FutureArcticLives

Future Arctic Livelihoods and Biodiversity in a Changing Climate

Proceedings of the first workshop

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Edited by

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Contents

Proceedings of the FutureArcticLives workshop in Copenhagen – March 2022

This document represents a collection of extended abstracts of some of the planned publications of FutureArcticLives. As a workshop proceeding, it is also the output of the first physical meeting of the project conducted in Copenhagen on March 16-17th, 2022. The document intends to highlight options for collaboration across the project's work packages and with external actors.

To follow the project's activities and output, see www.futurearcticlives.eu

Quantifying reliance on hunting and inshore fishing in Greenland – Spatial differences and temporal developments 2012-2020

Authors: Martin Reinhardt Nielsen, Mona Estrelle Bachman, Henrik Meilby and Birger Poppel

People in smaller settlements along the coast of Greenland rely partly or entirely on hunting and coastal fishing for their food security, health and income (Rasmussen 2005; ECONOR 2008; ASI 2010; Hendriksen 2013). However, quantitative assessments of the importance of hunting and small-scale fishing in Greenland are scarce, and particularly the subsistence component is not visible in national income assessments (AHDR 2014).

Natural resources are unevenly distributed in time and space, posing a challenge for people who rely on wildlife and fish populations (Díaz et al., 2018). Historically, people have been able to shift to relying on other species when populations of some species declined, or management regulations tightened. However, such adaptive strategies are becoming increasingly constrained by climate-induced changes. Changing physical conditions affect the distribution of living natural resources by causing severe and often complex, interrelated alterations in ecosystems and along the food web (Huntington et al. 2020). Global warming is a non-linear process with periods of abrupt warming and regime shifts, including long-term transformations of ecosystems (Huntington et al., 2020).

Reduced hunting and fishing yields because of climate change, conservation initiatives or both may severely affect the material wealth and general well-being of hunting households without being detected in national income statistics (ECONOR 2008; ASI 2010).

This study, therefore, aims to quantify the reliance on wildlife and fish of traditional and inshore hunter and fisher households and evaluate the cause of change over time and the differences between locations. Predictions will be made about the likely prey target shifts because of regulations and climate change, identifying species likely to come under increased pressure. Finally, the study will identify specialised groups of hunters and fishers, targeting a particular portfolio of species or characterised by specific locations such as remote communities.

The study applies anonymised household-level statistics for all registered hunter and inshore fisher households in Greenland in the period 2012-2020 obtained from Piniarneq (the catch register database) and the tax authorities through Greenland Statistics. Combining information on catch, trade and household income from other sectors, the study will quantify both cash and subsistence reliance on wildlife and fish as the share in total household income following the Poverty-Environment Network approach (e.g. Nielsen et al. 2017 and 2018).

To test the association between reliance and changing biophysical conditions, reliance will be modelled against environmental predictors such as sea surface temperature (SST) and Sea Ice Concentration (SIC). SST is a good proxy of prey availability (Hoover et al. 2013a; Descamps et al. 2017) and shown to affect the abundance of arctic mammals such as narwhals (Chambault et al. 2020; Heide-Jørgensen et al. 2020), bowhead whales (Chambault et al. 2018), and sea birds like black-legged kittiwake (Descamps et al. 2017). Also, SIC has been shown to affect bearded seals (Boye et al. 2020), ringed seals (Yurkowski et al. 2016), narwhales (Louis et al.

2020), beluga whales (Hauser et al. 2018), bowhead whales (George et al. 2015) and polar bears (Laidre et al. 2015b).

