as most local hunting and fishing is for local use. Although the scientific studies (e.g. animal, fish populations, water, soil conditions studies, like those by the Kajbasovo Station) are the basis on which justifiable decisions should be taken when developing environmental protection legislation, decisions are made by officials often without connection to data obtained by the academic community (Rakhmanova 2018). The scientific basis for sustainable use of resources is not used to give everyone equal access to a certain natural resource, but to prohibit extraction by certain groups and to grant this right to other groups and communities. Thus, the Indigenous inhabitants and other local peoples in these territories may be legally branded as poachers for years, while their actions, from a humanitarian perspective, could be assessed as a search for ways to survive (Shaduyko Morozova et al. 2019).

Balancing conservation needs, local economy and environmental protection is an activity that requires researchers, local peoples and decision-makers to work together (Callaghan et al. 2019). The Kajbasovo case study (2019) raises the issues that this type regulating effects to the loss of traditional knowledge of the local people: "Earlier, bear meat was purchased in large quantities by special organizations; also bear bile and skin were used. Now, experts who collected and processed bear and beaver products, have grown old and retired, and young people are no longer interested. Consequently, today, neither skin nor meat of beavers and bears attract local hunters, resulting in an additional cause of increasing populations of currently (inappropriately) protected species and greater environmental damage. Such societal changes can affect the physiological well-being of Local People as well as their economy. Also, traditional and local knowledge and skills are being lost" (Shaduyko Morozova et al. 2019).

Ways forward

According to these examples, decision-making is done usually far from the area itself. The Greenland case study proves: "Population specific harvest levels are determined for commercial fisheries and most hunted species by the Department of Fisheries and Hunting in Nuuk – more than 500 km from Qeqertarsuaq." Similarly, the "decisions are made by officials often without connection to the data obtained from the academic community" in the Kajbasovo case study report. The Greenland case study discusses an influence on centrally decided harvest regulations: "The hunting law stipulates that the department must include local knowledge in the management of hunted species, i.e. the hearing process described above. While executive orders stipulate that harvest regulations should be based on biological advice, the orders do not state how local knowledge or observations should be used (e.g. executive order on protection and hunting of muskoxen from 2013). Consequently, local knowledge is rarely used today, when harvest levels are decided (apart from through the hearing process described above)" (2019).

Adaptation to climate change in the circumpolar North demands that local Arctic leaders, such as leaders in the research stations, be trained in long-term sustainable thinking based on the best available adaptation knowledge. This should include both scientific and experienced-based traditional knowledge, as well as incorporate online teaching platforms. Integrated observation systems will be required to build community adaptation in future.

7. Lessons learned and suggested actions for the stations

We found out some well working examples of different types and levels of cooperation. There definitely will be room for improvement in the research stations and the cooperation models they have with the Indigenous peoples and local communities around. We for example found that some research topics are important for the research stations themselves are not exactly those that serve the Indigenous peoples, local communities and local livelihoods the best. Some types of cooperation are already implemented in respective locations and research stations but there could be so much more cooperation that would benefit the Indigenous peoples and local communities. We have gathered our view about the parts that are currently lacking or should be developed and increased in the cooperation for our recommendations in the chapter 2 that are also serving as our result of guidelines in this guide book.

An important aspect for continued and agile collaboration is to formalize contact between the station and the local community. There should be continued exchange of views and ideas related to the different components of the partnership. For example, at the Arctic Station case the University of Copenhagen must consider how to sustain dialogue with the local community with rapid turnover of station managers. Arctic Station initiated a dialogue to develop and formalize the cooperation to maintain the agility of today's cooperation (Topp-Jørgensen & Rasch 2019).

7.1 Ethical considerations: ethical issues in research and science cooperation

Ethics – Research done in communities or by documenting their sources of knowledge should be done without exploiting the communities or knowledge holders. Self-determination is the starting point of Indigenous research ethics as it aims to build an equitable relationship between Indigenous peoples and academic researchers (Juutilainen&Heikkilä 2016.)

When working with Indigenous issues, on Indigenous land and with Indigenous peoples, then cultural sensitivity plays an important role. The ICR Ethical Guidelines (2006) discuss the ownership of the knowledge:

- *We realize the explicit right of reindeer herders to both preserve their TK and determine how it should be used. TK carriers shall play a central part in shaping projects and shall be involved as equal partners in consultation and decision-making. Hence, both TK and SK must be appropriately integrated within a framework of cooperative research.*
- *Because TK is the intellectual property of the people who hold it, it is essential to agree with those people on the rules for the use of TK. Researchers are therefore to abide by the ethical guidelines set out by the respective communities.*

