



NORDREGIO
Nordic Centre for Spatial Development

Sustainable Regions - Sustainable Local Communities

NORDREGIO Contributions to ICASS VIII: Northern Sustainabilities Congress

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Foreword

Every three years the International Arctic Social Sciences Association hosts its International Congress of Arctic Social Sciences and this May 22-26 we have the pleasure of attending ICASS VIII in Prince George, Canada. The theme of this year's congress is Northern Sustainabilities, which will cover a diverse range of issues, including: culture & knowledge, education, environment & climate change, governance, international relations & law, renewable resources and urban & community sustainability.

Nordregio has a long history of conducting policy relevant research and analysis on Arctic issues. In particular, this includes socio-economic issues such as demographic changes and impacts of increased natural resource exploitation; territorial patterns related to migration and urbanisation; and the publication of Arctic maps presenting the latest assemblages of social and economic data. Three recent cornerstones of our Arctic work include the 2011 publication of the book MEGATRENDS, hosting the First International Conference on Urbanisation in the Arctic in Nuuk, Greenland, in 2012, and the 2013 publication on Urbanization and the role of housing in the present development process in the Arctic.

Nordregio currently has the Arctic territory as a core research activity, which is translated in practice through a number of activities. This includes its role of Secretariat of the Nordic Working Group on Sustainable Regional Development, which among other things, is conducting a major foresight study on the future development in the Nordic Arctic. Nordregio also has the role of Chairmanship of the Nordic Council of Ministers' Arctic Co-operation Programme 2012-2014. The objective of the Arctic Co-operation Programme is to support processes, projects and initiatives that will help promote sustainable development and benefit the people of the Arctic under the conditions generated by globalisation and climate change.

The papers, summaries and extended abstracts presented in this working paper represent the first year of research conducted within the project Sustainable Regions - Sustainable Local Communities. This project is funded through the "Friends to the West" programme funded by the Nordic Council of Ministers and is designed to promote cooperation on Arctic sustainable regional development between the Nordic Countries and Canada. As such, this working paper also reflects our participation, together with our partners, in year's ICASS Congress.

Collectively, the material provided shows the breadth of our current work – covering issues such as mining exploration and development, cross-border cooperation, big data and social interaction, relations between global production and local growth, land use management in urban areas, among others. We look forward to sharing our work in Prince George and continuing our focus on sustainable development of the Arctic going forward.

Ryan Weber, Research Fellow, Nordregio

1 Introduction to the Arctic Co-operation Project Sustainable Regions - Sustainable Local communities

A comparison of experience in dealing with ongoing changes in resource-based regions and communities in the Arctic and Sub-Arctic Regions of the Nordic countries and Canada

By Rasmus Ole Rasmussen¹

The Arctic and Subarctic regions which historically have been heavily dependent on natural resources – both renewable and non-renewable - are currently in a situation where both regions and especially local communities are strongly challenged by globalization processes. And these challenges are greatly felt in the arctic and subarctic regions of both the Nordic countries and Canada.

1.1 Characterisation of the challenges

Former strengths such as the use of renewable resources in fishing, hunting and forestry, which were the backbone of local economies in the Arctic, are diminishing as world market prices and increased mechanization reduce competitiveness. As a result, the professional qualifications related to traditional activities do not easily transfer to new industrial activities, to the service sector or to qualifications relevant for the new “knowledge economy”.

Newer business activities related to the use of raw materials and energy resources have traditionally been an opportunity for the local workforce to ensure a financial basis for the regions, but the combination of globalization and specialization of the labour force has resulted in a situation where the necessary skills are often retrieved from afar. As a result, local communities are not necessarily given a right of priority as a source of workforce supply.

The problem is further enhanced as a result of demographic challenges. This includes the impacts of aging populations and especially increasing mobility, which results in the exodus of young people and especially young women. It creates the risk of an inadequate supply of children, the absence of younger women and the tendency for much smaller families than was previously the case. This is compounded by the fact that an increased focus on education in dealing with the global development challenges is primarily met by women entering the knowledge economy, while men tend to be more path dependent in their choice of jobs.

As a result of these processes, local labour markets and workforces are under dual pressures as a consequence of demographic change and changing production structures and business environment. The interaction between these factors generates a need for a substantial

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modification of the welfare state's role, thereby becoming a core issue for both regions and communities in sparsely populated areas.

1.2 Related research issues

In recognition of the many similarities, but also in recognition of significant differences in the handling of these problems across northern regions of Scandinavia and Canada, this project is looking into two closely interwoven themes: *Sustainable Regions* and *Sustainable Local Communities*.

While these terms can be seen as two sides of the same coin, they can also represent a set of inherited potential conflicts in the development process. Where the region has a potential opportunity to benefit from the exploitation of both renewable and non-renewable resources on a large scale - for instance, through generated royalties, taxes, etc. - local communities are seldom able to take the same advantage. Although new projects situated in neighbouring communities may derive a certain level of employment, it is far from a situation that characterizes the community as a whole. And herein emerges the seeds of a possible conflict between the individual communities. Frequently, new project activities require highly specialized labour which is not available locally and therefore does not contribute to ensuring of the permanence of local settlements.

The focus of this project is therefore on three broad research questions in relation to the continued harnessing of essential resources such as oil and gas, mining, hunting, reindeer husbandry, fisheries and forestry:

- What characterizes the current resource development in relation to local communities and regional development?
- What has been the impact of past and ongoing resource development for regions and communities?
- What are the future possibilities for including past experiences in handling future activities in order to promote the local development while mitigating negative consequences?

1.3 Theme: Sustainable Regions

Policies and tools are needed to ensure that social and economic benefits of continued natural resource exploitation are retained locally, which in turn can create opportunities for encouraging population growth.

The premise of this approach includes the experience of the Canadian "Research Development Initiative 2009-2011". This project had a focus on policy-relevant research, creating a basis for a deeper understanding of the new northern economic conditions. These themes have also been carried forward in a number Nordic projects focusing on the experience of regional policy in relation to achieving greater consistency and complementarity between local and regions development and resource exploitation activities (Nielsen , Karlstad and Eikeland 2010; Ringholm, Aarsæther, Nygaard and Selle 2009; Rasmussen 2003).

The institutional framework for economic planning and decision-making with respect to resource development in northern Canada is a consequence of three decades of political development and a remarkable social change (Abele, 2009). It has been emphasized how much of what exists today is an institutional response to the indigenous peoples' struggle for more democratic control over the conditions of their own lives. In recent years, both federal and local representatives of indigenous peoples developed an innovative regulatory framework in support of greater involvement of indigenous interest groups in development matter that affect their own regions, (McCrank 2008 Braden 2009). This pattern – a top-down versus a bottom-up concern – is to a large extent reflected in most of the Arctic.

In this context, the development of self-government in the Nordic countries (Greenland and the Faroe Islands) and the establishment of self-governing territories of Canada – i.e., Nunavut, Yukon and the North Western Territory and in the near future also Nunavik (Northern Quebec) - plays a key role. The link between the experiences in Canada and the Nordic countries creates excellent opportunities to investigate the many new initiatives, but it also increases the need for the northern communities to ensure evidence-based policy development that is coordinated, collaborative and open to continuous improvement (Rasmussen 2003; Ringholm, Angell and Gjertsen 2006; Lindqvist 2011)

Through comparisons the project therefore aims to improve the understanding of policy options and to ensure greater dialogue between policy makers across the Nordic countries and Canada. Among the main questions that will be answered are:

- What were the negative effects of past mining, energy development, and renewable resource extraction, which have served as obstacles to sustainable development at the regional level?
- What policy changes are needed in order to promote resource development that contributes to greater sustainable regional development?
- What are the appropriate models for the development of new commercial activities that ensures development takes place development in a sustainable way?
- What kind of regional partnerships with the future economic activities work best in relation to the regions?

- Where are the key knowledge gaps that could help facilitate the necessary insight and policy formulation in relation to the goal of sustainable regional development?

1.4 Theme: Sustainable communities

Arctic communities have changed dramatically over the past 100 years, and especially in the last three decades under the influence of increased globalization. As mentioned, while some communities have coped or benefitted from this change, many more have been negatively affected by demographic and economic challenges that have resulted in growing social and economic stress (Heininen and Southcott 2010; Rasmussen 2011; Rasmussen 2003; Hansen, Rasmussen and Roto 2012). Additionally, many Arctic communities are faced with ongoing environmental change, which poses new challenges altogether. Meanwhile, the increasing focus on the difficulties for communities themselves to handle such challenges - let alone having their voices heard when they are handled outside the community - mean that there have been many initiatives aimed at ensuring their participation have been undertaken (see for instance, Furgal 2005; Ford 2010; Hörnström, Hansen, Roto, Perjo and Claessen, 2012). Some of these initiatives have found new ways to deal with such challenges, and have provided tools that help communities manage challenges locally (Winther, 2001; Natcher and Hickey 2005; Smith 2005; Fondahl et al 2010; Rasmussen 2003, Rasmussen 2005; Rasmussen 2009; Carson, Rasmussen, Ensign, Huskey and Taylor 2011).