Aiming to explore the effects of changing physical and ecological conditions on reliance requires acknowledging that the response to more abrupt changes might be different than the response to moderate ones (Descamps et al., 2017). The analysis will therefore apply methods such as threshold analysis or the sliding window approach to detect non-linear effects (Jenouvrier et al., 2005; Descamps et al., 2017). To account for spatial differences, such as higher reliance on hunting in more remote regions, we will include hunter residency as a random effect in the model. In addition, to incorporate species-specific responses to harvest and climate change, species will be included as random effects. Furthermore, species experts at the Greenland Institute for natural resources will be consulted to determine whether it would be more meaningful to subdivide locations at the population level (Hoover et al. 2013b). Other effects that will have to be considered are the type of hunter (occupational or recreational), equipment used (snowmobiles, boats or sledge dogs) and hunter and household characteristics. Hence, variables describing the cost of living (i.e. the consumer price index), hunting and fishing (e.g. fuel costs), as well as social services, household size, age of the hunter (hunting success varies over a lifetime, Walker et al. 2002), and location will be controlled for. Also, the quotas will be included to capture the effect of regulations on the reliance on individual species (Nielsen & Meilby 2013).

Overall, the study aims to make visible the high reliance on natural resources of arctic communities expected to rival and surpass that of communities in the Global South and, through that information, inform natural resource management and development policy in Greenland.

Intended journal: Ecological Economics

Hunter and inshore fisher household welfare implications in future scenarios of climate and biodiversity change in Greenland

Author: Martin Reinhardt Nielsen, Mona Estrella Bachman, Henrik Meilby and Birger Poppel

Climate change is occurring faster in the Arctic than in any other region (IPCC 2014), causing rapid large-scale ecological and social changes (ACIA 2005; CAFF 2013; AMAP 2013; AHDR 2014). Recent years have seen an exceptional decline in sea ice volume, area, age and thickness, while on land, the climate is becoming unpredictable with increasing rain, snow and thawing events during winter (Arctic Council 2016). Observed consequences include the disappearance or dramatic modification of habitats, ecosystems and populations, shifts in species' geographic range and the timing of ecological events and outbreaks of pests and disease (CAFF 2013). The Greenland and Antarctic ice sheets' rate of loss is now in line with the worst-case scenarios outlined by the Intergovernmental Panel on Climate Change (IPCC) (Slater et al. 2020), and sea ice concentration and sea surface temperature will continue to change over the next few decades, depending on which emissions scenarios the world's governments will choose.

These changes will have severe consequences that can undermine established production patterns of hunting, fishing, gathering and herding by Arctic communities, negatively influencing their welfare and well-being (ECONOR 2008; AMAP 2011; Hoover et al. 2013a; CAFF 2013; AHDR 2014). Examples include a strong negative influence on seals, polar bears and narwhal - the basis for traditional Inuit communities in Greenland. Arctic mammals are an essential food, a cultural and economic resource for indigenous populations throughout the Arctic (Hovelsrud et al. 2008). People in smaller settlements along the coast of Greenland depend partly or entirely on hunting and coastal fishing for their food security, health and income (Rasmussen 2005; ECONOR 2008; Hendriksen 2013). However, quantitative assessments of the importance of hunting and small-scale fishing in Greenland are scarce, and particularly the subsistence component is not visible in national income assessments. Climate and biodiversity change furthermore occurs in a context of far-ranging economic, cultural and political change (ECONOR 2015), including commercial fisheries and tightening conservation measures. The combination of ecological and societal changes facing small-scale rural users and indigenous groups in this region through reduced hunting and fishing yields may well surpass their resilience and adaptive capacity, severely affecting their material wealth and general well-being detected in national income statistics (ECONOR 2008; ASI 2010) and therefore needs urgent assessment to reduce adverse social and ecological outcomes (Arctic Council 2016). Particularly social and economic forecasts and scenario assessments are required to assess the impacts of climate and biodiversity change on Arctic communities and explore adaptive management options under global policies and trends (NRC 2014; ECONOR 2015; Arctic Council 2016).

