

Integrating Activities for Advanced Communities



M9.1 – Case study 1: Adapting reindeer husbandry to vegetation change and snow cover changes

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

Publishable Executive Summary

INTERACT Work package 9 has four tasks. Task 9.1 *Leading the design of standardized procedures to guide the case studies, to supervise the consultations and to compile the case studies into the guide book* and 9.3: *Adapting reindeer husbandry to vegetation change and snow cover changes* are both led by ICR. 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. In Ohcejohka there are Sámi and Finnish people living where Sámi people are the majority. Population in Ohcejohka in 2019 was 1,235. 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 owned 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 are up to 8 winter sidas in Gáldoaivi, 8 in Baišduottar. The work is planned and compiled by respecting cooperatives seasonal work, as the fall and winter until April is the busiest season in the Ohcejohka area.

Kevo station has been working since the 1950's and is mostly focused on ecological and environmental research, but a wide range of disciplines are supported by the institute. 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.

Geographically, the work was based in Kevo station, Ohcejohka municipality and surrounding areas: reindeer herding cooperatives in Ohcejohka municipality: *Gáldoaivi* and *Baišduottar*. This area also covers the Kevo Strict Nature Reserve. Topic wise our work field consisted of research ethics, guidelines, traditional indigenous knowledge combined to science, climate change adaptation and in cooperation in a broader sense. The work started by identifying important actors in this field and inviting them to the local meeting. This case study started by arranging a workshop at Kevo station in Finland. The task force had its first meeting getting 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.

The case study topic was discussed and started though creating cooperation on the adaptation of the environmental changes. In the local meeting the participants did not conclude the case study yet. In this phase they mapped the cooperation, discussed possible cooperation models about the topic and listed on-going or already existing models and challenges. One outcome in this discussion was that some topics that are relevant to science are not exactly those that serve the local community and livelihoods the best. Some concerns for the local reindeer herders in Ohcejohka are land use changes, shortening winters, difficulties to predict winters as well as that tundra is becoming forested.

The overall aim is to produce a guide book for research station managers and local communities to develop a deeper mutual understanding of how to work together to build integrated local observation systems enabling local communities to respond to the challenges of present and predicted environmental change. All three case studies will be compiled into the guide book.



WP9 Case study – Kevo, Finland

Theme: Adapting reindeer husbandry to vegetation change and snow cover changes

By: Rosa-Mären Magga, Svein Mathiesen

Otso Suominen contributed a text about research station and biodiversity in Kevo

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1. Introduction and aim of the case study

Focus area: Adapting reindeer husbandry to vegetation change and snow cover changes.

The aim of this case study is to better the cooperation between local reindeer herder community and Kevo station to identify the environment, including vegetation and snow cover changes, and their effects for the environment and for the local people; and to connect the local knowledge, which is here mostly the traditional indigenous knowledge with the scientific knowledge generated at the Kevo research station.

Country: Finland

Area: 338,424 km²

Population: 5 513 000 (2018)

Municipality: Ohcejohka (Utsjoki in Finnish) municipality

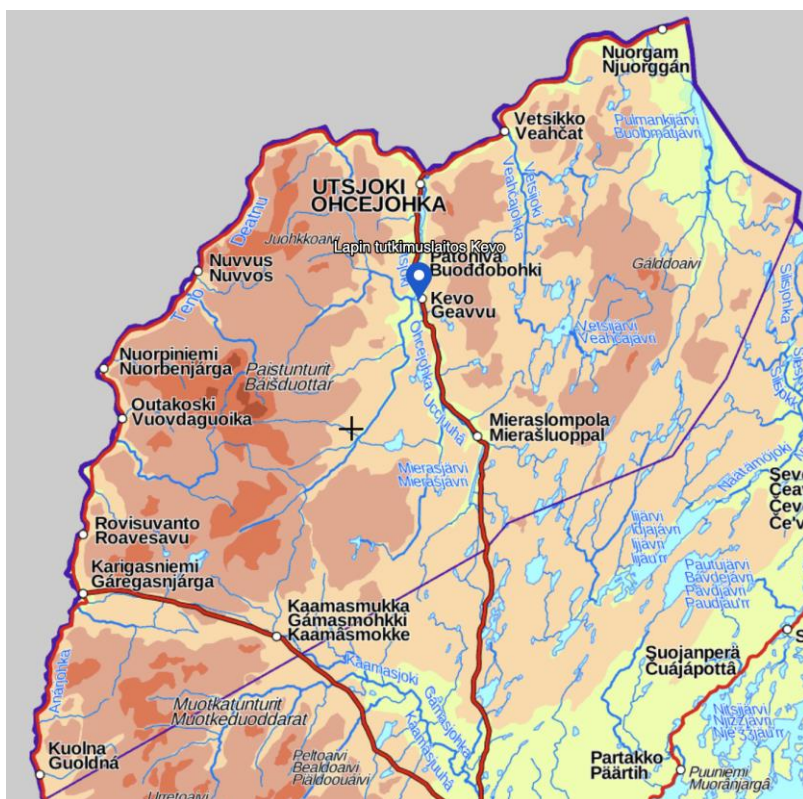
Area: 5372 km²

Population: 1215 (2018)

Local community: Baišduottar (Paistunturi in Finnish) and Gáldoaivi (Kaldoaivi in Finnish) reindeer herding cooperatives

Area: 5371 km² in total (Baišduottar 2893 km², Gáldoaivi 2478 km²)

Reindeer owners: 160 in total

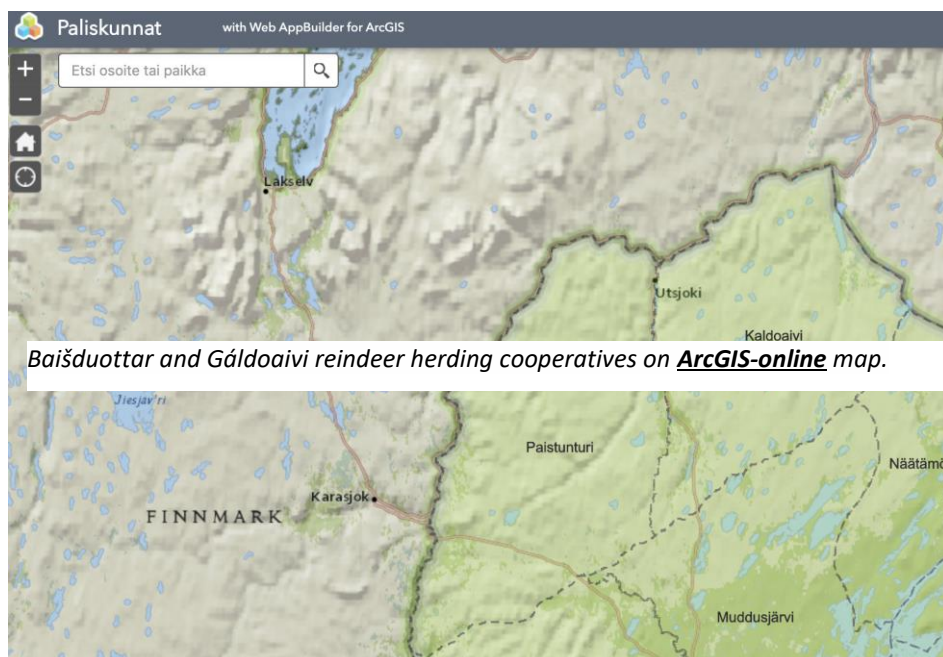


Ohcejohka municipality with its villages. Kevo station marked on the map.