While the theme of Sustainable Regions focuses on policy-relevant questions, this theme has a focus on examining the specific effects in relations with local communities. Among the main issues which the project will seek uncovered are:

- What are the short- and long-term effects of resource development, including the side-effects of resource-related migration on local communities?
- How do changes in economic activities and/or social structures impact urbanisation processes in the Arctic and what impact does this have on urban land use and land use management?
- What are the current and future impacts of resource use in relation to health and well-being?
- What kind of local partnerships with the future economic activities work best for local communities?
- Where are the knowledge gaps that could help facilitate the necessary insight and policy formulation in relation to the objective of sustainable local development?

1.5 Synthesis: Sustainable regions - Sustainable communities?

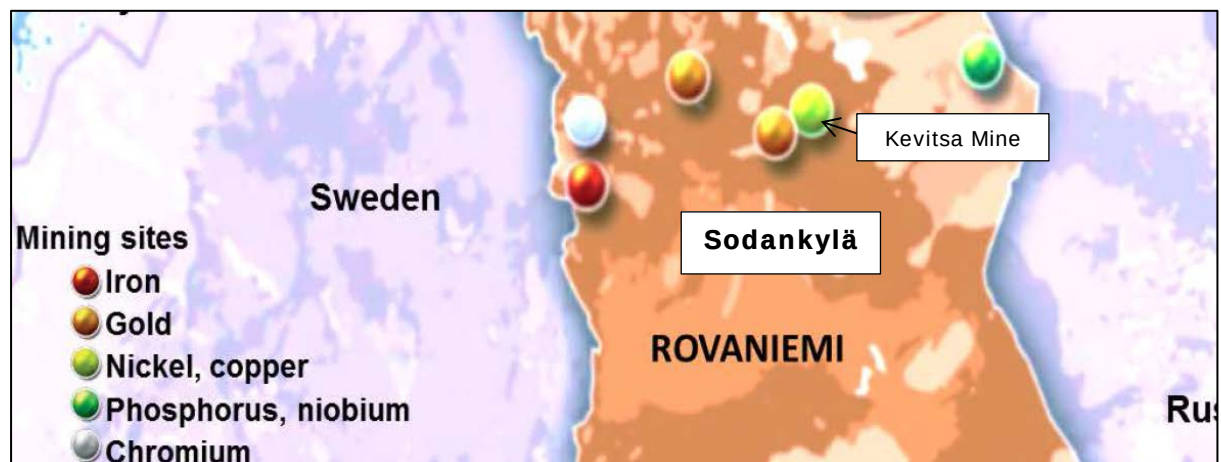
Based on the two themes described above the project seeks to answer the following questions:

1. How can analysis on the impacts of social and economic changes specifically focus on life changes or changes in quality of life?"
2. What welfare measures are necessitated in order to promote sustainable regional and local development of Arctic societies?
3. How can we ensure the best possible use of the social indicators that have been developed under the Arctic Council project on "Arctic Social Indicators"?
4. What are the knowledge gaps that could help facilitate the necessary insight and policy formulation for promoting sustainable local development and sustainable regional development?

2 Arctic Local Communities and the Competence Building in Relation to Large Mining Projects - Case Sodankylä, Finland

By Jukka Teräs²

The Arctic mining industry in the northernmost parts of Europe has recently experienced an upturn. This is largely due to the abundant ore deposits found in the Fennoscandian shield, which stretches through Norway, Sweden, Russia, and not least, the Lapland regions of Northern Finland (see figure 1).



Map 1 Fennoscandian Shield and the concentration of mines in Lapland, Finland (Adapted from: Lapland – our heart is gold and other minerals)

Finland has a tradition of mining activities since the 16th century. The first industrial wave of mining took place in the 1920s when the state-owned Outokumpu was the locomotive mining company. However, due to lower metal prices, the company had largely withdrawn from mining activities by the end of the 20th century. Yet a rapid increase in metal prices in early 2000s, together with the liberation of the mining industry in Finland, including permissions for the foreign mining companies to act, has resulted in a “renaissance” of mining activities, especially in North Finland. As a result, Finland currently has 12 ore mines and 31 industrial mineral mines in North and East Finland,, which are run by a combination of domestic actors and international well-known mining companies.

But along with this Finnish mining renaissance, the new mix of mining actors in Finland face a new situation regarding sustainability, which has become a key issue in the industry. Sustainable development balances three major dimensions: economic development, environmental protection, and social cohesion. For the Finnish mining industry this means that the flow of

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minerals and metals needed by the society is to be ensured - in harmony with stakeholders and the society at large.

Due to the territorial specificities of the Arctic regions in which these activities are taking place, a sustainable mining sector must focus on the fact that these areas are sparsely populated, with vulnerable nature, demographic challenges and less diversified regional economy. In this connection, the availability of qualified labour is an essential prerequisite for any mining activity and cultivating a suitable local labour force is a key dimension of a sustainable approach. Therefore, mining companies must have a policy of training and employing locals and of engaging local contractors, which brings direct and indirect benefits to the entire regional mining community.

Key focus, research question and method: The paper analyses the role and importance of local communities in building up the necessary competences in Arctic mining regions. This is analysed through all three dimensions of sustainability: economic development, environmental protection, and social cohesion. Moreover, the paper discusses the Arctic interplay between (often multinational) mining companies, the local community and other interest groups in competence building. In this connection, some of the key challenges described include uneven distribution of labour demand throughout the mining projects, and existing gender patterns affecting opportunities for women, both in the mining industry and in local mining communities in general. The capacity of local government is also highlighted and analysed in terms of questions like planning, communication, preparedness and ability to deliver sustainable solutions regarding labour issues. The key research question of the paper is formulated as follows: How and to what extent is it possible to local communities to contribute to sustainable labour policy in mining regions? Additionally, what kind of specific characteristics related to local competence building can be identified at Arctic mining environments? In answering these questions a review on academic literature on labour issues related to local and regional mining activities and communities has a focus on Arctic regions, and the empirical research is based on a case study of the Sodankylä mining region.

Case study Sodankylä: The municipality of Sodankylä (see figure 1) was established in 1893. With a geographical area of 12 415 km², it is the second largest municipality by geographical area in Lapland and has 9 000 inhabitants. The Kevitsa nickel-copper-platinum group elements (PGE) mine is located 142 kilometres north-northeast of Rovaniemi, the capital of Finnish Lapland. The mineral rights to the Kevitsa property were acquired in 2008 and are held by a wholly-owned subsidiary of First Quantum Minerals.

The empirical study analyses how and to what extent the local community has contributed to the mining activities in Sodankylä especially regarding competence building. In addition, the paper discusses the Arctic interplay between mining companies, local community, and other interest

groups in competence building in Sodankylä. The case study focuses on Kevitsa mine activities and the interplay between the Kevitsa mine and the Sodankylä community.

3 *Connections between global production networks and local production systems in the High North*

By Trond Nilsen³, Hjalti Jóhannesson⁴ and Ingvild Nylund⁵

In recent years, the Arctic region has become increasingly more interesting due to exploitation of natural resources for large, multinational companies. One important dimension in this development is the increasing presence of multinational corporations, mobile industrial actors and a mobile labour force. We want to take a closer look at the consequences that such an increased mobility has on local value creation and local labour markets in the Arctic. Thus, we search to determine *to what degree local and regional actors influence mega-projects and multinational corporations in the High North*. By monitoring and evaluating a petroleum and an aluminium site in Northern Norway and Eastern Iceland from 2003-2009, we apply data in order to identify, explore and analyse linkages between transnational companies and local firms, and how they develop when two different “systems of production” interact. The two monitoring research projects use different methodologies and data collection and this provides a challenge when it comes to comparing results. However, there are important similarities between the two cases, such as corresponding rural settings in each country and the dominant role of foreign multinational corporations creating various challenges and benefits for the communities.

Multinational Corporations connect to Arctic regions in different ways. To be able to document the actual impact MNC's have on local communities and regions, we argue that complex relationships should open up for in-depth empirical studies of industrial complexes like petroleum construction and aluminium facilities so that we may be able to highlight and analyse this dynamic in practise. This is also pointed out from scholars representing theories of global production networks (GPN) advocated by Coe (2004), Bridge (2008) and Yeung (2009).

The local and regional firms in the Norwegian case were mainly connected to the oil industry in three different dimensions, creating potential for upgrading the local and regional industry. Involvement for local firms in mega-projects depends on geographical proximity to the construction site. However, local and regional firms participate where skills are standardized, as sub-contractors or even sub-sub-contractors. The two extractive industries subject to the analysis show the existence of strong links with independent suppliers in the corporate network that largely inhibit the development of local linkages in the host economy. This is because of the familiarity with existing networks and linkages that may well discourage the developments of new

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ones. Development projects experience a "mismatch" between development's size and the local population. Learning new methods of working and involvement in technology networks is prevented by external systems of commuting. This may hamper a long term learning basis in the local arena and limit innovation possibilities.