This study will therefore assess the potential impact of future climate and biodiversity change on household welfare in two climate change scenarios - a 1.5-2 degree IPCC emissions scenario, in line with the Paris Climate Agreement (Hoegh-Guldberg et al. 2018) and the most likely business-as-usual scenario of 3 °C (Hausfather & Peters 2020; IPCC 2021) - and associated implications for access to hunting and fishing of relevant species considering range shifts, population density change and likely regulations imposed (Hoover et al. 2013a).

The cash and subsistence contribution of relevant species will be quantified in monetary terms as the share in total household income based on data from Piniarneq (the catch register) and the tax authorities through Greenland Statistics for all hunter and costal fisher households in Greenland in the period 2012 to 2020. A literature review of species specific climate vulnerability will be conducted and species experts consulted to develop scenarios for each relevant population in the time frame of 2021 to 2040, according to the two temperature change scenarios provided by the PPCC (IPCC 2021) although additional assumptions will be needed. Similarly, expectations regarding the development of the tourism, transport and raw material industry (i.e. mining), will form the basis for exploring scenarios regarding this source of income for hunters in different areas and with different ages and educations.

Monte Carlo simulations will be conducted to assess the household welfare implications of changes in these future scenarios combining the implications of changes in hunting and fisheries as well as other sectors. The analysis will compare groups based on specialisation, wealth and location in terms of vulnerability to change measured as the income gap or welfare decline experienced in various future scenarios and proposed management recommendations. Results can be illustrated in maps facilitating optimisation of strategic investments in social services.

Intended journal: Conservation Biology

Where and how to live? Regulation of coastal Fisheries in Greenland in the light of climate Change

Authors: Birgitte Hoffman and Kåre Hendriksen

Greenland's most important industry is Fisheries, contributing 95% of exports and 91% of total export earnings. (Statistics Greenland 2021a) The fishing and fishing industry provides just over 4,100 jobs and thus accounts for 15% of total employment in Greenland (Statistics Greenland 2021b).

The three species, shrimp, halibut and cod, make up most of the catch that is exported as largely unprocessed raw materials. Hence the value added through processing is transferred to other countries. This high dependence on exports of a few species as unprocessed raw materials makes the Greenlandic economy vulnerable. At the same time, a sustainable economy is central to the vision of an independent Greenland. This points to the need to develop a more sustainable income portfolio.

However, the challenges remain considerable. The development needs to address the contextual conditions such as the extreme and changing climate conditions, the diverse settlements in the vast and disparate geography and the ongoing encounter between indigenous and modern cultures.

Here we take departure in the island operation as a unique feature of many small artic settlements that creates a strong dependency on societal infrastructure systems. (Nielsen 2000, Hendriksen 2013). Island operation in Greenland is based on the fact that there are no roads or other physical infrastructure connecting settlements, which means that the transport infrastructure includes only ships, planes, and helicopters. Furthermore, the arctic climate changes the viable modes of transport across the seasons. It is thus impossible to commute between settlements daily, and all settlements must have their own supply of power, water, and waste handling, as well as their own social infrastructures such as shops, a school, and healthcare. (Nordregio 2010, Hendriksen & Hoffmann 2017a) The island operation naturally creates considerable challenges in providing services to citizens and supporting business activities.

Accelerating climate change creates additional challenges to the systemic set op up of business development and livelihoods. In recent years, Greenland's nature and culture have gained global focus due to climate change. The sea ice is rapidly becoming thinner, and the polar bear and the hunter are becoming icons of the threatened Arctic nature and way of life. And in some districts, the risk of landslides and subsequent Tsunamis is putting pressure on existing settlements. At the same time, climate change creates improved access to Greenland's mineral wealth. It also opens new sailing routes in the Arctic, which has increased Greenland's geopolitical role, highlighted by increased superpower tensions and significant economic and military interests (Nuttal 2008, Breum 2013).