ICR Ethical Guidelines for handling traditional knowledge underline that *all researchers working in the North have an ethical responsibility toward the people of the North, their cultures and the environment. Traditional knowledge is of equal value as scientific knowledge and when traditional knowledge holders' knowledge is used, they have a right to determine how it should be used. Traditional knowledge carriers shall play a central part in shaping projects and shall be involved as equal partners in consultation and decision-making* (ICR 2006). Also, it talks about the value of traditional knowledge:

- *TK is of equal value as SK. The same applies for the different systems of producing, organizing and transmitting knowledge in Indigenous and scientific communities. TK is more than simply a source of enquiry for researchers.*
- *In addition to the cultural value of TK, it also includes an instrumental value. That is to say that TK has essential practical value for the carriers of such knowledge in their day-to-day activities and subsistence, and shall be respected as such.*



Building capacity among Indigenous youth can lead to award-winning results. Team EALLU in Yantai, China in 2018 at International Gourmand Awards right after receiving an award of the Best cook book in the World. Photo: ICR

Capacity building - benefitting the communities (ICR Ethical Guidelines):

- *Capacity building means to empower Indigenous peoples as minorities through increased knowledge, in order to make them able to become truly equal partners in processes with mainstream society. Capacity building thus includes building knowledge in the Indigenous societies themselves, their people, their own institutions and organisations.*
- *All relevant projects shall include capacity building as a separate project-goal. As far as practically possible, the projects should involve some form of evaluation of effects on capacity building. The projects should preferably be designed so that any results of capacity building are made measurable. Object achievements related to capacity building shall also be included in the communication plan.*

Arctic Station

When working with local communities, a station should prepare for the services provided by the local community. The station needs to find a balance for what activities locals should be paid/compensated for depending on who is leading the initiative and its purpose. Arctic Station will continue to pay for local participation when locals contribute to scientist-driven initiatives (e.g. as field assistants). Consider this in light of ICR Ethical Guidelines: *TK has the same value as other professional knowledge, and qualified reindeer herders shall receive the same compensation for their efforts in projects, etc. as senior scientific workers do. They represent the state-of-the-art knowledge in their field, and shall be respected as such.*

When using local knowledge or conducting interviews to be used in scientific reports or publications, it is important to get consent from the involved persons. This needs to include agreement on what data will be stored, where it will be stored, who has access to it, whether data is anonymous or not, and how knowledge/persons should be acknowledged (Topp-Jørgensen & Rasch 2019).

Kevo Station

On ethical issues, the station follows the guidelines of the University of Turku and the Finnish Research Ethics Advisory Board (Finnish research funders require compliance with the projects they fund). Most station research is conducted by visiting teams who are not station staff. They are mainly responsible for the ethical issues of their own research, according to the rules of their own background institution. Of course, Kevo Station will intervene if they notice something that is not going well.

Currently each researcher at Kevo Station mainly manages their own data. Each research project owns its own data, unless otherwise agreed or required, for example, by their sponsor. The research data (mainly monitoring and long-term tests) collected by Kevo Station staff during their working hours is data owned by the research center and the University of Turku. The data collected by collaborative research institutes (Meteorology, Institute of Seismology, SYKE, etc.) is theirs. However, many of them have long agreed that data will also be available to researchers at Kevo Station, and today they are sharing their data as open data. The data collected by the station's own staff is scientific measurement and species data that does not include information collected from local communities or Indigenous people, so Kevo Station does not have a policy or practices in that. This type of information has been collected over the last few decades only by outside station researchers, for whom the station is not aware of the ownership of the data collected.

Kajbasovo Station

According to Kajbasovo case study, there is little sensitivity about cultural issues because the Indigenous peoples are totally integrated into local communities and the Association of Indigenous Native Minorities of the North of the Tomsk Region “COLTA KUP,” TSU and Local Authorities convened a festival of the “Peoples of the River Ob” at Tomsk in May 2019; researchers from TSU participated by giving lectures. A founding researcher at TSU became an official in the “COLTA KUP” Association. This is the only example in which the Indigenous people were separate in their activities from other local people. The contribution of TSU to the event is important because it signifies the intent of the owners of the Kajbasovo Station to support and enhance Indigenous peoples’ issues. Furthermore, TSU, the owner of the station, works with local communities to promote the preservation of threatened Indigenous languages, maintain a museum of anthropology and support anthropological and ethnographic research. (Shaduyko Morozova et al. 2019.)



The challenges of communication and dialogue, an example: “...so they sent some experts from Yakutsk, that came by helicopter. But they only reported that they couldn’t see any reindeer or reindeer herders. That is because we don’t use that area in summer. But still, this area is crucial to us.” Mrs Claudia Tikhonova, Evenk reindeer herder in Obschina “Idjek”, commenting on the process of development of a hydro-electric power plant in their area (Timpton river). EALÁT Khatystyr, 2009. Photo: ICR

Currently, there is no Indigenous environmental knowledge that is identifiable from local knowledge. Consequently, there are no ethical issues relating to ownership of knowledge (Shaduyko Morozova et al. 2019).