Based on this analysis we support the GPN-perspective in advocating for local and regional development as a focus when studying extractive industries, in order to illuminate local and regional firm possibilities in these industries. However, one cannot exclude the main characteristics of extractive industries. We recognize the fact that global extractive industries have rationales that differs from important local and regional discourses. Future research conducted in different countries could benefit from collaborating on research design from the very beginning, to establish a solid basis for comparison later on. We find a need for further theoretical elaborations on the concept of extra-local linkages that embraces clusters of firms who enter new geographical areas as fixed production systems. By adding the potential of local and regional firms in connecting to such a system of production, it seem obvious that these processes are not comparable with standard ways of thinking about clusters as geographical embedded in specific places.

4 Impacts of cross-border cooperation on the socio-economic development of Kiruna and Narvik

By Anna Berlina⁶

Border regions are significantly influenced by the proximity to the international border. Some border regions are characterised as zones of enhanced economic and entrepreneurial activity due to geographical proximity to the foreign markets (Topaloglou & Petrakos 2008). More often, however, border regions are considered disadvantaged due to their peripheral location, from the aspects of both geography and socio-economics. These regions may suffer from the deficits on the labour market due to migration, negative demographic development, often have lower living conditions, etc. Cross-border cooperation (CBC) plays an important role in boosting the territorial potentials and diminishing the territorial imbalances of the border regions, as well as building mutual trust and social capital and, thus, compensating for the disadvantages of the peripheral location.



Map 1: Kiruna-Narvik border region, including railways and main roads connection the region

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This paper explores how the proximity to the border influences the socio-economic development of Kiruna (Sweden) and Narvik (Norway) border regions. It examines current CBC activities in the border region and sheds some light on the challenges and opportunities for CBC. The paper is based on the interviews conducted with a broad range of stakeholders in Kiruna and Narvik, including local governments, large enterprises and SMEs, development organizations and NGOs in the framework of EU FP7 EUBORDERREGIONS research project. In total 45 qualitative interviews were conducted (19 in Kiruna and 26 in Narvik) during 2013-2014.

Both Kiruna and Narvik are industrial towns, which lie north of the Arctic Circle and are closely linked through iron ore production and trade. The emergence of Kiruna was linked to discovery of iron ore fields in the area, whereas a background for the establishment of Narvik was the development of iron ore railway from Kiruna to ice-free ports of Narvik. Both municipalities enjoy a high level of socio-economic development today. However, the local economies are vulnerable due to a low level of economic diversification. Moreover, both municipalities are characterised by a population decline over the last decade.

The Swedish-Norwegian border stands out among other external EU borders, as Europe's longest, oldest and the most peaceful border. Therefore there are significantly less barriers for CBC if compared with other non-EU neighbouring countries. Moreover, the countries share a long common history, have a similar governance system and significant cultural and language similarities (Regeringen 2008).

Despite the above mentioned factors facilitating CBC, the study showed that CBC in Kiruna - Narvik border region has been quite limited. Funding from the EU and Nordic cross-border and transnational programmes since 2007 has been poorly used. CBC projects have so far focused mainly on developing transport linkages and improving logistics between the two towns. CBC between the business actors, except for those who are involved in iron ore mining, has been quite weak.

At the same time the interviewed actors, particularly from the tourism industry in Sweden, expressed an interest in enhancing CBC. Among the findings was that a lack of specific and concrete cooperation objectives between the two municipalities was identified as a limiting factor for CBC. All interviewed actors in the border region had a positive attitude towards the physical proximity of the border. The economic and socio-cultural differences and certain particularities of the neighbouring country have been the main drivers for the cross-border flows (e.g. lower prices on commodities and services in Kiruna, Riksgränsen ski resort, natural environment). The paper concludes by presenting views on cooperation opportunities in future and draws some recommendations for enhancing CBC.

5 Inclusion of Sami tourism in destination development

Lise Smed Olsen⁷

Tourism is a growing industry in Sápmi, an area spanning northern Norway, Sweden, and Finland, as well as the Kola Peninsula of Russia. The area is often referred to as Europe's last wilderness, and the indigenous people, the Sami and their culture is considered a main asset for a growing tourism industry (Müller and Huuva, 2009). This paper is focused on Sami tourism in Northern Norway and Northern Sweden. Map 1 provides a map of Sápmi (the highlighted area).

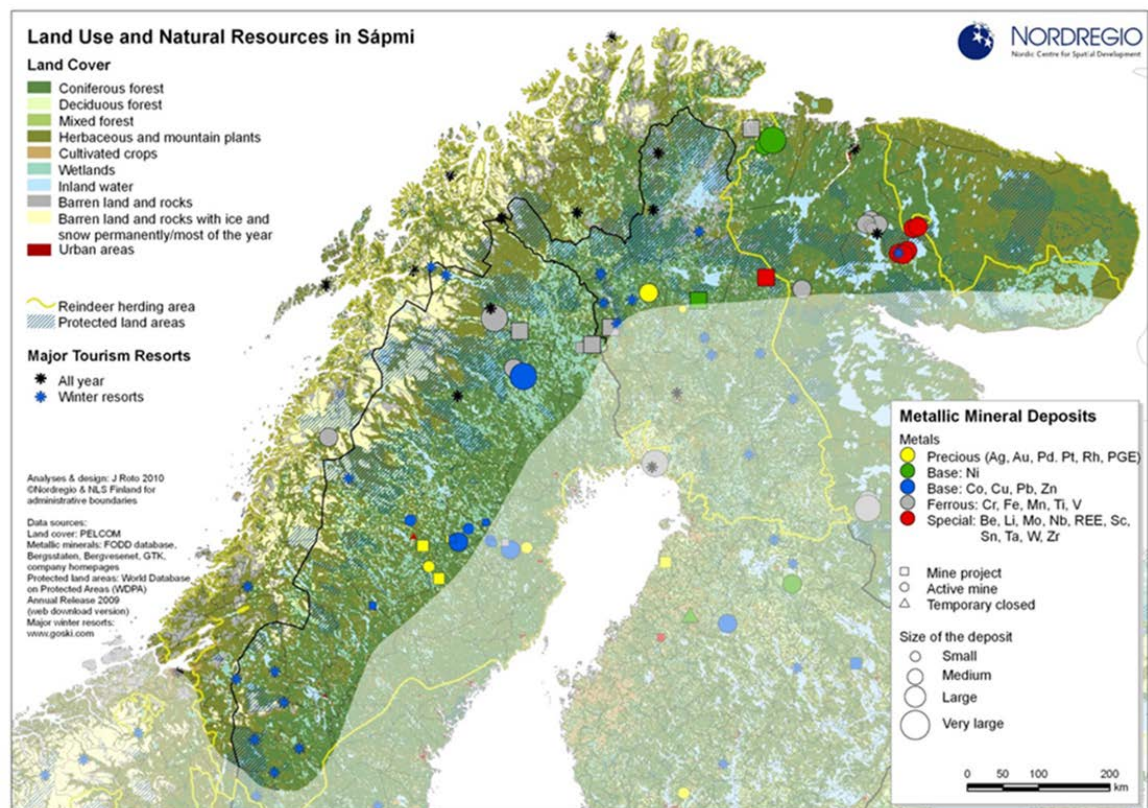


Map 1: Land use and natural resources in Sápmi (2010)

Politicians and authorities in the Arctic region are increasingly highlighting tourism as an opportunity for economic development (Grenier, 2011; Müller, 2011; Müller and Jansson, 2007; Hall, 2007). Resource extraction industries such as forestry and mining continue to be dominating sectors (Müller, 2011; Müller and Jansson, 2007), and in the cases of northern Norway and

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Sweden, land claims by Sami reindeer herders continuously create debate with resource extractive industries, agriculture and forestry. Moreover, land use conflicts are common between the tourism industry and resource extraction, agriculture and forestry industries, as well as between the tourism industry and the reindeer herding industry. An important difference between the two countries is that Norway has signed the ILO Indigenous and Tribal People Convention No. 169, and has also decided to re-transfer ownership of forests in Finnmark County from the Norwegian State Forest Company to the local community. This entails stronger rights and land use claims for Sami reindeer herders in Norway compared to Sweden (Müller, 2011). Map 2 provides an illustration of land use and natural resources in Sápmi.



Map 2 Land use and natural resources in Sápmi (2010)

Indigenous people have been noted to have a competitive advantage in tourism, based on their unique cultures and the traditional land in which they are based (Notzke, 2004; Hinch and Butler, 2007). The increasing demand for Sami tourism products in Northern Sweden and Norway indicates that there are good opportunities for Sami entrepreneurship and the development of indigenous experiences in the tourism industry. Hinch and Butler (2007:5) describe indigenous tourism as tourism activities in which indigenous people are directly involved either through control and/or through their culture serving as the essence of the attraction. Control, in terms of how indigenous tourism products are developed is significant.