This paper explores the contemporary regulation of fisheries in relation to the development of livelihoods and adaptation potentials. It does so by taking a socio-technical approach, taking departure in the system building and path dependency of infrastructure constructed in the

colonial period to support specific cultural living standards and business profiles as a backdrop (March & Olsen 1989, Hoffman et al. 2022)

An important distinction in fishery management is between offshore and inland fishing, and this article focuses on how to regulate inland fishing. The Fisheries Commission (The Fisheries Commission 2021), set up by the Greenlandic Self-Government, proposes a change in regulation with the consequence that inland fishing is concentrated on fewer and larger vessels. The suggested change will have far-ranging implications beyond the fishing technology, including decisive impacts on business structure, settlement patterns and everyday life.

The proposal will change the existing practice, where most fish are caught from open dinghies or as longline fishing from the sea ice during winter. Most of the fishing for halibut takes place in Upernavik and Uummannaq districts as well as in Disko Bay – a coastline of approximately 1,000 km with a total of almost 1,100 dinghy fishermen in and represents an important source of income in small settlements.

The option of longline fishing with a dinghy and from the sea ice in smaller settlements with a first-sale facility has facilitated the maintenance of a decentralised settlement pattern. If implemented, the Fisheries Commission's suggestion will mean that these settlements will lose their income base, forcing people to move to larger cities. (Hendriksen & Jørgensen, 2015). However, several larger fishing cities are already challenged by limited and insufficient infrastructure, e.g. water resources and housing, to support further industrial development. Hence, it may not be feasible to conduct a higher degree of local processing and, through that, achieve the envisioned sustainability and local added value.

This paper, therefore, aims to provide an understanding of the requirements for sustainable future arctic livelihoods by analysing the interaction between the organisation of fisheries and the settlement patterns and societal infrastructures in the context of climate change.

Intended journal: Arctic

Welfare implications of climate change for reindeer herding Saami in northern Sweden and Norway – A bioeconomic model

Authors: Irmelin Slettemoen Helgesen, Anne Borge Johannesen, Göran Bostedt, and Erlend Dancke Sandorf

The Arctic is warming three times faster than the global average. It is predicted that rising temperatures could reduce the snow-covered season and increase plant productivity in the spring, fall and summer. While this may increase the carrying capacity and growth of semi-domesticated reindeer, rising temperatures could also increase rain-on-snow events during winter. Rain-on-snow creates hard ice layers in the snow, making it difficult for the reindeer to reach the lichen and negatively affecting their body mass, survival, and reproductive success. Moreover, the capacity of winter grazing areas tends to determine the maximum possible reindeer herd size, suggesting that climate change affecting winter conditions could be a factor in reducing maximum viable herd sizes.

Here we demonstrate how climate change affects the welfare of reindeer herders in a set of stylised areas; northern- and southern reindeer herding areas in Norway and mountain- and forest-Saami village areas in Sweden. To achieve this, we construct a stage-structured bio-economic model of reindeer husbandry that incorporates the contrary effects of climate change on reindeer growth, reproduction, and survival. The model is calibrated using Norwegian data on reindeer numbers and slaughter weights in combination with historical climate data. Looking at three future climate scenarios (the shared social pathways, SSPS 119, 245 and 585), the model is used to study both a simulated future where current harvesting rates continue and the welfare-maximising rate of harvesting.

Intended journal: Natural Resource Modeling

Coping with climate change - reindeer herder's preferences in Sweden and Norway

Authors: Göran Bostedt, Anne Borge Johannesen, Erlend Dancke Sandorf, and Irmelin Slettemoen

Reindeer herding is of great importance to Saami communities, the only indigenous population of Scandinavia, both economically and, not least, culturally. Historically, herders have handled seasonal changing environmental conditions by moving herds across huge areas between winter- and summer grazing ranges. To cope with sudden vegetation shortages, difficult winter conditions, pests, and losses to carnivores, Saami reindeer herders have often practised herd size accumulation as a risk management tool. Climate models predict more variable future winter conditions in the Scandinavian Arctic. This has the potential to negatively affect reindeer husbandry and make reindeer herding even more vulnerable to potential external limiting factors such as forestry and predation by carnivores, negatively affecting the welfare of the Sami.