7.2 Increased sharing of information in accessible formats including Indigenous languages

Information sharing between research stations and local communities will benefit both. The scientific community enjoys access to information and knowledge from Indigenous peoples and local communities, and the communities enjoy access to the scientific information and knowledge. This is built on the principle of mutual and equal knowledge sharing. One way to achieve better cooperation between researchers, Indigenous peoples, local people and decision-makers is to provoke thoughtful dialogue among them.

Indigenous languages

Most of the documents of the Kevo Station and even the web pages are in Finnish and English. In Ohcejohka, the Sámi language is strong. Therefore, the Sámi language needs to be part of the station in some capacity (as does traditional knowledge). Support for Indigenous languages has had a bigger role since the United Nations International Year of Indigenous Languages in 2019. As ICR Ethical Guidelines (2006) state about language:

- *TK about animals, landscapes, climate etc. is preserved in the language by exact expressions and precise terms for those concepts that are important for exploiting nature's possibilities to support life, and transmitted through oral tradition and firsthand observation.*
- *Cultural and linguistic diversity goes together with biological diversity. It is through the language that TK is available. Native languages shall therefore always be used in communication.*

Moreover, the IASSA Principles state in Article 3: Research results should be presented to local communities in non-technical terms and where possible translated into local languages. Copies of research reports and other relevant materials should be made available to local communities.

Regarding communication and publishing results, ICR Ethical Guidelines (2006) state: *It shall be a goal to make information usable and useful at a local level, and then integrated in larger data sets.*

In the Kevo case, all the current and past collaborative initiatives and activities (annual open house day; annual visits from the local school; an introduction of the station and its activities for visiting groups upon agreement; summer high school; children's university and science camp for children, traveling Kevo-exhibition) are science communication and outreach to the local community among different age groups, executed through different activities. Currently, Kevo Station is the only one of the three case study stations that offers an annual open house for the local people. The idea of these open house days is that the station offers programs for adults and children and tells about the science activities going on. For these events the station has tried to get visiting lecturers to tell about the research they have done on the area or at the station. Both research stations, Kajbasovo and Arctic Station, are planning or recently tried a pilot for this type of activity. They see this as a good opportunity to outreach and communicate about their activities.

Arctic Station is willing to contribute to outreach initiatives in the community, while participation in community-driven cooperation ideas will have to be considered from case to case and depend on requirements and availability of resources (financial/human). Arctic Station will have regular contact with the local municipality office and stakeholders to continuously address ethical concerns with them (Topp-Jørgensen & Rasch 2019).

In the Kajbasovo case study, scientific activities on climate change effects are communicated to local communities (and audiences over a far wider area) through numerous media products presented on TV, newspapers, etc. In addition, educational resources such as the "Changing Arctic" online course on Coursera

(in English) and on the Lectorium platform (in Russian) are resources “Virtual Arctic” is developing in TSU. (Shadyko Morozova et al. 2019).

As ICR Ethical Guidelines underline: *All parties shall be heard by taking draft information back to the communities for review and feedback to be integrated into reports/ publications for local, regional and wider use. The communication / publishing of the results must be coordinated with the stakeholders that include the Indigenous peoples affected by the study.*

8. Conclusion Why This Matters - The Urgency of Arctic Change

Indigenous peoples across the high north regions of the world face unexpected and unparalleled challenges, demanding resilience and adaptive capacity. Climate change exceeding 6 degrees Celsius of seasonal warming are now observed in some Indigenous communities, significantly affecting their economies and well-beings. Nomadic reindeer herding and caribou hunting societies are living on the frontlines of climate change and globalization. They are also guided by generationally inherited knowledge about the environment. Yet past Indigenous peoples' assimilation and ongoing marginalization, including inaccessible decision-making structures and science, exacerbates adaptive capacity to these changes. They are thus faced with urgent and persistent needs to develop creative ways that constructively support the future of their cultures, well-being and daily lives.

These challenges require new kinds of cooperation between researchers and communities that make use of multiple ways of knowing – including science, traditional Indigenous knowledge and local knowledge – to increase holistic understanding, societal resilience and adaptive capacity. This involves focus on community strength, and real interaction between traditional knowledge holders and scientists, where structured transboundary approaches make for better results for Indigenous communities and their leaders. Researchers and local communities must embrace coproduction of knowledge. This calls for increased awareness raising and leadership locally.

We now witness an explosion of research, development and policy agendas in the Arctic, especially regarding climate change and globalization. These are complex realities, and more collaborative relationships will facilitate innovative educational strategies and integrated observation systems. We need future training for leadership capabilities in both station-driven research activities and within Indigenous communities. Training should address long-term sustainable thinking based on the best available adaptation knowledge; this includes both scientific and traditional knowledge, as well as online teaching platforms. Integrated observation systems are required to build community adaptation in the future.