Map: Maanmittauslaitos, Karttapaikka:

www.asiointi.maanmittauslaitos.fi/karttapaikka

This case study together with case studies from Kajbasovo and Qeqertarsuaq aim to develop a deeper mutual understanding of how to work together to build integrated local observation systems enabling local communities to respond to the challenges of present and predicted environmental change. The guide book will include a general section on key steps in the process for developing a dialogue between local communities, researchers and station managers, identifying perceptions of what is driving the need for adaptation, what information is needed to adapt, and how to develop an integrated local monitoring strategy.



Deatnu bridge in Ohcejohka village welcomes the visitors and can be seen already before entering the village. Picture: Svein D. Mathiesen

Each case study will be a specific task and each task will unite a research station manager/representative with local communities and researchers. The case studies will be combined to produce an inspirational field guide to adaptation actions that can be based on local observations and scientific understanding, describing in a

standardized format how communities in cooperation with research stations and researchers can address impacts of changes to their natural environment that affect local livelihoods.

Case study 3 in work package 9 is called *Adapting reindeer husbandry to vegetation change and snow cover changes* and is located in Kevo Station.

This case study together with others under WP9 will be compiled into the guide book on how the research stations can better work together with local communities.



Rástegáisá is a holy mountain for the locals. This East-Finmark's highest peak, 1066 m above sea level, can be spotted on the way to Ohcejohka. Picture: Svein D. Mathiesen

1.1. Reindeer husbandry in the area: history and development

The Sámis have practised reindeer herding from time immemorial. Mikkel Nils Sara (2009) writes that formerly semi-nomadic local communities had their own territory and governed the natural resources and central aspects of societal issues. These communities have been categorized as Sámi hunting siidas, although small-scale reindeer herding was a part of the resource base. The development of large-scale reindeer herding started more than 400 years aiming to secure one of the main resources, the reindeer herds and pastures. The formation of reindeer herding units, the reindeer herding siidas, was an adaptation of old siida principles to fully nomadic reindeer herding practices. (Sara 2009.)

Sara (2009) explains the Sámi concept of reindeer herding siida as follows: “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 siidda 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.)

Reindeer herding played only a small part in the life of the Ohcejohka, where the main feature throughout the first half of the twentieth century remained more or less multi-economic - with people earning their living from many different sources according to the seasonal migration. (Lehtola 2012, 38.) Traditionally livelihoods wise, the people in the area could be divided into reindeer herders and fishermen. The Fell Sámis (Sámis living mostly off the reindeer herding), were counted as seven families at the beginning of the century, three of whom had built the house. The river Sámi (fishermen) had gradually settled down in the late 1800s. (Lehtola 2012, 37.) At the beginning of the 20th century, the reindeer herders of Ohcejohka settled in their permanent dwellings, and by the 1930s all reindeer Sami in Ohcejohka were already living in doves. For permanent housing with the transition, the reindeer herders stopped their summer shepherd. (Näkkäljärvi 2007.) The River Sámi relations with the Reindeer Sámi were generally good because the groups did not compete for the same natural resources. (Lehtola 2012, 37.) The River Sámi also had small-scale cattle breeding. As the Deatnu fishery temporarily faded and trade with Norway began to draw, handicraft (*duodj*) began to become an important branch of life in some economies in the early decades of the 20th century (Lehtola 2012, 40.)

One thing that has affected the reindeer husbandry the most in this area was the closure of the nation state borders of Finland and Norway. The border between Norway and Finland was closed in 1852 from the reindeer and reindeer herders to migrate from the summer pastures in Norwegian coastal area to the forest lands for the winter. In spite of the closure of the border, the nomadic Sámi of Ohcejohka herded their reindeer to Norway until the 1860s (Itkonen 1948). Vuojala-Magga & Turunen (2015) write that according to one of their interviews an old herder recalls the old pasture rotations: During those years when there were no fences separating co-operatives, reindeer foraged in their natural ways – there were rutting places, calving places and winter areas. In summer time reindeer grazed in the coastal area of Varangerbotten (in Norway) and later (winter) went all the way to the Saariselkä forest area. (Vuojala-Magga, Turunen 2015)

In 1899, a reindeer herding association was established in Ohcejohka, the statutes of which were established in 1900 and two reindeer herding cooperatives were established. (Lehtola 2012, 152.) They are the same that still remain: Gáldoavi and Baišduottar.

2. Description of the local area

2.1. About Ohcejohka

Ohcejohka is the northernmost municipality in Finland. It has a border with Norway as well as the municipality of Inari. The municipality was founded in 1876. It has a population of 1,235 (31 January 2019) and covers an area of 5,372.00 square kilometers of which 227.51 km² is a water line. Ohcejohka was established as an independent

municipality in 1876. Fishing, reindeer herding and livestock farming, as well as hunting and berrying provided the livelihoods of the then Ohcejohka people. 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.)

Fishing, hunting, agriculture and reindeer herding determine the Ohcejohka landscape and Ohcejohka settlement has concentrated on the Deatnu River (Tenojoki in Finnish) and along the river Ohcejohka. The Sámi culture is basically the same on both sides of the river and many families live on both sides. Natural resources have been the basis of the model for settlement and the living conditions. The Deatnu river fishing Sami economy has been characterized by the versatile use of natural resources. The decisive factor in choosing a place of residence has been the possibility of salmon fishing and farming combined with hunting as well as reindeer herding. Whitefish has been fished in the waters of the lakes. The scarce resources have made it possible to have sparsely populated settlements along the riverbed.

2.2. Climate, biodiversity and natural environment in Ohcejohka

Climate characteristics

The climate in the region is Sub-Arctic with polar night from late November to mid-January (see diagram). There is a snow cover for about 200 days per year from late October to mid-May (10% reduction in the snow cover duration from 1960's). There is a lot of variation among years in the timing of snow melt and first permanent snow, and it may snow even in the summer. The average yearly precipitation is 432 mm being lowest in winter and highest in summer.

Data from Kevo meteorological station (Finnish Meteorological Institute). Mean values for the latest reference period 1981-2010.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Monthly mean (°C)	-14.0	-12.8	-8.2	-2.5	3.7	9.6	13.1	10.7	5.7	-0.5	-8.3	-12.3
Monthly min (°C)	-35.7	-33.9	-29.3	-22.5	-8.4	-0.4	3.2	-0.3	-4.9	-16.6	-27.2	-32.1
Monthly max (°C)	2.0	2.2	4.2	9.3	18.2	24.9	27.4	24.4	17.3	9.6	3.5	2.8
Snow monthly max (cm)	55.8	66.8	73.5	75.8	50.4	1.3	0.0	0.0	0.8	12.7	27.2	40.9
Precipitation (mm)	27.0	23.4	20.7	24.7	27.3	49.5	71.9	57.4	38.1	39.1	27.8	25.2

	Start	End	Duration (days)
Polar night	26.11.	16.1.	51
Polar day	17.5.	28.7.	71

Biodiversity and natural environment

Ohcejohka area is in the subarctic zone north of the continuous coniferous (Scot's pine, *Pinus sylvestris*) forest line with mountain birch forests, the birch treeline (mountain birch *Betula pubescens* ssp. *czerepanovii*) at forest-tundra ecotone and low alpine tundra. It consists of low alpine tundra heaths and subarctic birch forests on highland with fells, wetland areas with peat bogs and palsa mires as well as local isolated pine forests mixed with birch and aspen (*Populus tremula*) in river valleys. The area is part of the large river basin of Deatnu river (Tana in Norwegian, Deatnu in Sami) running to the Arctic Ocean. Deatnu river is the border river between Finland and Norway, and it is one of the major spawning areas of the Atlantic salmon (*Salmo salar*).