Here we report on a discrete choice, contingent valuation study conducted with Saami reindeer herders in Sweden and Norway. The study aims to reveal the optimal adaption strategy as seen by the individual herder, depending on how the herder weighs non-market values and harvesting income to identify adaption strategies. Specifically, the study aims to compare herd reduction strategies to increased winter foddering as adaptations to climate change. All respondents are faced with six discrete choices, three dealing with herd reduction and three dealing with increased winter foddering. The three choices represent three different levels of severity of climate change. These levels have been developed using a database for climate change scenarios developed by the UN Climate Panel. Using 1985-2014 as the reference period, scenarios were selected based on an average of this model collection.

Intended journal: Environmental and Resource Economics

An overview of climate change effects on reindeer herders in Sweden and Norway

Authors: Erlend Dancke Sandorf, Irmelin Slettemoen, Göran Bostedt, and Anne Borge Johannesen

Reindeer herding is of great importance to Saami communities, the only indigenous population of Scandinavia, both economically and, not least, culturally. This paper aims to determine to what extent climate change will affect reindeer husbandry and make reindeer herding vulnerable to potential external limiting factors. Another objective is to determine the cultural and intrinsic values and the income derived from reindeer husbandry and their importance to the modern Norwegian and Swedish reindeer herder household, including as an adaptation strategy in the face of climate change.

The paper reports the results of a household survey aiming to quantify market and non-market values of reindeer husbandry. This survey was implemented in reindeer herding communities in Sweden and Norway, covering productive and non-productive environments and minor and more carnivore-dense areas. An underlying hypothesis tested is that climate change adds to other factors, such as the presence of wild carnivores, that creates stress for the reindeer herder. The survey, therefore, includes questions addressing the perception of the impact of climate change on reindeer husbandry and its importance compared with other factors that create anxiety and insecurity in everyday life as a reindeer owner.

Previous research has shown that the intrinsic utility of being an active reindeer herder plays an important role in determining the supply of reindeer meat . For this reason, questions about how important reindeer husbandry is to the respondent and the main reason why they work with reindeer herding are also included.

Intended journal: Pastoralism

Optimal adaption strategies for sustainable reindeer husbandry in the face of climate change

Authors: Göran Bostedt, Anne Johannesen, Erlend Dancke Sandorf, and Irmelin Slettemoen

Climate change affects natural environments (IPCC 2014), including the distribution and conservation of wild species and the possibility of using wilderness areas for various activities like pastures for livestock grazing, harvesting natural resources, and human recreation. IPCC projections indicate that the mean annual temperature will increase, and most substantially so at higher latitudes (Solomon et al., 2007). Temperature increases affect icing during winter, the onset of spring and the length of the autumn, all of which affect reindeer herding pasture conditions and grazing availability. However, climate changes may have contrasting effects on grazing conditions and animal body mass, depending on the geographical location of the reindeer herding grazing areas. Consequently, the economic impact and optimal adaption strategies may differ between geographical locations.

This paper presents results from a contingent valuation survey in Norway and Sweden, evaluating and comparing reindeer herder's willingness to apply various adaptation strategies (herd reduction and supplementary feeding) to climate change. The analysis considers that climate changes may have contrasting effects on grazing conditions and animal weights across and within countries. Furthermore, the paper analyses to what extent the choice of adaption strategy depends on how reindeer herders weigh non-market values attached to the herd size.

A bioeconomic model is used to derive optimal adaption strategies across geographical locations, taking reindeer's non-market values into consideration. The bio-economic model allows other external factors than climate changes limiting grazing areas, such as encroachment and predators, to account for any differences in welfare consequences between more or less vulnerable areas.