During recent years a body of research has been produced on the issue of Sami tourism studied from the perspective of Sami stakeholders (e.g. Müller and Huuva, 2009; Müller and Pettersson, 2006; Viken, 2006). This paper contributes with empirical research on a less explored issue of indigenous tourism development, as *it aims to identify which strategies key public and public-private-partnership organisations adopt to include Sami tourism in local and regional destination development*. Case study analysis will be carried out in two local communities where a high share of the population is Sami and where tourism is a significant industry, Jokkmokk (Dálvvadis) in Sweden and Kautokeino (Guovdageaidnu) in Norway. The analysis is based on network theory and its intersection with collaborative planning in tourism destination development, which involves the importance of including diverse stakeholders in participatory processes of consensus building and partnership formation. The bringing together of different stakeholders also involves tension and conflict in tourism planning and policymaking, and research has indicated that power differentials play a significant role in shaping the collaborative process, and extent of ownership over the solutions that are selected (Dredge, 2006a; 2006b).

The issue of including Sami tourism in destination development involves taking into consideration the perspectives of reindeer herding Sami and land use issues, as well as the development of indigenous tourism. These are considerations that are included in the analysis. Differences in approaches to Sami stakeholder involvement may differ between the two case studies, not least due to the stronger rights and land use claims for Sami reindeer herders in Norway compared to Sweden.

6 Narsaq: A Community Challenged by Municipal Restructuring and Uranium Mining in South Greenland

Rasmus Ole Rasmussen⁸

6.1 Introduction

Mining in Greenland has for periods of time been an important element in the exploitation of the country's natural resources and with mining tradition extending far back in Greenland's history. During the last years it has become even more important due to the harsh economic realities. With most of the renewable resources used close to its maximum - for some species even beyond this point - and with dwindling world market prices for fish and fisheries related products, the need of alternatives in order just to maintain the living conditions has become obvious. And with ambitions of increased level of autonomy based on a reduced dependency of transfers from Denmark the need for alternatives has become still more obvious, with mineral and energy resources among the most obvious means of promoting this process. This has been further emphasized by the transition from Home Rule to Self-Government where further advances in relation to independence and autonomy have become a matter for decisions by Greenland.

6.2 The South Greenland situation

The success so far, however, has been limited. In spite of many known resources which in principle might serve as an economic base for Greenland in the future, the attempts among both national and multinational companies to establish a "take off" for a new economic situation in Greenland have shown a lot of promises but only limited results.

In South Greenland especially three activities attract attention – two of them with a longer track record that are important in relation to evaluation of the perspectives. The third one which is just in the phase of getting approval is planned to take off in 2014 or 2015 and is important to show the needs of preparing for large scale projects.

6.2.1 The Nalunaq gold mine, Nanortalik

Nalunaq Gold Mine A/S started gold production in 2004. The company was owned by Crew Development Corporation and NunaMinerals A/S. The deposit has a small tonnage and a great grade. The gold is in quartz veins with an average thickness of 0.7 m, the measured resource of 440.000 tons of ore or about 9,1 tons of gold. Further exploration licenses in the area suggest that there in addition is a possible resource of approximately 1, 7 million tons of ore equal to around 30 tons of gold. At the time of approval the gold mine was assumed to have a lifespan of up to 10-11 years. Profitability study resulted in an assessment that the ore volume did not make a sound

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economic basis for establishing a processing plant on site, after which the ore was shipped for processing in Spain. In October 2006, the company has decided that the future processing must be done at a processing plant in Newfoundland.

Nalunaq Gold Mine A/S was granted an exploitation license in 2003 with the authorization being valid for a period of 30 years and in July 2004, the mine was at full production. The camp was established as a small village in the middle of the valley in a distance of around 20 km from Nanortalik. It was arranged to be able to accommodate about 100 people. An approximate 10 km road connects the camp with the quay situated at the bay. It comprises a pontoon quay. Employment has been up to approximately 30 employees including both the persons on-the-job as well as the employees being at home. The tasks performed under mine management, geological surveys, etc. by Procon Mining & Tunnelling included the employment in July 2006 approx. 79 persons, 10 of whom were resident in Greenland. Transport jobs, construction projects, etc. was outsourced to contractors company R.C. Construction Services A/S. The company was based in Qaqortoq. There were approximately 12-18 employees at the company in the mine depending on the tasks that are currently to be solved. This corresponds to approximately 20 to 22 man-years. In relation to recruitment the company created an internship in the mechanic workshop. Catering and cleaning were outsourced to a company based in Nuuk and involved approximately 10-12 employees at the mine. All employees were residents of Greenland. Only one employee is not born in Greenland. It has not been possible at the present to accurately calculate the indirect and induced employment and income generated by the Nalunaq Gold Mine in Greenland.

Due to high transport and processing costs (primarily in Canada) the company stopped its activities by the end of 2013. At this point of time there are no information about whether it might be re-opened with other owners, or if it would be closed down permanently.

6.2.2 The Kvanefjeld uranium deposit, Narsaq

Concerns regarding the mining of Uranium in Greenland have been focusing on the major deposit in the Kvanefjeld (Ilimaussac intrusion complex) in Southern Greenland. It was investigated intensively over the period 1955 to 1986 when it was dropped for many reasons.

The available resources were not too large but had a very high grade: Three zones of deposits were mapped: Zone 1 indicated resources of 101.000 t U in ore with 0.023% U and inferred resources of 33.077 t U of 0.018% U; Zone 2 indicated inferred resources of 62.308 t U in ore with 0.026% U; Zone 3 indicated inferred resources of 24.231 t U with 0.025% U. Uranium is found together alongside several rare earth minerals which, however, were not of commercial interests at that point of time.

The Danish government discussed in the beginning and mid of the 1970ies the possibilities of pursue Nuclear power as an option for energy supply for Denmark, and included discussions on taking into account the available potentials from Kvanefjeld. There were, however, objections

within the government, and even more in the Danish population which eventually led to a general stop on further development in this direction.

In Greenland this decision was supported for several reasons. The impact assessments done in conjunction with the general resource surveys showed negative impact on several resources (for instance blue mussels) in the waters around Narsaq whereby mining might generate health hazards for the population. The most important decision in this context was the claim from the newly established Home Rule Government in 1979 that future development in Greenland “should be based on the living resources” whereby any option for mining the Uranium ore was abandoned. It is therefore only quite recently that the whole discussion of the options of opening a mine in the rich Ilimaussaq complex, in the beginning focussing on the Uranium content, but later on with focus on the complex of rare earth minerals.

The full Kvanefjeld uranium resource (JORC compliant) is recently estimated at 221,600 t U, 46% of it as indicated resources at 0.015% U₃O₈ cut-off, and 10.3 million tonnes of REO including 0.37 million tonnes of heavy REO. Involved companies have demonstrated over 90% co-recovery of REOs via effective beneficiation of concentrates followed by atmospheric sulfuric acid leach and solvent extraction recovery. This will lead to hydrogen reduction of uranium minerals and beneficiation followed by acid leach for REOs including yttrium. The Kvanefjeld deposit also has 2.25 Mt zinc as potential by-product. The potentials will allow an annual production of 1000 t U with about 40,000 t REO as well as zinc concentrate, from a large open pit mine. Project cost is expected to be \$1.53 billion. A definitive feasibility study is proceeding to mid-2013, concurrently with pilot plant trials, environmental impact assessment and social impact assessment.

The following companies are performing uranium prospection and/or exploration in Greenland: Prime Minerals Ltd, Greenland Minerals and Energy Ltd, and Ram Resources Ltd. All companies are Australia based.

The case is very interesting due to the diverse and complex role of the population, the communities, the regions, and the Self Government administration – and not the least the political parties – in the process which, at this point of time is totally unpredictable.

6.2.3 The “Kringlerne” rare earth deposit, between Narsaq and Qaqortoq

In conjunction with the same geology resulting in the Kvanefjeld deposits the Ilimaussac complex include a large deposit of rare earth minerals (with Uranium as a minor part) in the nearby “Kringlerne” rare earth deposit. Rare earth elements (REE or REO) are a set of seventeen chemical elements in the periodic table, specifically the fifteen contiguous lanthanoids plus the lighter scandium and yttrium. Scandium and yttrium are considered REE since they tend to occur in the same ore deposits as the lanthanoids and exhibit similar chemical properties. Because of their geochemical properties, REE are typically dispersed and not often found in concentrated and economically exploitable forms. REEs are often found together, and are difficult to separate.

Economically and geologically there is a distinction between light REE, or cerium earths (scandium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium - elements 21, 57-64) and heavy REE, or yttrium earths (yttrium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium - elements 39, 65-71). Gadolinium and europium apparently can fall into either category. Since 1998 China has produced over 80% of the world's REE, mostly from Inner Mongolia, and the proportion is now higher. All of the world's heavy REE (such as dysprosium) come from China.