Being an ecotone zone between northern boreal zone and arctic tundra Ohcejohka area has rich fauna and flora, but it is also very sensitive to pressures such as climate change. At present as well as in the past reindeer grazing (first wild and now semi domesticated) and climate are the factors shaping the ecosystems in the areas. Since it is one of the very few areas with treeless tundra in Finland, Ohcejohka area is a home to many nationally endangered and protected arctic animals and plants, such as several arctic waders, gyrfalcon (*Falco rusticolus*), snowy owl (*Bubo scandiacus*), Ring Ouzel (*Turdus torquatus*), rock ptarmigan (*Lagopus muta*), snow bunting (*Plectrophenax nivalis*), and Norwegian lemming (*Lemmus lemmus*). The last known breeding of arctic foxes (*Vulpes lagopus*) in Finland was observed in the Ohcejohka area. Examples of the rare arctic/northern plant species are: fragrant cliff woodfern (*Dryopteris fragrans*) Lapland rosebay (*Rhododendron lapponicum*), roseroot (*Rhodiola rosea*) and several rare moss species. The impact of the already warmer climate and longer growing season can be seen especially in the mobile insect fauna, where new formerly more southern species have been observed.

Reindeer (*Rangifer tarandus*, wild or semi-domesticated) grazing has been an important part and modifier of these ecosystems ever since the end of the last ice age. During the recent decades moose (*Alces alces*) population has been expanding and increasing in this area close to their former northern limits and having an increasing impact on vegetation. Moose and grouse/ptarmigan are important game animals for local hunters. Another important group of mammalian herbivores in these ecosystems are the small rodents (voles and lemmings) with regular cyclic population dynamics with peak population densities at about every fourth year having huge impact on both their predator populations and vegetation dynamics.

Several large-scale outbreaks of birch feeding moth larvae are characteristic for the birch forests. The latest outbreak in 2005-2009 destroyed about 400 km² of the treeline birch forests in Ohcejohka. Grazing by semi-domesticated reindeer is another important factor that shapes the ecosystems. The area is part of the basin of the river Deatnu, which is one of the top salmon rivers in Europe. (INTERACT 1.)

Water resources

The water bodies include the biggest and most important river: Deatnu river but also its tributaries. There are altogether 1820 lakes in the municipality from which Pulmankijärvi lake is the biggest. From the municipality's surface area 202.93 km² is water bodies. (Utsjoki municipality 2020.)

Land and forest resources

Metsähallitus is in charge. Metsähallitus and the Association of Reindeer Herders have an agreement aimed at improving cooperation between reindeer husbandry and forestry and the conditions for carry on these economies. Harvesting and other forestry activity issues in the area and agreement on how to cooperate on areas of importance to reindeer herding are covered in negotiations, that are done in each reindeer herding cooperative and that are required by the agreement. The aim is to jointly develop forest management practices that take into account the needs of reindeer herding. (Metsähallitus 1.) There are special agreements between Metsähallitus and the Reindeer herding cooperatives in the Sámi Homeland Area.

Natural food resources

Reindeer husbandry not only produces meat but also material for handicrafts and clothing. Salmon and other fishes are important for the area as well as the many berries and herbs growing in the area: cloudbberries, blueberries, lingonberries.

Hunting

The Ohcejohka area belongs to two hunting permit areas: 1602 Baišduottar and 1603 Gáldoaivi. The area sells a limited number of small game/quarry permits per day, which non-locals can also use for hunting mallards, hares, small predators and waterfowl during the hunting season. Reindeer herding is an important livelihood in the area, so hunting for a running dog is forbidden by the sale of permits. Areas may have seasonal restrictions due to reindeer herding. (Explore Utsjoki 2020.) In Finland Metsähallitus manages and sells the hunting permits.

Protected areas

In Ohcejohka municipality, there are three large protected areas, strictly protected Kevo Strict Nature Reserve as well as Gáldoaivi and Baišduottar wilderness areas with lighter protection status. These three areas comprise more than 95 % of the land area. Reindeer herding and natural source of livelihoods (berry picking, grouse hunting, fishing etc.) are allowed in the protected areas for local people. Kevo Nature reserve covers a territory of 712 km² and there is a 63 km long hiking trail. This 63 km long trail leads through Kevo Strict Nature Reserve alternately through fell birch forests, across open fells and through pine forests as well as through Kevo Canyon. The canyon is 40 km long and more than 80 meters deep and it forms the central part of the strict nature reserve, through which most of the trail also travels. (National parks.)

Mineral and raw materials

According to Kai Hytönen (1999, 359) in Ohcejohka the minerals that are found are: Almandine, augite, biotite, diopside, enstatite, ferrosilite, phlogopite, corundum, gold, maucherite, monazite, platinum, rutile, sillimanite. There is no active extractive industry in the area.

2.3. Human dimension, main economies and government or local administration issues

Human population

The population is 1235 in the whole municipality, both Sámi and Finnish people. Ohcejohka has two official languages: Finnish and Northern Sámi. Ohcejohka is the only municipality in Finland with a Sámi majority with the largest portion of Sámi speakers: 46.6% of the total population. Sámis have always been the majority in Ohcejohka. Like Lehtola (2012, 121) writes: in the beginning of 1900 century the Finnish population made a small minority in Ohcejohka which was around one % of the total population. In Ohcejohka village (18 km north of Kevo) there are grocery shops, a post office, a library, a swimming hall, accommodation providers, pubs, a bank, and a health center. Anthropological, sociological, and archaeological studies on the local community have been managed by the Kevo research station (INTERACT 1).

Main economies

Fishing, reindeer herding and livestock farming, as well as hunting and berrying provided the livelihoods of Ohcejohka people in the late 19th century and beginning of the 20th century. 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. (Usjoki municipality 2020.) The most important livelihoods of Ohcejohka are border trade (retail trade), reindeer husbandry, traditional means of livelihoods/subsistence livelihoods (*Iuontaistalous* 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: its' new top themes are wild, silence and traditions which refer to the three main villages in municipality. Ohcejohka municipality renewed its tourism brand together with its people, reindeer herding cooperatives and businesses. So, dismantling of the old fishing regulations and its consequences on the Deatnu River were turned in the new direction.

Reindeer husbandry

Reindeer husbandry in Finland is not a sole-right for the Sámi only unlike in Sweden and Norway. The Finnish legislation does not recognize the Sámi *siidas* as self-governing bodies in reindeer husbandry. In Finland the reindeer husbandry is governed through the reindeer herding cooperatives (*paliskunnat*). In Norway the Sámi *siida* was legally acknowledged in 2007 by Norwegian national authorities recognizing *siida* as the basic institution regarding land rights, organization, and daily herding management (Sara 2009). Before acknowledging and still today the reindeer husbandry is regulated by the national authorities and they constructed the reindeer herding districts which are not based on the Sámis traditional reindeer herding and traditional knowledge. The traditional reindeer husbandry still lives and thrives alongside the regulated reindeer herding model which is based on the national authorities' regulations and agricultural models. These differences also cause challenges and conflicts in many areas. Still the Sámi herders – in many areas – hold their traditional knowledge to which the husbandry is based on. *Siidas* and the use of them are holding this knowledge. The border closure between Norway and Finland in 1852 also caused moving of reindeer herding Sámis in Ohcejohka and limited the Sámi reindeer herding so that reindeer were shepherded in the Ohcejohka fell and in the lowlands in winter. (Näkkäljärvi 2007.)