Intended journal: Land Use Policy

Implications of climate and biodiversity change for coastal Saami well-being

Authors: Camilla Brattland and Bente Sundsvold

How are narratives about change connected to images of coastal Saami well-being, and can narrating positive change be used to increase well-being? Building on results from several research projects documenting the historical use and ongoing caring practices for the Porsanger fjord seascape, this article presents an overview of the implications of climate and biodiversity change for coastal Sámi well-being.

Through map-based interviews and collaborations with local knowledge institutions and community-based researchers in the field, the impacts of climate and biodiversity change on well-being in terms of the level of subsistence and nature use were collated and analysed. Compared to how other Arctic indigenous peoples identify climate change as impacting subsistence use, interviews with resource users in Porsanger identified a lack of identification of climate change as influencing coastal Sámi well-being. On the contrary, rapid biodiversity change and governance failure were the main factors impacting well-being over time and in several phases. The first phase (1985 – 2004) started with an invasion of seals, followed by a failure to protect local cod stocks from overfishing, which resulted in the reduction of cod fisheries as a source of income and well-being. This influenced the use of nature for subsistence and a source of well-being, as fishing grounds emptied of fish and outmigration from rural districts ensued. The second phase was initiated by the invasion of king crab and the failure to govern local access to the fisheries, resulting in a troublesome period followed by a temporary boom in local fisheries (2004 to approximately 2011). The temporary rise in fisheries activities led to continuity in nature and subsistence use for young families who gained their income from a combination of king crab and cod fisheries through formal occupations. However, recent years have witnessed a dramatic exit from rural communities such as Repvåg. Here inhabitants are no longer permanently settled but only keep up seasonal nature and subsistence use such as berry picking and harvesting of eggs from islands in the summer.

We developed a series of StoryMaps to narrate temporal and spatial changes in land and seascape use and in contributions from nature to humans over time. The narratives mediate a rich and complex story of multiple changes in the Porsanger fjord seascape, which may change the narrative of dramatic biodiversity change leading to outmigration and loss of well-being. The relevant question is if these StoryMaps can also contribute to changing the dominant narratives from loss to building up capacity and well-being in the Porsanger fjord in the future? This will be investigated through narrating and discussing the positive aspects of change in the past, combined with ongoing initiatives to revitalise and create new values from the fjord.

Intended journal: Polar Geography

Harvest control rules and adaptive local management initiatives in Porsanger

Author: Arne Eide

Porsanger is a Norwegian municipality in the northernmost part of the country with a population of about 4000. More than half live in Lakselv, at the southern end of the Porsanger fjord. Most of the remaining population is found along the western coast of the fjord. The Porsanger fjord is the fourth longest fjord in Norway, stretching over a distance of about 123 km from north to south and more than 20 km wide.

The settlements around Porsanger reflect that the fjord has always been the population's most important source of food and income. The fjord ecosystem is complex and heterogeneous (Fuhrmann et al., 2015), and different fisheries are defined spatially and seasonally. In an EcoPath study of the fjord, more than 60 distinct groups of species were identified (Pedersen et al., 2018). Economically the local cod fishery was by far the most important until recently when the king crab fishery took over (Fuhrmann et al., 2015).

As an ecosystem approach to management, Harvest control rules (HCR) have been developed for the most important commercial stocks in the Northeast Atlantic Ocean (Kvamsdal et al., 2016). The basic principle of HCR is to employ different benchmarks to decide the present exploitation rate given a predefined preferred stock size. The ecosystem perspective involves uncertainties and other considerations that must be incorporated through the best available knowledge and assessments. Since HCR methodology does not require inputs from modelling procedures (though such inputs certainly are used), it is possible to apply available heuristic knowledge and common-sense statements. As such, HCR represents an expert system, providing numerous possibilities for development and extension (Eide, 2017). The HCR benchmarks employed within the Norwegian fisheries use a range of model estimates of two stock indicators: The current fishing mortality rate and spawning biomass.