The TANBREEZ Project is owned by a Greenlandic company called TANBREEZ Mining Greenland A/S. TANBREEZ is an abbreviation of the metals which are planned to be extracted from eudialyte including: Ta for Tantalum, Nb for Niobium, REE for rare earth elements and Z for Zirconium. The company was established in 2010 by its parent Australian based company Rimbal Pty Ltd. In 2001, Rimbal Pty Ltd obtained the licence to explore the Project area and have carried out a number of investigations in the license area. According to the company the mining project is expected to consist of:

- an open mine pit;
- a processing plant;
- a port (including a helipad);
- a mine camp;
- a tailings deposit;
- internal connecting roads.

The processing of the ore is a simple process where no chemicals are used, and consists of a crushing plant followed by a magnetic separator (a process that utilizes the minerals different attractions to magnetic fields).

The outcome of the separation is made up of three fractions: a black highly magnetic fraction (Arfvedsonite), a red concentrate (Eudialyte), and a white non-magnetic concentrate (Feldspar). The concentrates will be stored before shipping. The initial plan is to mine approximately 500,000 tonnes of ore per annum (TPA) producing Feldspar concentrate and Eudialite concentrate. The deposit is estimated to have a size of more than 4.3 billion tonnes, and therefore it could be in operation for generations. The first phases of the development of the mine site is expected to take place during 2014 and 2015.

The project is divided into the construction and the operation phases. The construction phase will demand 30-40 workers at the beginning. This figure is expected to increase to 120-140 during the summer month year 1 and 2 of construction (expected to be 2013/2014). The operation phase will require approximately 97 employment positions. Catering and housekeeping duties will most

probably be outsourced to local businesses. The majority of the employers will work 4 weeks on and 2 weeks off. Potentially unemployed workers are expected to benefit from the job opportunities created by TANBREEZ during both the construction and operation phases. However, according to the company the most likely scenario is that the project will mainly attract workers who are already employed in other sectors. Indirectly, this will create new opportunities for the unemployed workers. And in this connection the closing of the Nalunaq gold mine has resulted in that Nanortalik has a pool of labour which is considered suitable for the requirements for employment at the TANBREEZ project after minor appropriate training. Furthermore, it is likely that people who left Kommune Kujalleq due to the lack of jobs will move back to Narsaq and Qaqortoq, when new job opportunities are created.

And new jobs are desperately needed in the region. And extremely high average age compared to the rest of Greenland, a very low percentage of young persons below age 15, a disfavourable gender distribution with women as low as 39% of the population show that the region has all the trademarks of a region in distress (see table 1 for details).

Table 1: Settlements and demographic characteristics in South Greenland.

Population in towns, village, sheep farms and sheep farm clusters, mine areas and stations as of January 1st 2013								
Type of settlement		Place name	Population 2013	Summarized in categories	% age 65 and above	% below age 15	% women	% work force (15-64)
Towns	1	Nanortalik (by)	1337	1337	8	25	45	67
	2	Narsaq (by)	1503	2840	11	22,5	46	66,5
	3	Qaqortoq (by)	3229	6069	7	20,5	47	72,5
Villages	1	Qassimiut (bygd)	22	22	17,5	17,5	33	65
	2	Igaliku (bygd)	27	49	16,5	14	35	69,5
	3	Saarloq (bygd)	37	86	12,5	18,5	30	69
	4	Ammassivik (bygd)	40	126	16,5	14	46	69,5
	5	Qassiarsuk (bygd)	47	173	18	13	41	69
	6	Tasiusaq (bygd i Kujalleq)	57	230	12,5	23,5	41	64
	7	Eqalugaarsuit (bygd)	79	309	12	15	43	73
	8	Narsaq Kujalleq (bygd)	98	407	10	21,5	42	68,5
	9	Aappilattoq (bygd i Kujalleq)	110	517	6	30	39	64
	10	Narsarsuaq (bygd)	143	660	2,5	17,5	43	80
	11	Alluitsup Paa (bygd)	263	923	12	18	39	70
Closed villages	1	Alluitsoq (Nedlagt bygd)	0	0				
Sheep farms and sheep farm clusters	1	Qallumiut (Fårehold)	6	6				
	2	Qaqortoq (Fåreholdersteder ved)	7	13				
	3	Upernaviarsuk (Fårehold)	10	23				
	4	Igaliku Kujalleq (Fårehold)	10	33				
	5	Igaliku (Fåreholdersteder ved)	10	43				
	6	Qorlortorsuaq (Fårehold)	11	54				
	7	Narsaq (Fåreholdersteder ved)	12	66				
	8	Tasiusaq (Fåreholdersteder ved)	14	80				
	9	Eqalugaarsuit (Fåreholdersteder ved)	29	109				
	10	Qassiarsuk (Fåreholdersteder ved)	48	157				
Closed sheep farms and sheep farm clusters	1	Qunnermiut (Fårehold nedlagt)	0					
	2	Niaqornaarsuk (NAN) (Fårehold nedlagt)	0					
	3	Narsarsuaq (NAN) (Fårehold nedlagt)	0					
	4	Akuliaruseq (Fårehold nedlagt)	0					
	5	Qaarsutsiaq (Fårehold nedlagt)	0					
	6	Eqaluit (Fårehold nedlagt)	0					
	7	Tatsip Ataa (Fårehold nedlagt)	0					
	8	Akia (QAQ) (Fårehold nedlagt)	0					
	9	Qeqertarsuaaraq (Fårehold nedlagt)	0					
	10	Arpatsivik (Fårehold nedlagt)	0					
	11	Ilerlak (Fårehold nedlagt)	0					
	12	Qinngua Kangilleq (Fårehold nedlagt)	0					
	13	Qimarnuffik (Fårehold nedlagt)	0					
	14	Itilleq (Fårehold nedlagt)	0					
	15	Itilleq Killeq (Fårehold nedlagt)	0					
Mine sites	1	Nalunaq (Mineområde)	2	2				
Stations	1	Angisoq (Loranstation nedlagt)	0					
	2	Nuussuaq (NAN) (Loranstation nedlagt)	0					
	3	Icecan (Station nedlagt)	0					

6.3 Impact of changing institutional frameworks

The merging in 2009 of the previous 18 municipalities in Greenland into four was an important part of the process of delegating more responsibility from the highly centralized Home Rule and later Self Government administrative bodies to the municipalities. The administrative organization of spatial planning can be performed in a myriad of ways, and changes / adjustments may be necessary to undertake from time to time. The main question to be answered is: how is the distribution of task distributed most adequately?

The division of tasks generates different conflict levels between the central wishes and municipal want. The national level often have some more general requirements for planning tasks: one wants to preserve the public's best interest, while the municipal level can have a more geographically limited goal of their priorities. How the distribution of tasks is allocated is also an expression of the overall distribution of power between the different institutions. For example: must state authorities decidedly approve municipal transactions or should they just have the right to object within just a few areas such as conservation interests, exploitation of natural resources, etc.? Or does the trust of the joint administrative interests at different levels allow for further delegations?

Structural reforms are generally reflecting the changing needs of society. It may be changes in the political structure, changing population and commercial structures or pressure on the service offering. Structural changes can also be a conscious decision to work closer to people or just remove decisions from the local level so that more independent processing, increased regional context, economies of scale etc. are obtained. Finally, there is of course an economic dimension to the various solution models. It may be the desire to save on administration by consolidating tasks into fewer units or fewer levels or an assessment of municipal economic base to carry out their tasks. Often they are therefore both a task and a component in a structural reform.

In Greenland, the recently completed structural reform led to renewed discussion about conflicts and common interests between the PA and the new 4 large municipalities. This discussion has become a very important factor in the present situation with increased focus on mining. An important issue in the project will be to identify the common interests and conflicts of interest which exist in the new Greenlandic planning system, and compare with the distribution of similar tasks in the other Nordic countries.

In addition to the structural reform from 18 to 4 municipal entities, the reform also included a new division of tasks. The idea has been that more work needs to be moved from the PA to the municipalities and the reasons for the large municipalities were therefore they should be of a size which makes the increased task performance possible - both in resources and capacity. It is primarily operational, moved out to the municipal level, and task performance - despite the new larger municipal units - immediately moved closer to the people. In planning, it is especially land management where tasks have been moved from the state to the municipal level, in particular,

with the intention that the binding planning details should shifted from the national to the municipal level.

6.4 Challenges in relation to other ecosystem services

An important issue in relation to the changes in the institutional framework is the legal framework in relation to both the mining activities with their impact on other ecosystem services, and in relation to the planning and management of the exploitation of such services. Most of the economic activities in Greenland are based on activities related to the sea. Some of these activities may be impacted through increased transport activities and dumping of tailings in the sea, which the history of the Uranium mining in Narsaq illustrates. Most of the impact will, however, be situated on land and thereby interact with other land use related activities.

Compared to the interests related to the sea there are a few commercial interests related to the land, for instance hunting of large land mammals and some birds distributed through the shops, through the local markets or distributed within networks of families and friends. In order to hunt for instance whales a professional license is required. To hunt for personal consumption or in small scale a leisure time license is required. For Greenland as a whole there are approximately 2.300 licenses for professional hunters and fishermen while there are 5801 leisure time licenses. In South Greenland there were 415 professional licenses in 1996 while the number has dropped to 179 in 2007. The leisure time licenses were 545 in 1996 and 507 in 2007 respectively. Compared to the total population in the region of 7151 persons the importance of the professional hunting and fishing activities has experienced a remarkable decline – less than half being professionals in 2007 compared to 1996. The leisure time activities have in contrast been kept at almost the same level over this 10 year span. These changes are not exceptional to South Greenland but follow more or less the same patterns as in other regions in Greenland.