Herder organisations: reindeer herders organized by their cooperatives but traditionally also by their traditional *sámi siidas* (both winter and summer *siidas*). Finnish reindeer herding association is formed by the Finnish reindeer husbandry whereas Sámi reindeer husbandry traditionally is based on the *siida* system.

There are two reindeer herding cooperatives with their respective districts in Ohcejohka municipality area: Baišduottar and Gálđoaivi. Baišduottar has 104 reindeer owners and the highest allowed number of reindeers is 6300, Gálđoaivi has 86 reindeer owners and the highest allowed number of reindeers is 5300. The number of *siidas* in each cooperative: Gálđoaivi has 8 winter *siidas* and Baišduottar also 8 *siidas* in winter.

Baišduottar: Reindeer herding cooperative is part of Ohcejohka reindeer earmark district. Reindeer herding cooperative is located in Ohcejohka municipality, in an area that is intended/ designed especially for reindeer husbandry in addition it's in the Sámi homeland area. The neighboring cooperatives are Gálđoaivi in the east, Muddusjávri in the southeast and Muotkeduottar in the south. In the west and north, the Deatnu River and the Norwegian national border sets the dividing line for the cooperative. 95% of the land area is state land and 5% private land in total of the cooperative's land area. There is not a lot of pine wood and no economic forest in the area. The terrain consists of the fells and the riverbank, where the woods consist of mountain birch. The Nature Reserve has been established on the cooperative's area under the Nature Conservation Act under the Law of Nature. The Baišduottar reindeer herding cooperative doesn't have calf marking in summer. They start the annual reindeer herding work in October when the rutting season starts too. Cooperative's only corral for reindeer round-up locates in Ailigas, 10 km from Karigasniemi. The settlement is sparse and is mainly located on the Deatnu River. The largest villages are Karigasniemi, Kaamasmukka and part of Ohcejohka. (Paliskuntain yhdistys.)

Reindeer herding year in Baišduottar: Reindeer round-up season starts in the beginning October until November. This time the reindeer are counted and sold for the meat market. Another round starts usually in February when the big herd will be separated in smaller herds according to the winter *siidas*. Winter 2019-2020 was an exception due to the high amount of snow. In comparison - the winter before was very warm and the second round of round-up season ended with rain and in spring when there was a thick ice layer on the ground and very little snow. All this was followed by the extreme warm summer in up North, 2018. Now (2020) the pasture conditions are good even though there is a lot of snow. Even the older reindeer herders in Baišduottar tell they have not experienced so much snow in their lifetime. In Baišduottar herders feed the herd with extra hay. (Local reindeer herder, personal communication, March 5, 2020)

Gálđoaivi: Gálđoaivi reindeer herding cooperative located in the northernmost part of Finland in Ohcejohka municipality. Its border neighbor is Norway across the Deatnu river. Reindeer herding cooperative is part of Ohcejohka reindeer earmark district. The neighboring cooperatives are Njávđán (Fi: Näättämö) in east, Muddusjávri (Fi: Muddusjärvi) in southeast-south, Muotkeduottar (Fi: Muotkatunturi) in southwest and Baišduottar in west. 95% of the land area is state land and 5% private land in total of the cooperative's land area. Cooperative has Skállovárri (Fi: Skalluvaara), Petsikko and Njállavárri (Fi: Njallavaara) reindeer corrals for reindeer round-up and also Annivaara gathering corral. Cooperative is fenced around. Settlement is located in an area close to the cooperative's border area: Nuorgam, Ohcejohka, Deatnu riverside and Ohcejohka riverside. (Paliskuntain yhdistys.)

Reindeer herding year in Gáldoivi: In summer the reindeer are grazing in bigger herds and won't be herded. (Gáldoivi reindeer herder 2019.) After the autumn/winter round-ups, at which meat is sold, reindeer are either separated and placed in siida/family pasture areas for the rest of the winter in Gáldoivi or herded using hay by each siida during the late spring in Baišduottar. (Vuojala-Magga&Turunen 2015; Gáldoivi reindeer herder 2019.) Gáldoivi reindeer herding work starts in September and lasts until the end of October when they slaughter up to 80% of the aimed amount of slaughtered reindeer. Until January they herd the reindeer and keep them in the southern part of the area, one more time corral before "siiddastallan" staying in their siidas. There are 8 winter siidas from February to the end of April. (Local reindeer herder, personal communication, June 17, 2019.)

Fishing

Fishing has always been one of the most important livelihoods for the Sami people in the Deatnu area. The fishing culture of Deatnu is an ancient one, the earliest mention of which is in the first archival sources of the late Middle Ages. Throughout history, salmon have been the most important natural resource for the people of the Deatnu region, both as a food source and as a means of payment. (Näkkäljärvi 2007.) Nowadays it's not one of the main economies in the area anymore but is a crucial part of the Sámi culture in the area.

One of the most significant resources of the area has for long been the salmon that rises from the Arctic Ocean to Deatnu river, which is the basis for the region's rich Sami culture, growing fishing tourism and the reputation of the Deatnu river as Europe's best salmon river. Of the other fish species, the most important are grayling and sea trout in Deatnu's main riverbed and mountain lakes with whitefish. In the eastern Sami region of Finland, the settlement concentrated on the waterways of the river such as the Deatnu river. Since then the most important natural resources in the area were salmon and salmon fishing played a decisive role in the settlement of the Deatnu river valley. The choice of residences was well determined by the fish species. The first written references to the fishing of Deatnu salmon are from the 16th century. Salmon was also a major commodity since the 17th century. Nowadays it is still a crucial part of the Sami culture in the area and brings most of the tourists to the area.

The predominant fishing model in the area has been net fishing. With increasing tourism, angling is the most common form of fishing today in Deatnu. The cross dam (rastábuođđu) is one of the oldest forms of fishing. (Näkkäljärvi 2007.) Fishing in the traditional way has always been a big part of the local reindeer herders as an additional part of the economy. Traditional fishing has faced some challenges in new times, for example new fishing regulations.

Agriculture

The Deatnu and Ohcejohka valleys of the Ohcejohka municipality differ from the rest of the Sámi region of Finland in that agriculture, despite its northern location, became a very important industry. As a result of agriculture, the form of living changed from mobile to permanent. Agriculture and livestock farming became an important addition to fishing, hunting and collecting, not so much to reindeer herding. (Näkkäljärvi 2007.) Agriculture produces milk which will be transported to the dairy industry in Oulu, another agricultural product is hay. Nowadays agriculture has decreased in the area.

Government or local administrative issues

From reindeer herders' point of view some of the changes that affect 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 using which leaves a huge number of tracks and marks on the grazing land. For them is crucial 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. Reindeer herders wish continuity for the good cooperation with the municipality on the land use plan. They are also willing to enhance or better the cooperation with Metsähallitus and The Finnish wild life agency to better plan the land using. Reindeer herders tell that they poorly get a support from anywhere. 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. On the other hand, they thank the municipality for a good cooperation. To some municipality plans is difficult to get their voice included and they still face some challenges even though in Ohcejohka reindeer husbandry is one of the biggest economies for the municipality. It also keeps the culture and language up and thriving.