Herring, capelin, sand eel and shrimp are important preys of cod, haddock and saithe in the Porsanger fjord. The fjord is inhabited by coastal cod, while migrating cod visit the fjord during the spawning season at the beginning of each year. Coastal cod spawn in locations along the western side of the fjord and used to be the economically most important species in the local fishery. It remains important, but the king crab fishery is today by far the most profitable fishery of the fjord. Although the cod, saithe, flounder and herring fisheries have declined during the king crab invasion, model studies do not support the claim that these fisheries have been repressed by king crab (Pedersen et al., 2018). Coastal cod catches are separated into coastal and migrating cod based on otolith growth zones.

The paper will present the Porsanger fjord ecosystem, the historical and current use of the fjord, and the present management challenges. The reader is introduced to the harvest control rules (HCR) concept, followed by a discussion of how HCR can be utilised in local management in the Porsanger fjord. The focus will be on possible management rules and relevant benchmarks rather than how they could be organised within the municipality.

Intended journal: Marine Policy

The potential for nature-based solutions: the role of understanding the possibilities for different actors in historically developed scaled systems

Authors: Carina Keskitalo, Maria Pettersson and WP4 participants

Nature Based Solutions (NBS) have recently, and not the least through EU policy, been highlighted as a climate change adaptation and mitigation tool. In particular, it has been developed as a contrast to a historical focus on hard engineering solutions, to instead emphasise for instance restoration, protection, management to support natural or semi-natural ecosystems, and creation of features such as for instance wetlands. However, it has also been noted that the effectiveness of these may differ depending on situation (Chausson et al., 2020). For instance, it has been noted that "the new NBS concept should be perceived as an opportunity, but also as a challenge since a good understanding of ecosystem processes is needed, a diversity of actors must be engaged and a broad set of societal facts/issues needs to be included and integrated" (Nesshöver et al., 2017).

To strengthen the role of NBS in improving policy on societal challenges, Albert et al. (2017) put forward three criteria for the application of NBS. According to the authors, NBS: (a) "need to provide simultaneous benefits for society, the economy and nature". To qualify as a nature-based solution, the benefits of the approach thus need to serve all dimensions of sustainable development; (b) "should be understood to represent a transdisciplinary umbrella", that is, including already existing attempts to address or accomodate similar challenges within different areas; (c) "need to be introduced gradually", in order to evaluate and calibrate its function in different context (Albert et al., 2017).

As with all policy instruments, it is thus important to tailor local solutions – NBS is not an exception to this – as well as to acknowledge that many of the solutions that qualify as 'nature-based' are not new inventions. Rather they can be seen as new ways of applying existing knowledge and practices in order to combat climate change.

On this basis, this article problematises the concept of NBS as an addition to the debate, and discusses the extent to which actors at the different levels can implement NBS to adapt to and mitigate climate change.

Intended journal: Ecology and Society

Scope for local use and adaptation in the regulatory frameworks relating to natural resources in Sweden and Norway

Authors: Maria Pettersson, Stine Rybraten and Carina Keskitalo.

Norway, Sweden and Finland are often seen as having a specific relation to nature. In this manuscript, the regulatory frameworks in Norway and Sweden are compared regarding the scope for local use and adaptation provided by the regulatory frameworks relating to natural resources.

How the use of nature and its embedded resources, including relations in hunting, fishing and reindeer husbandry in northern Sweden and northern Norway, are discussed, with particular focus on the Swedish regulatory framework concerning the Norwegian Finnmark Act. The study compares the Finnmark Act case and the protection it affords local resource users with that in northern Sweden under general Swedish and municipal regulation systems. The study thereby poses the question - Can the Finnmark act be seen as a way to consider the rights of all resource users on a local, regional basis, or should it be seen as related more to an international discussion of ethnically based rights?

Intended journal: Environmental Policy and Governance?

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