There is, however, a very important difference between South Greenland and the other municipalities. Sheep farming which was introduced as a vocation in South Greenland in 1908 has been expanding step by step since then, and a major reform in South Greenland during the 1980ies turned the region into being characterized by combinations of hunting, fishing and sheep farming. And sheep farming is consequently the major land use based activity in South Greenland. A total of around 70 farms were established as a total of 25 individual and clusters of farmsteads, slaughtering around 20.000 lambs for the home market in Greenland. As the table 1 indicates a total of 157 persons (no details regarding age structure, but encompassing around 50 families) are representing a business activity and use of ecosystem services with a potential conflict with other land consuming activities – and in this context with mining. Not only due to the areas for the mine sites, but especially because the surroundings of a mine site may be impacted by dust, tailings and water containing hazardous waste materials.

In Greenland all land areas are commons which means that there is no private ownership to land, neither individually nor through interests groups. Instead the rights to use and manage the land

can be delegated to both persons – for instance for housing – or organizations – for instance grazing rights to the Greenland Sheep-farmer's organization. In relation to delegation of land for exploitation of mineral resources the authority is situated outside the municipal responsibility as it due to a national directive require approved license under the Mineral Resources Act or equivalent. It means that whatever planning a municipal council has decided on such plans could be undermined if the area is covered by a country scheduled interest. The system of planning and land use as it currently operate, exposes - in spite of the existence of a formal zoning for the entire Greenland – that all parts of the territory of Greenland have the potential to be included in a large-scale project of any kind. An initiative in establishing zoning in Greenland was initiated in 2012 and had its focus on announcing a special business zone established north of 81° north latitude, which in practice means the whole of northern Greenland. The purpose of establishing such a zone was the introduction of new and more attractive conditions for industry in just that area. Exactly what will be the impact of such an initiative, and to what extend the overall zoning of land for specific activities would be stretched further south is still undecided. But if there is a political consensus of doing it would basically mean a step back to square one compared with the whole ideology of the municipal reform aiming at decentralizing responsibility regarding local matters to the municipalities.

6.5 Narsaq involvement

Narsaq has been an important place in connection with the Danish modernization of South Greenland both before and especially after WWII. The town was chosen as centre for the commercialization of the district by means of sheep farming as well as fisheries and the first

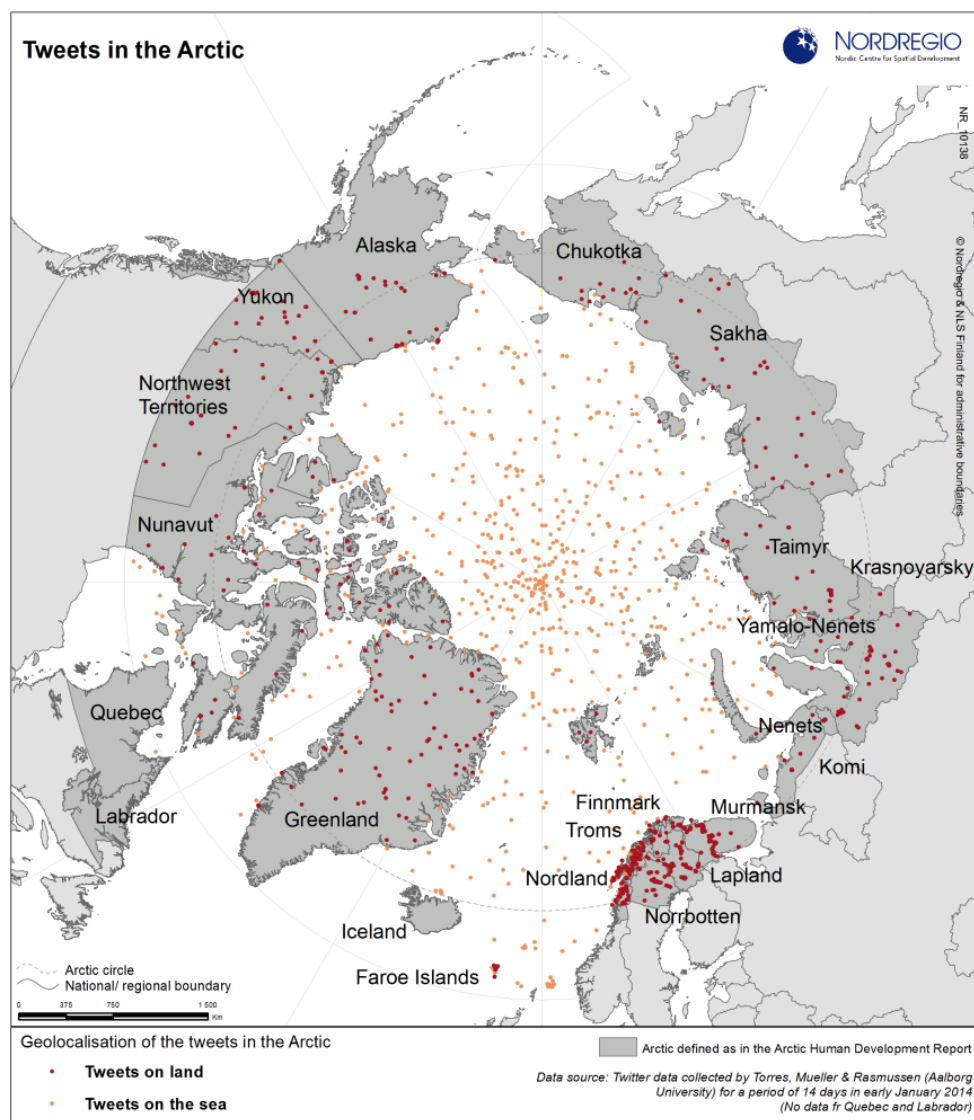
The town situated close to –or actually more or less in the mid of - the Ilimaussaq Intrusion containing a large diversity of rare minerals has a substantial Uranium ore in the Kvanefjeld which could have provided resources changing the town into a centre for large scale industrialization many decades ago. But both prior to and after the establishing of the Home Rule Government the focus on the two first mentioned resources and abstained from making use of the latter. Recently, however, the option of becoming a mining centre in the new economic plans for Greenland has re-opened the old ideas which might generate a new future for the town that lost its importance in connection with the municipal reform and turned into a dull town of pensioners.

7 Mapping virtual mobilities in the Arctic - Examples from North America and Northern Sweden

Julien Grunfelder⁹

Context

A feature on Twitter enables its users to save the location of their tweets. This feature that is turned off by default records the latitude and longitude (on phones and mobile application) or the city or neighbourhood (on twitter.com). It is estimate that over 3% of all tweets have the exact



Map 1 Geolocalisation of the tweets in the Arctic

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Data

The tweets were collected over a 2-week period in mid-January 2014 for most of the Arctic area as defined in the Arctic Human Development Report. Data for each tweet includes the user id, the text of the tweet, the name of the country where the tweet was sent, hashtags, and geographical coordinates. The latter was used to map the collected tweets (Map 1). 15 830 tweets have been collected in total. 12 186 tweets were sent on land, with the big majority sent from the Russian parts of the Arctic, following by Norwegian and Finnish parts of the Arctic (Figure 1). A selection of the tweets have been made in order to only map the tweets sent by actual Twitter users, as opposed to, for instances, tweets sent by robots in stations.