A lot of pressure for the municipality comes from the south that the nature should be kept as a big area as an area without people. But the people here are connected and people use and live in nature. The local view on nature is that they use it sustainable way. Ohcejohka municipality is supporting reindeer herding, for example telling the other authorities that hunting is disturbing reindeer husbandry and opposing the extractive industries and big power plants in grazing lands. Land use is a main issue for reindeer husbandry. One upcoming change that the people see already is that tourism is getting bigger and bigger in Ohcejohka. Sustainable development, reindeer herders and cooperatives are always included in negotiations from the beginning.

Land/water ownership issues:

Metsähallitus manages most of the land in the Sámi Homeland area in Finland. What comes to the forestry, forest management and the activity of Metsähallitus there are agreements, like an Agreement between reindeer herding cooperatives in the Sámi Homeland, the Sámi Parliament, the Skolt village meeting and Metsähallitus on forest management instructions and procedures and more specific local agreements in state lands in the Sámi Homeland region; and the reindeer herding cooperative agreements and special agreements with the reindeer herding cooperatives in Sámi homeland area. (Metsähallitus 2.)

Deatnu river fishing rights faced changes in 2017 due to the renewed River Deatnu 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 most strongly limit the traditional Sámi net-fishing, while lighter limitations were set for tourist fishing and a new group of fishing rights holders – non-local cabin owners – was created. New restrictions were made, according to fish biologists, 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 reasons why Saami oppose the new regulations is that traditional Saami fishing

rights are limited most at the same time denying some Sámi completely their right to practice traditional fishing methods. 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.)

2.4. Kevo Research Station

Kevo established in collaboration with the Forest and Park Service and Finnish Forest Research Institute a tree-line arboretum for the study of the different tree species of the circumpolar forest line area in the 1970's.

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 the lake Kevo.

Station is open year-round, but the kitchen offers meals (full board) outside the main field season (May-September) for larger groups only. 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.



Left: Lake Kevo in June. Picture: Rosa-Mären Magga, on the right: Map of the research station area.

Kevo station gives access to research on the subarctic 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 got 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, 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.

In ecology Kevo is internationally best known for the research on plant herbivore interactions that initiated from the study of the autumnal moth (*Epirrita autumnata*) larvae outbreak in the 1960's that led to death of birch forests in large areas. The latest winter moth (*Opeorophthera brumata*) outbreak in 2005-2009 destroyed about 400 km² of the treeline birch forests in Ohcejohka and the station is monitoring the recovery 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. Kevo has taken part in several large international projects. 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 steers also research interests on northern ecosystems. The long-term data, well established research tradition at Kevo and location at forest-tundra transition zone where we can see and measure the changes makes it a perfect site for the study of environmental changes in the north.

3. Description of the focus areas of the case study - Changes and challenges

Reindeer husbandry 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.)

3.1. Climate change

As the Earth's climate is warming, also the northern regions experience changes. While the globally averaged temperature data show a warming of 0.85 °C degrees over the period from 1880 to 2012, the northern circumpolar region has been warming approximately twice as much. (Käyhkö & Horstkotte 2017.) In Finland, for example, the respective warming has been 2.3 °C, and during winter months, almost five degrees (Mikkonen et al. 2015). Increases in precipitation accompanied by swift changes in temperature in winter are expected to create climate challenges for reindeer herding in the future due to their effects on snow cover over reindeer pastures. On the Norwegian side from 1922 to 2018, spring temperature increased by about 3 °C. This 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.) Sensitivity to changes in the fell area modeled at mid-July temperatures: 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).

The winter has become shorter from both ends: the fall is longer and the spring starts earlier. Also, what is prominent is the rain in the winter which makes the pastures and grazing for the reindeer very difficult. Gáldoaivi reindeer herders' 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. The closer the Arctic sea you are the more likely there are rains in the winter and ice layer 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."

3.2. Vegetation change and snow cover changes

Sámi reindeer husbandry has been facing 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. Researches show 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 for 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.

According to local reindeer herders, winters are getting shorter, approximately one month per each side (at the beginning and at the end of winter). 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. Barely real winter by Christmas nowadays. The closer the Arctic sea you are the more likely there are rains in the winter and ice layer on the ground. Spring comes earlier. Climate change and warming temperatures affect the vegetation in the area. Moss and roots grow fast and cover and kill lichen. Treeline in tundra: sprouts have grown which causes that the treeline moves up and the tundra area gets smaller. Leaf worm, roots and moss affect too – in reindeer husbandry there is not so much concern about birch because lichen has started to grow also in places where the worm has damaged the leaves. Now the reindeer also stops in these places where it didn't stay earlier for longer. More concerned about the moving of tree line: reindeer is the only animal that keeps tundra as tundra and slows down the growth of sprouts. According to the local reindeer herders referring to the reindeer studies: should be careful when willing to reduce the number of reindeers as the reindeer is one of the only factors that prevent climate warming in tundra.

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

Reindeer herders also mentioned how the environment has changed a lot in such a short period that they remember: "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 Gáldoarvi 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 using 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."

Other challenges in land use: in the summer there is increased traffic of tourism on the land, especially atv's. Hunting licenses to hunt moose for no-local inhabitants, increased use of dogs for hunting as well as increased number of illicit routes in forest and tundra which effect on the grazing lands. Reindeer have started to avoid these moose hunting areas. Monitoring and observing these clearly fishing tourism caused 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 that the satellite data could be used in this research in cooperation with the research station.

Number of scientific articles about vegetation and snow change from the area or in some type cooperation with Kevo research station are vast and impressive including articles that are done in cooperation with Kevo station or that cover the topic and area: Kumpula & Turunen (2018) in Kontula, T. & Raunio, A. (toim.). 2018; Rasmus, Kumpula and Jylhä (2014); Rasmus, Kumpula and Siitari (2014); Turunen et al. (2016); Markkula et al. (2019) and Käyhkö & Horstkotte (2017) but none include indigenous reindeer herders traditional knowledge in design, collection of data and in results analyses. One article Vuojala-Magga & Turunen (2015) includes interviews of reindeer herders to analyze their past, present and future views on the behavior of moths and the growth of mountain birches and where is said they investigate the behavior of the two herbivores by combining the indigenous knowledge (IK) of Sámi herders with the results of relevant studies in biology and anthropology. Also, Turunen et al. (2018) includes a cooperation with local reindeer herders through questionnaires about reindeer

herders' observations about climate change, snow and vegetation changes and autumnal moth destruction in their reindeer herding areas.

3.3. Cooperation between local communities and research station - traditional indigenous knowledge and scientific knowledge in cooperation and co-production of knowledge

In rapidly changing Arctic, the research 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 who will experience the most extreme changes, these communities will need access to the knowledge gathered about and around them, so that they can adapt to the rapid changes.

But how to involve the local communities in science and how to inform these communities when the challenges they face are mostly not caused by these communities? How to provide the information and knowledge to the communities to grasp the opportunities that arise from the changes in the Arctic?

Co-production of knowledge will benefit the local communities and the scientific community and the end product will be sustainable science. When the local community is involved in the production of knowledge, the design of methods and the research questions can be influenced by these communities, making the research more relevant for the communities. The co-production of knowledge will also benefit the scientists, making the research more relevant and useful for communities in the Arctic should encourage the co-production of knowledge, but the scientific community could gain access to data that is not accessible. Another relevant factor is that co-production can give different angles at approaching and looking at issues and phenomena that can contribute to robust results.