In general the cooperation needs to be increased as Professor Matthias Kaiser suggested in his seminar speech in Science and Traditional Knowledge Seminar in Kautokeino, March 2020: *Let us sit down and learn from each other, let us use these traditions, let us use these different frames of knowledge and these different value systems in order to mix them and to learn from each other"*



Photo: ICR

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Appendix Guidelines and principles:

(ARPA) The United States' Arctic Research and Policy Act of 1984 (ARPA) provides for a comprehensive national policy dealing with American research needs and objectives in the Arctic. The ARPA establishes an Arctic Research Commission (ARC) and an Interagency Arctic Research Policy Committee (IARPC)

(AFN) Assembly of First Nations. Environmental Stewardship Unit. Ethics in First Nations Research. (Ottawa 2009).

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Some sources of information on ethical research conduct for scientists and engineers:

General guides:

*A useful general starting point for ethics in engineering, but with information that applies in most cases to sciences, can be found here: <http://onlineethics.org/>

*The Poynter Center for the Study of Ethics and American Institutions has a variety of case studies and resources: <http://poynter.indiana.edu/tre/index.shtml>

*The Vancouver Rules (Uniform Requirements for Manuscripts Submitted to Biomedical Journals) can be found here: <http://www.icmje.org>

*The Common Rule, governing studies with Human Subjects, can be found here. <http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html>

*The US federal agencies that adhere to The Common Rule can be found here: <http://www.hhs.gov/ohrp/humansubjects/commonrule/index.html>

*Resources related to international research:

Reports from the 2010 “World Conferences in Research Integrity” <http://www.wcri2010.org/> *Resources related to Community-based and participatory research can be found here: <http://depts.washington.edu/ccph/commbas.html>

NSF Policy Resources

*NSF’s conflicts of interest rules and guidelines can be found here:

<http://www.nsf.gov/policies/conflicts.jsp>

*NSF Responsible Conduct of Research rules and practices can be found here:

<http://www.nsf.gov/bfa/dias/policy/rcr.jsp>

*FAQs about Responsible Conduct in Research can be found here:

<http://www.nsf.gov/pubs/policydocs/rcr/rcrfaqs.jsp>

*NSF Implementation of the Common Rule (governing Human Subjects) is available at:

<http://ecfr.gpoaccess.gov/cgi/t/text/text->

[idx?c=ecfr&sid=bf82741062b65521a894ff5a97c2cd1a&tpl=/ecfrbrowse/Title45/45cfr690_main_02.tpl](http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=bf82741062b65521a894ff5a97c2cd1a&tpl=/ecfrbrowse/Title45/45cfr690_main_02.tpl)

*NSF Research Misconduct Regulation is available at: <http://ecfr.gpoaccess.gov/cgi/t/text/text->

[idx?c=ecfr&sid=bf82741062b65521a894ff5a97c2cd1a&tpl=/ecfrbrowse/Title45/45cfr689_main_02.tpl](http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=bf82741062b65521a894ff5a97c2cd1a&tpl=/ecfrbrowse/Title45/45cfr689_main_02.tpl)

*NSF Office of International Science and Engineering provides information and policy about working with international partners:

<http://www.nsf.gov/od/oise/intl-research-integrity.jsp>

*NSF Proposals and Awards Policies and Procedures Guide provides RCR and other policy information:

http://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp

Licences and ethical approvals in Canada:

Aurora Research Institute (ARI) <https://nwtresearch.com/licensing/scientific-research-license>

Checklist for conducting Research in Canada’s North <https://www.arctic.gov/science-agrmt.html>

Gwich’in Tribal Council. 2004. Traditional Knowledge Policy.

<https://gwichincouncil.com/sites/default/files/GTC%20FINAL%20TK%20POLICY%202004%5B1%5D.pdf>

IARPC) Principles for Conducting Research in the Arctic, U.S. Interagency Arctic Research Policy Committee (IARPC: <https://www.nsf.gov/geo/opp/arctic/iarpc/start.jsp>). The principles document is permanently housed on the NSF Polar Programs and are always available at Principles for Conducting Research in the Arctic.

Polar Knowledge: Checklist for Conducting Research in Canada’s North

<https://www.canada.ca/en/polar-knowledge/online-portal-for-researchers.html#h3-3>

Other links:

<https://www.arcus.org/witness-the-arctic/2019/2/highlight/2>

<https://www.nsf.gov/geo/opp/arctic/conduct.jsp>

http://www.iarpcollaborations.org/uploads/cms/documents/iarpc_annex_j_arpa.pdf

<https://www.iarpcollaborations.org/about.html>

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