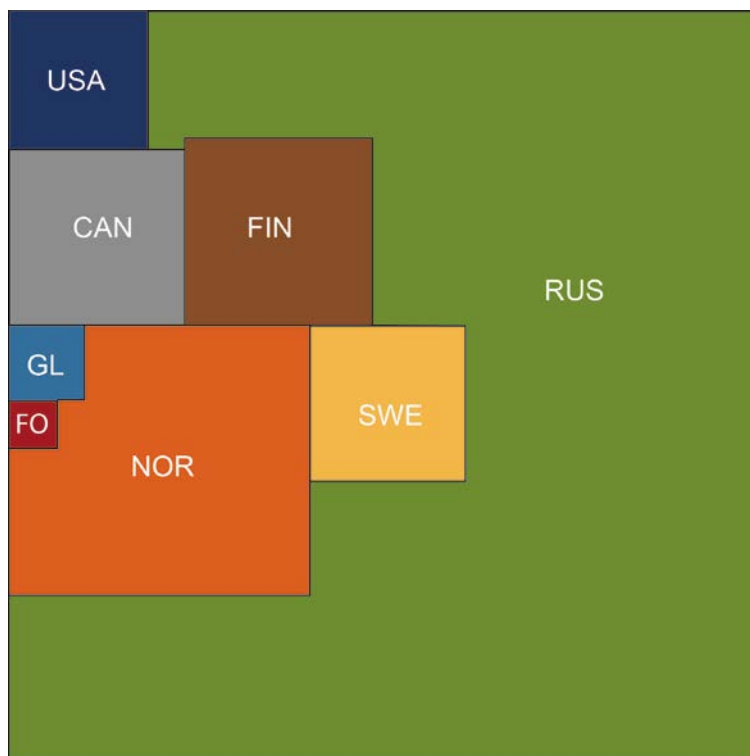
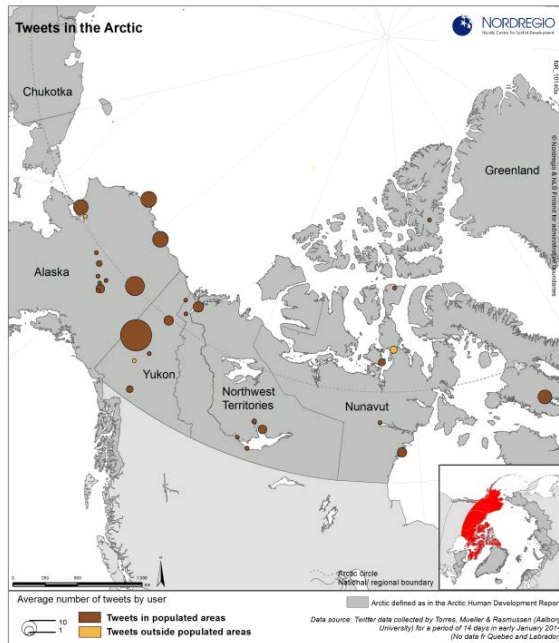


Figure1: Proportion of collected tweets per country (land area only)

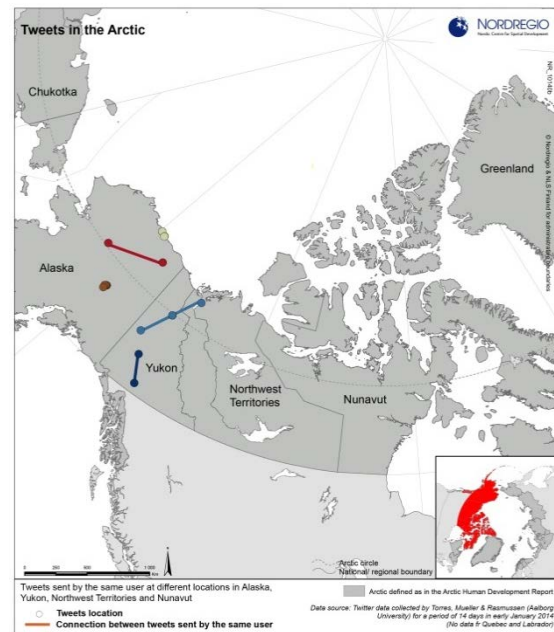
Tweets and mobilities of Twitter users in North America

Tweets in Alaska, Yukon, the Northwest Territories and Nunavut are, for the great majority, sent from populated areas. Only a limited number of tweets have been sent in non-populated areas; those were mainly sent by tourists (Map 2 and 3). Looking at the main topics in the tweets, there are pretty similar between the four Provinces or States and in almost the same order of popularity. It appears the most popular ones are related to entertainment, feelings, work, and family and

friend. A natural event in Nunavut (blizzard) has moved the topic related to weather as the most popular over the 2-week period in mid-January 2014.



Map 3: Tweets in North America



Map 2: Tweets in North America

It is possible to mention another user in the message of each tweet. An analysis of this data (Figure 1) highlights different degrees of connections between Twitter users of the case study and the rest of the world.

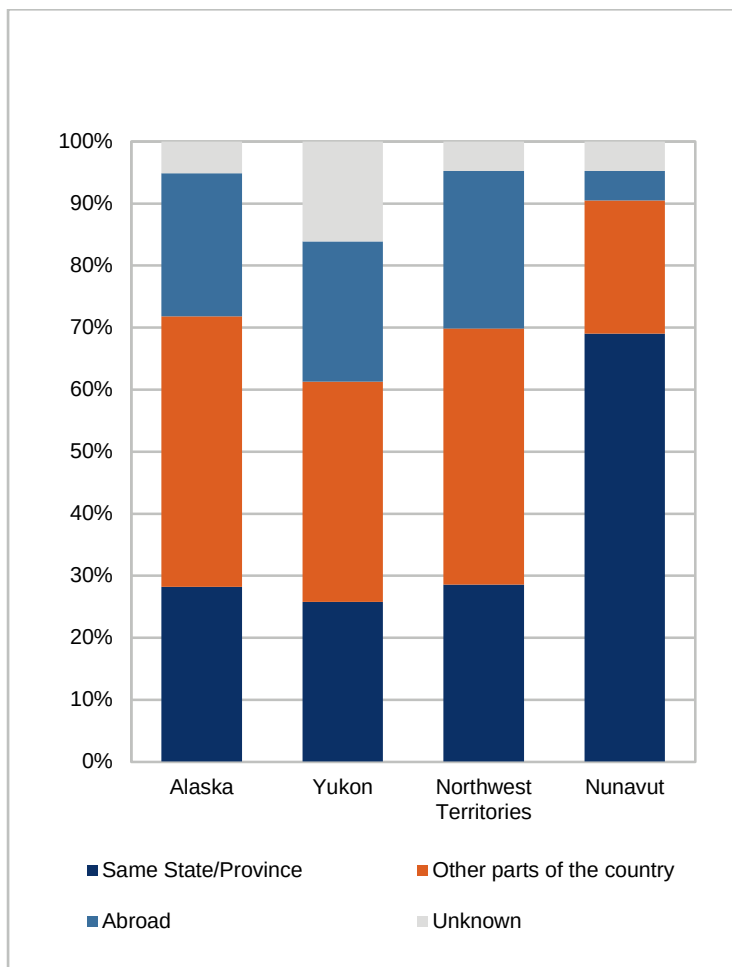
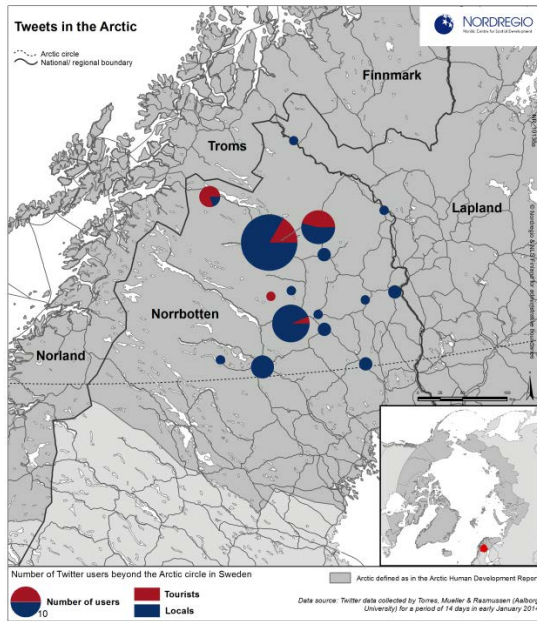


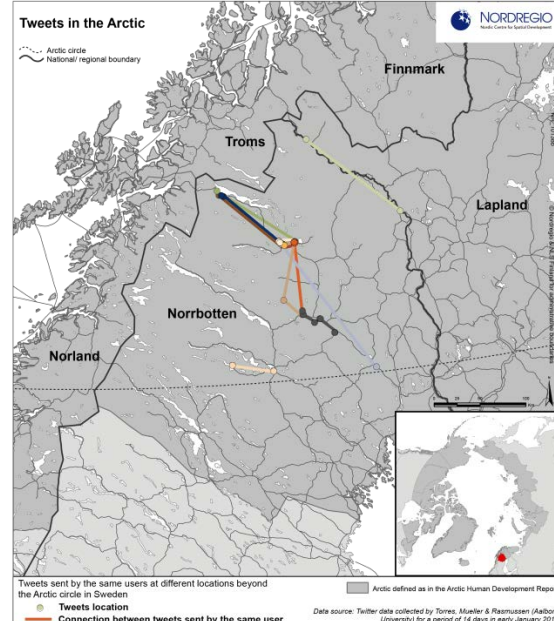
Figure 2: Tweets containing another Twitter username, classified by destination

Tweets and mobilities of Twitter users in Sweden

An analysis of the content of the messages in geolocalised tweets sent beyond the Arctic Circle in Sweden enhances to distinguish tweets sent by local population from tweets sent by tourists (Map 4). A mapping of these two population groups highlights that tourists are concentrated in a limited number of locations, such as Abisko and the Ice Hotel near Kiruna. Having both information such as the user ID and the precise location of the tweet, it is possible to map the mobility of the Twitter users in this part of the Arctic within the 2 week period covered by the collected data. A map illustrates these mobilities (Map 4 and 5), each colour corresponding to a different Twitter user. The analysis of these mobilities indicates that most of the mobile Twitter users in that period are tourists going from one sight of interest to the next one. The maps on mobile Twitter users in both North America and Sweden also demonstrate that most of the users had a very low degree of mobility in mid-January 2014.