4. Relations and rationales of partners to cooperate

Relation to the local community prior to WP9: Kevo station has been an active part of the local community ever since it was built in 1958. There has been research on local economically important animals and plants such as the Atlantic salmon, reindeer, cloudberry, angelica etc. From the very beginning the station has been open to studies on social science and humanities focusing 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 (them visiting us and vice versa). Kevo scientists offer their expertise to local administration (municipality, Metsähallitus, etc.).

Ohcejohka is the only municipality in Finland with a Sámi majority for whom the traditional reindeer herding and fishing are still important livelihoods, even though it is in general a normal modern community with modern services. In Ohcejohka village (18 km north of Kevo) there are grocery shops, a post office, a library, a swimming hall, accommodation providers, pubs, a bank, and a health center. Anthropological, sociological, and archaeological studies on the local community have been managed by the research station

Aims of the cooperation (from the research station perspective): cooperating with local people is already mentioned in the missions of the university which they follow. One of the aims of the founder of the station,

prof. Paavo Kallio, already in 1958 was that the research conducted at the station would benefit the local people and society. Nowadays the station thinks that in addition to that the knowledge of the local community can be of benefit to the station's science.

4.1. Rationale for Kevo station to cooperate with local community

Rationale for engaging with local communities and administrations: One of the four main topics of the strategy of the University of Turku is that the university is "A catalyst for social well-being and the economy". Kevo station carries this mission out in its local environment. Kevo station (owned by the University of Turku) has been working since the 1950's and is mostly focused on ecological and environmental research, but a wide range of disciplines are supported by the institute. 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" (Saessalo 2017).

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

4.2. Incentives for local communities to participate to research station activities

Local administrations: According to the public servant of the municipality (representing the local administration), Ohcejohka municipality doesn't have an adaptation plan for environmental change yet but they are welcoming for the ideas and are hoping to have some contribution or at least ideas to their next municipality plan. According to the station staff and municipality representative, Kevo station itself is important for the municipality and they already have existing cooperation through summer school, school visits and open-door day examples.

Local people/communities (not authorities): Sámi reindeer herding cooperatives including their *siidas* are the everyday observers of environmental change. They also want to contribute to science and make some direct suggestions about what and how some issues could be researched. What comes to projects/research projects that 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, village and sámi organisations didn't participate in the local meeting arranged at Kevo station)

4.2. Rationale for local community to cooperate with Kevo station

Reindeer husbandry, land using – the information and scientific knowledge is important for reindeer herders in order to adapt to the environmental changes (vegetation, snow cover changes). Interestingly enough the local reindeer herders named other changes as bigger and more effective for their livelihoods than snow cover changes or vegetation changes. As a few examples that were named: other land users, illicit (unauthorized) trails and paths crossing the grazing lands. In contrast to what the Kevo research station is researching: the autumnal

moth and its' effects on the birch grove in fell area are not that disastrous from the reindeer husbandry point of view rather the other way around: the reindeer has even better grazing land on the area since the grass grows better.

5. The process by which the cooperation was developed

In this case study INTERACT and ICR as a leading partner. In general, the cooperation initiatives regarding the Kevo station seem to be initiated solely by the station itself as there are no many examples of the types of cooperation currently.

Activities and timeline for how the cooperation was initiated and developed in this case study

Here a short description of the activities and steps of cooperation development between ICR, Kevo station and the local community in Ohcejohka.

2016 – ICR involvement

In 2016 (or 2017?) ICR is approached by INTERACT to take a lead on the WP9 developing the cooperation between the local community and Kevo research station as well as lead Kevo case study which is located in Kevo Station surroundings. ICR shows an interest in the task.

2017 – Svalbard INTERACT meeting

2018 – INTERACT meeting in Salekhard.

Wp9 is ongoing full speed in the case studies. Kevo study is still in the planning phase.

February 2019 – Initial contact and participants identification

The new responsible person on behalf of ICR starts and approaches the possible participants of the case study. Contact the Kevo station manager and they agree on internal meetings at the station discussing the study template and the process in general. Discussing the potential and important participants for the case study and the local meeting.

March-April 2019 – contacting the potential participants

ICR contacts the local reindeer herding cooperatives and discusses the best timing for the local reindeer herders. There are two reindeer herding cooperatives in Ohcejohka municipality: Gáldoaivi and Baišduottar. The work is planned and compiled by respecting their seasonal work, as the fall and winter until April is the busiest season in reindeer herding work in the Ohcejohka area and the fishing season starts in June. Municipality is of course seen as an important participant and after talking with different researchers ICR decides to invite a researcher on research ethics to the meeting as guidelines are on the agenda.

The date for the local meeting was finally agreed at the end of May for the June and invitations sent out in early June.

June 2019 – First and only community meeting

Meeting takes place in Kevo station on June 17th. Meeting is held in English and North Sámi with the help of a local interpreter. The INTERACT project is presented for the participants and the purpose of better cooperation. Ideas for cooperation are identified during the meeting. Some already existing, well working forms of cooperation are presented by the station and the municipality. These ideas as well as new research ideas are discussed. Unfortunately, with time limitation there was no possibility to have another local meeting where these ideas could be tested in practice. All participants show mutual interest to develop the area and reindeer husbandry at some level and this is something that was discussed widely.



The first and only local meeting was held at Kevo station and it took place on June 17th 2019.

Participants included staff at Kevo research station, local reindeer herding cooperatives' head persons, Sámi parliament member in Finnish reindeer herding association, Chair of the board of ICR, Head of the development and business/livelihoods department in Ohcejohka municipality, Researcher at Thule Institute in University of Oulu and ICR representation including an interpreter representing and having a deep knowledge about the traditional fishing in Deatnu river. The work of the Kevo case study was planned and compiled by respecting the siidas seasonal work, as the fall and winter until April is the busiest season in Ohcejohka.

The participants were invited to the meeting about one month earlier and chosen because of their profession and experience related to the topic *Adapting reindeer husbandry to vegetation change and snow cover changes*. Presentations from many perspectives were held: Adaptation to environmental changes; Reindeer husbandry in Ohcejohka and traditional knowledge in reindeer husbandry and how it could be used better for observations; Ethics in science cooperation; Adaptation knowledge; Ohcejohka municipality's adaptation plan and research cooperation in developing the municipality of Ohcejohka and some other experiences related to the cooperation and environmental changes. Most importantly there were very fruitful discussions and some cooperation plans for the future were talked about.

Now and future – The implementation of ideas for cooperation

There is not much going on. The cooperation is seen important from the station perspective but the engagement is still missing as the local people are not actively involved in the research processes and there are new openings in horizon.

6. Points to be taken into account in cooperation development process

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

Communication / publishing results (ICR ethical guidelines 2006):

- *In order to secure clarity and trust between cooperating partners, institutions, communities and ICR, a Memorandum of Understanding (MoU) should always be signed.*
- *A program for publication and communication (PPC) shall always be developed, signed for all formal cooperation where new knowledge is produced and/ or compared and where results are to be published. The purpose of such a program is to secure that:*
 - *all acknowledged partners are given the ability to review and comment the results to be published.*
 - *dissenting comments which, for whatever reason, are not taken into account in the final reports etc. are included in the appendix, unless otherwise agreed upon with the dissenting parties.*
- *It shall be a goal to make information usable and useful at a local level, and then integrated in larger data sets.*

Authorship and contributorship (ICR ethical guidelines):

- *Following the Vancouver Rules¹¹, authorship credit should be given based on contributions to project design, data-acquisition, analysis, and drafting or revising reports etc. Whenever these criteria are met, reindeer herders shall be given full status as authors.*
- *Following the Vancouver Rules, all reindeer herders that contribute but do not meet the criteria for authorship shall be listed in an acknowledgments section.*

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.*

Meeting/workshop to explore possibilities and interests in cooperation

- In order to finish the project, it's very important to engage the local community even before the meeting. Local meetings or workshops need to be inclusive, open and safe space to talk and with this way build the dialogue between the research station and local community. Open communication, clear vision and clear group roles. Get to know each other – executive support. Clear goals and clear visions.
- 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.
- From a report in 2016 Parks Canada – Working together with Indigenous Peoples: “PARKS” Guiding principles, as 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”:
 - Partnership: Working collaboratively in heritage place planning, management and operation.
 - Accessibility: Encouraging access to traditional lands and traditional activities.
 - Respect: Building mutual respect, trust and understanding.
 - Knowledge: Honoring and incorporating traditional knowledge.
 - Support: Supporting Indigenous partners’ community interests.

Agenda building

- all the participants can share their views. If meaningful cooperation is wanted to be created is important to guarantee an environment where everybody can speak freely and share their ideas. From indigenous perspective it could be called a safe space to talk and share views, where your perspective is understood and you can be sure that your knowledge is not appropriated or used without permission or compensation.

6.1. Ethical considerations: Ethical issues in research and science cooperation

- Ethical issues at Kevo station: On ethical issues, the station follows the guidelines of the University of Turku and the guidelines of the Finnish Research Ethics Advisory Board (Finnish research funders require compliance with the projects they fund). Most of the station research is done 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.
- Cultural sensitivity: when working with indigenous issues, on indigenous land with indigenous peoples, then cultural sensitivity plays an important role. About the ownership of the knowledge in ICR ethical guidelines (2006):
 - *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 TK3. Researchers are therefore to abide by the ethical guidelines set out by the respective communities.

- Data ownership as it is managed at the station currently: mainly each researcher / 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 research 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 does not know how they will deal with the ownership of the data collected.
- Most of the documents and even the web page is in Finnish and English. Language situation in Ohcejohka is that the Sámi language is strong there. This is why the Sámi language needs to be part of the station too as the traditional knowledge too. Support of Indigenous languages has got bigger role as UN had its international year of Indigenous languages in 2019. As ICR ethical guidelines (2006) states 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 first hand observation⁹.*

Cultural and linguistic diversity goes together with biological diversity¹⁰. It is through the language that TK is available. Native languages shall therefore always be used in communication.
- ICR's ethical guidelines for handling traditional knowledge underlines 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 the 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 empiry 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.

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.

7. The cooperation

Kevo station's own staff is doing quite purely scientific research and monitoring that does not directly involve ethical issues or procedures related to the knowledge of the local community or indigenous people.

On ethical issues and cultural sensitivity in the cooperation development: When station researchers / projects need information from local actors in their work, such as reindeer herding, grazing or fishing, this information and / or contacts with local actors are often communicated through station staff. In this case, issues of cultural sensitivity, Sámi, reindeer herding or local customs are discussed at a practical level when discussing the issue. The contacts and local knowledge of the local staff at the station will help. They are part of the local community.

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

7.1. Agreements & agreement evaluation and modification

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

- School cooperation such as visits from kindergarten to upper secondary school at Kevo research 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 on 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 been asked for permission from the reindeer herd. 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.

7.2. Examples of collaborative initiatives and their results

Current activities in cooperation with local people in Ohcejohka:

- 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) – children's university - and science camp for children have been organized at the station
- A travelling 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)

There is a cooperation between the municipality and local people e.g. in research and municipality development but not agreements on those.

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, travelling Kevo-exhibition are having results like science communication and outreach to the local community among different age groups, done through different activities.

Collaborative initiatives are developed in Kevo station mostly science driven, some parts jointly with the municipality, still not so much together with the local community or local reindeer herders. Station staff tell that they have not received direct research requests from reindeer herders/indigenous people but many times the needs are similar for both reindeer herders and researchers. Kevo station is not really focused on the reindeer research, the station for that locates in Kaamanen.

From Ohcejohka municipality perspective: The municipality says they have on-going plans together with tourism enterprises and reindeer herding cooperatives about tourism development planning and area planning. They have received good feedback from the reindeer herding cooperatives from this cooperation model and for being

part of the planning from the beginning. Reindeer herders are part in planning the tourism areas so reindeer migration is taken into account.

8. The Future

Possible type of cooperation at the Kevo station recognized by the authors

- Paid field assistants for scientific work. Kevo station example currently is that the members of local indigenous community work and have worked as a staff at the research station (kitchen, maintenance etc.) but could be hired as field assistants for scientific work
- Another type could be citizen science program i.e. Traditional Indigenous knowledge (locally) combined with scientific knowledge run by the station together with the local people as equal partners combining their knowledge and needs to the scientific knowledge produced at the station. Example of this: mapping local traditional indigenous knowledge of snow, snow cover, vegetation conditions and changes
- Co-managed monitoring system run by the station together with the local community (requires engagement from both sides, structured system and clear roles). Examples: Local adaptation plan to climate and environmental change.
- Community based monitoring scheme addressing local concerns (developed by local communities for local communities – how to involve the station). Example of this could be Circumpolar Local Environmental Observer Network (CLEO) which is created by the indigenous peoples for the indigenous peoples to help to observe the environment and climate change locally.
- Local outreach and education examples are scientists' lectures in schools, scientists' field trips with reindeer herders and seasonal newsletter for local people, municipality, local authorities, local media which would better the outreach and communication to the local community.
- Traditional indigenous knowledge driven research and co-production of knowledge
- Answering to the local herders concerns about the other land users' illicit tracks on the grazing lands: Reindeer herders are important observes on these changes. To study this would be quite easy with remote sensing or satellite data to see tracks (even the station staff said this is something their university and station could easily do).

From the local people perspective: Reindeer herders have 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 reindeer herders' initiative for cooperation and co-research. In general look into to how to build cooperation with the scientists because there are no clear roadmaps yet.

From Kevo station perspective: the station hopes that existing cooperation will continue and increase, but there are no clear new concrete openings. They have previously organized a two-week summer high school where Ohcejohka High School (the municipality) was the main responsible for the activities. However, these summer high schools have not been organized for many years. This summer there will be a summer high school where the main organizer is Ohcejohka Ursa Association and the University of Turku.

From the municipality perspective: It is important that the science/research information about climate and environmental changes, that are happening, is translated into easily understandable language so the people understand what the changes means.

A new municipality strategy in progress and will be released in a few years. It would be great to have an information about climate change there on the background and that the changes in reindeer husbandry would be there included too. Also, it would be great to arrange workshops regarding the changes that will be taking place here so the municipality could take them into account in the strategies – for example changes in reindeer herding and land use. In this way they could focus on municipality’s projects on these topics regarding to tourism.

Municipality’s concrete example on the cooperation with Kevo station: There has been a suggestion about cooperation between Kevo station and Ohcejohka high school to develop the high school and work together with the theme of environmental change in Arctic regions. Based on the conversations in the local meeting the municipality representative would not mind the municipality having an adaptation plan and program in the future and for this the research cooperation is really needed.

The research station could be used more for promote the municipality in tourism: the future role of tourism, experience based tourism. Science based tourism could be a new initiative. They are working with development of program for herbs, mushroom, meat and other local products. Angelica (which is researched and grown at the station) could be potential.

9. Analysis and recommendations

9.1. Analysis - What did we find?

One outcome in this case study and the local meeting discussion was that some topics that are relevant to science are not exactly those that serve the local community and livelihoods the best. For example, the study on autumnal moths. Some concerns for the local reindeer herders in Ohcejohka are land use changes, shortening winters, difficulties to predict winters as well as that tundra is becoming forested. According to the local herders the weather, especially in winter has changed drastically and the prediction is almost impossible. The winter has become shorter from both ends: the fall is longer and the spring starts earlier. Also, what is prominent is the rain in the winter which makes the pastures and grazing for the reindeer very difficult.

What ICR calls two ways of knowing and a co-production of knowledge lack while the station says they actively involve the local community to their work but when asking from the local reindeer herders they could not mention many examples how they could have contributed the work and research done at the station. Also, the research topics conflict many times what comes to the needs of the local reindeer herders.

The information and scientific knowledge are important for reindeer herders in order to adapt to the environmental changes. The local reindeer herders named some of the changes that affect their livelihood: other land users, illicit trails and paths crossing the grazing lands. There is very little or no research on the topics that are relevant to reindeer herders.

Kevo station already offers open doors' day for the local people, guided tours for the tourists and together with the municipality and local schools established 'children's university' as a science camp for the kids. So, there is cooperation with the local community. This is something that the local community, municipality and the station sees important and wants to continue in future. However, the only agreement they have with the local community is only a vague agreement with a school, otherwise, the station does not have any special cooperation agreement with the people of the local communities (reindeer herding cooperatives, Sámi Parliament, etc.). At the station, there is a lack of ethical guidelines and a system to include indigenous knowledge as the research done at station is *"purely scientific research and monitoring that does not directly involve ethical issues or procedures related to the knowledge of the local community or indigenous people"*. We have not found organized cooperation about science between reindeer herders and the station. So, there is a need to bridge this gap since the local community holds very valuable information and knowledge about the surrounding nature, too.

According to the University of Turku, 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. Still, the interest of the station doesn't always meet with the interest of the local community, especially the reindeer herding community and the wish from reindeer herding community was that the station would ask from the local people what would be worth to research on the area that would serve the local community the most. Current situation is that there is cooperation but it's still mostly led and decided by the research station. Local community adapts and gets involved in the cooperation if it is seen as beneficial for them. In this model they need co-production of cooperation itself if they need the cooperation and the cooperation needs to be better.

Traditional indigenous knowledge needs to have a greater space in science. It is almost impossible to try to cooperate and fulfill a research project together with the scientists and traditional knowledge holders who are in the front line of the climate change affects and affected by the environmental change in their daily basis if the other side is not seated at the table and their knowledge through their voice is not heard.

Some of the best practices: In Canada they have good examples and systems how to work together and make research in Indigenous communities. Courses that need to be completed and permission from the community in order to start a research and indigenous language included. In Canada they have system to increase this cooperation. There is an on-going work in Finnish side of Sápmi on ethical guidelines on cultural heritage lead by the Sámi parliament that have stated to work on the research protocol in order to make a research on Sámi land. In Finnish Sámi academia there is an initiative on research ethics and guidelines.

There is no adaptation plan for the climate and environmental change from the municipality's or station's side. Ohcejohka municipality says that they don't have a special strategy for adaptation on environment changes. In many contexts especially when talking about sustainable development they are very aware of the changes. They highlight the importance of reindeer husbandry for the area and the municipality. Visions for Ohcejohka 2025 plan is respecting the traditions and describe themselves as a forward-looking municipality. Cross-border businesses, culture, nature and tourism is important. One core value of the Ohcejohka municipality: nature as a cultural environment. The herders told that what comes to the Ohcejohka reindeer herders, they have started to make an environment plan aiming to minimize their own impact on environment. This project is in the

beginning but they have got some positive signals from the world conservation organizations. This could be a very good cooperation initiative and station as well as the municipality could support this and join the planning. In this way that could work as an excellent example of coproduction of knowledge.

9.2. Recommendations

We recommend the research station should include indigenous peoples' knowledge and language in a co-production of knowledge.

We encourage research stations to provide consultations and inclusion of indigenous peoples in the early phase of project development. Based on the meetings, articles and the knowledge we have gained, we have not found adaptation plans for climate change for the reindeer herders in Ohcejohka. For this a co-production of knowledge is needed. Traditional indigenous knowledge needs to have a greater space in science.

We recommend the research station to use indigenous peoples' traditional knowledge in the planning of their work, in the design, collection and validating data used, and in the discussion of their main findings. Indigenous peoples' traditional knowledge has to be included on all levels where co- production of knowledge is used. Without this involvement by indigenous peoples in the development of research design and research questions, the conclusion might have been biased.

We encourage the research station to include traditional indigenous knowledge in a co-production of knowledge with the Sámi people who are the local people. We encourage research stations to provide consultations and including of indigenous peoples in the early phase of project development. Based on the meetings, articles and the knowledge we have gained, we have not found adaptation plans for climate change for the reindeer herders in Ohcejohka. For this as well the co-production of knowledge is needed.

Few concrete examples for better the cooperation (ICR perspective) based on the local meeting's discussion:

- Try different ways to get people to talk: Arctic lávvu dialogue
- Engage the young people: EALLU project
- Arctic Indigenous peoples can contribute to protection of Arctic nature and biodiversity
- Both scientific and traditional knowledge is needed: *"use the knowledge of our people to develop our society"*

10. Conclusion

Reindeer husbandry in Ohcejohka is based on the indigenous knowledge about reindeer and pastures. In doing so, 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.

There is a need for more scientists who at the same time are traditional indigenous knowledge holders: this is one example of how scientific and traditional knowledge work together. Academics work due to their principles and rules but with their indigenous world view in the background. Involving local people in research, like indigenous informants and their knowledge included in the research. There is still a wall between the science community and the local community/indigenous knowledge system. 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. That is where more cooperation is needed.

It is almost impossible to try to cooperate and fulfill a research project between the scientists and traditional knowledge holders (=reindeer herders) - who actually are in the front line of the climate change affects and affected by the environmental change in their daily basis in their work - if the other side is not seated at the table and their knowledge through their voice is not heard.

The mainstream community has today begun to demand the implementation of traditional knowledge, and institutions such as the United Nations requires and encourages that traditional knowledge should be embedded into scientific research of the natural environment. The results matter if the research stations and the local communities should work together better in a meaningful way so that all the partners benefit and the process can be called cooperation. Stations should include the needs of the local communities and indigenous peoples. This way the stations can give back and benefit the communities and the information and relation is two-sided. The 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.”

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Maps:

Maanmittauslaitos, Kansalaisen karttapaikka: www.asiointi.maanmittauslaitos.fi/karttapaikka

Reindeer Herding cooperatives in Finland on ArcGIS online map. Direct link on Paliskuntain Yhdistys web page: <https://py.maps.arcgis.com/apps/webappviewer/index.html?id=0e4b8e9e5721456bbbf73760f1a6543a>

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