Map 4: Tweets in Northern Sweden



Map 5: Tweets in Northern Sweden

Conclusions

Even though the recording of the precise geographical location of tweets cannot be representative for all tweets, it gives some indications in connection to virtual mobilities in the Arctic. Using two case studies (the North American and the Swedish part of the Arctic), the geolocalised tweets give interesting information about the geographical context, the content of the message and characteristics of the Twitter user. When it comes to virtual mobilities, this analysis highlights that people using Twitter in Yukon and Northwest Territories have a more similar use of this social media than people in Nunavut. In the case of Sweden, the study highlights that it is possible to distinguish tweets sent by tourists from the one sent by locals. When comparing mobilities of Twitter users in both case studies, it shows that the users have a higher degree of mobility in Sweden than in Northern America.

8 Multi-Functionality as Scenarios for Land Use Development in the Arctic

Rasmus Ole Rasmussen¹⁰

8.1 Introduction

Rural land use activities used to be separate and distinct activities in the Arctic. Examples could be: grazing areas for husbandry; fencing of agricultural activities producing field crops; hunting grounds; suburban areas surrounding larger settlements and urban areas; tourist resorts; open cast mining and tailing areas; protected areas; etc.

It is obvious that many uses may be mutually excluding, and cause conflicts. For instance impacts of dust from tailing areas may be causing negative impact on grazing areas. Fencing may be prohibiting free passing of wildlife. And free passing of wildlife may destroy field crops. It is, however, just as obvious that potential conflicts may be turned into mutual beneficial situations. Wildlife is an attraction for tourists. Traditional farming activities are similarly considered an attraction by tourist. And with farming not only focussing on mass production but furthermore emphasizing distinct qualities of food products from the Arctic additional attractions are added to the rural activities.

Even active mining sites may be considered worth visiting by many tourists. And the reconstruction of abandoned mine sites may even provide options for establishing landscapes with attractions connected to a variety of leisure activities such as biking and other sports related activities. By thinking beyond the individual activities and instead considering options for including multiple functions in the land use by merging interests related to agriculture, hunting, tourism, housing and other land use based activities a more viable and sustainable development in rural areas may be obtained. The presentation will – based on the concept of multi-functionality - give examples of both rudimentary but also advanced integrative multi-functional land use activities in the Arctic. And the selected case is related to the development of sheep farming in South Greenland.

Although fishing in Greenland today plays a dominant role in economic development, there are also other forms of exploitation of renewable resources. Since the beginning of the 20th century, there has been sheep farming as a sideline in South Greenland, and since 1924 as a full-time occupation. But unlike fishing, which can be questioned how sustainable the industry has evolved sheep farming in many ways comply with the assumptions in the Brundtland Report sets out as a policy for sustainable development (Rasmussen, 1998)!

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A crucial step in this development was a modernization and development of the industry which emerged in 1983. With this plan the sheep farmer association in collaboration with the Home Rule Government was expected to develop as a business that could contribute to the Home Rule's overall goal of a society largely based on the country's renewable resources. And the starting point for the expansion plan at the time was already approximately 60 years of experience with the industry .

8.2 A different landscape

The Greenlandic landscape is by most perceived as unproductive areas of ice and snow, bare mountains and vast areas of tundra where caribou and musk oxen as the only large mammals can survive on the sparse vegetation. It therefore often comes as a surprise that Greenland also offer verdant pastures, grassland and bush-clad hills, and particularly sheltered valleys, even large trees. Similarly, it is rare to think of sheep farming as a traditional Greenlandic occupation.

But beyond the traditional occupation - hunting and fishing - sheep farming is a profession which today contributes positively to the economy of Greenland. After the Norse period breeding and agricultural activities began again in 1780, when a Norwegian cattle farmer, Anders Olsen, his Greenlandic wife Tupaarna and their children settled in Igaliku, and the small society was sustained by cattle and goats livestock, fishing, hunting and horticultural activities. An analysis around 1990 show that that point of time the farming generated a net profit for the Greenlandic society of more than 4 million DKK after all costs of production, investments etc has been deducted.

8.2.1 The beginning

It started when reverend Jens Chemnitz from Frederiksdal / Narsaq Kujalleq in 1905/1906 drew attention to the opportunities that could be provided based on the landscapes in south Greenland. Up till that point of time the colonists had brought along sheep that could ensure food and milk supply for the colony. But no one had thought of sheep farming as a real profession. Jens Chemnitz traveled to the Faroe Islands to learn about sheep in practice, and he came in 1906 with the first herd of 11 animals - 2 rams and 9 mares to Julianehåb / Qaqortoq, and later returned with another 8 animals, some Scottish sheep and 170 animals from Iceland, which led to the establishment of a sheep farm in Qaqortoq in 1915.

Initially, sheep was only considered a complement to the area's fishing and hunting, but the situation changed in 1924 when Otto Frederiksen settled in Qassiarsuk with 145 animals, and thus became the first full-time sheep farmer with sheep farming as the main occupation. In 1935 Otto Frederiksen had increased his stock with 300 sheep, 2 cows and six horses, and inspired by his success further 14 sheep farms within the settlements Qassiarsuk and Igaliko were established and began to act as centers for further development.

8.2.2 Dependence on the environment

Sheep farming was very extensive, with the sheep out throughout the year, such as was the case both the Faroe Islands and Iceland. The conditions were however more harsh in South Greenland's something colder and more snowy winter climate. Only frequent Föhn winds during the winter could keep the snow cover at a reasonably low level because the relatively warm Föhn wind went through the valleys letting the snow melts away whereby the vegetation becomes available for the sheep. If this were not the case the snow eventually would become so deep that the sheep no longer were able to get access to food.

And occasionally it would happen that the otherwise regular Föhn would fail, the sheep eventually having difficulty finding enough to eat. Or even worse - the föhn would only melt on the surface and then freezes into ice. When that happens the sheep would not be able to not get anything to eat. To remedy the problem experimenting with different kinds of winter feeding of local products such silage of grass and fish waste, and also substituting the natural forage would be replace by imported winter fodder. This would, however, becomes too expensive, and furthermore leading to situations where the sheep would gathered around places with less snow, and eventually, treading down vegetation and opening the landscape to increasing erosion.

The industry has therefore since its start been subject to a wide range of uncertainties that it would be necessary to live with. First uncertainty about how many sheep would be able to survive during winter. Next the problem of storing winter feed to compensate for failure in the frequency of the Föhn. Furthermore the need of showing attention to the vegetation and the risk of overgrazing and erosion of the landscape that would lead to a reduction of the stock. And finally the question of the issue of the annual review of the price the farmers' would receive for their products – basically the fundamental problem of being able to survive solely on the basis of sheep farming.



Map 1: The sheep farming areas in South Greenland. An important part of the development policy by the Home Rule was to prevent overgrazing, and in order to do that the sheep farmers were designated specific areas where their sheep were allowed to graze. The map above show the subdivision of South Greenland in grazing units. In most cases the grazing areas were kept within natural borders, and where this was not possible fencing of the areas took place.

8.2.3 Home Rule policy

These were the problems Home Rule was facing and the reason for the development of a new development model that would take into account the above outlined problems: the general uncertainty regarding winter fodder and a shift from sheep farming as secondary to their main occupation. Before 1985 Greenland was member of the EU due to the Danish enrollment into EU by 1972. Their membership was first promised support from the EU's Regional Fund, but with the resignation from EU in 1985 the Home Rule would be guaranteeing the funding that originally was offered by the development program. The Sheep Farmers' Associations, led by Chairman Kaj Egede, was responsible for starting the practical design of a new structure of the trade where the main points of the process can be summarized as the following 7 steps .:

- The first step was the preparation of a master plan for the development, where issues such as occupation, securing fodder, better incomes, better communication options, greater social interaction, etc. would be central issues for the development plan.
- The second step was the mapping of vegetation resources with a view to determining vegetation potential. Since the early decision was made in order to accommodate a situation where the individual sheep farmer should be self-sufficient in winter feed, the mapping work also aimed at the designation of potential areas for intensive cultivation of winter fodder.
- The third step was the development of the necessary technology for cultivation and designing the stables that would be housing the animals during winter. One of the main problems was the approach to food during winter. By keeping the animals in the barn instead of keeping the animals outside during the winter it would be possible to minimize feed consumption and partly reduced wear and tear on the vegetation around the feeding place.
- The fourth step was the preparation of an optimal spatial structure based on vegetation utilization, which would also enable cooperative organization of machines, use of transport facilities, and the possibility of increased social interaction between the scattered sheep farms.
- The fifth step was the practical clearing and cultivation of arable land which would provide the necessary winter fodder, the construction of barns, and the establishment of the dividing fence which should make better use of the vegetation resources and prevent overgrazing, and enable the construction of roads and improved port facilities.
- The sixth step was the establishment of a counseling and education facility which would be able to live up to the wider objectives where vocational training within the sheep industry should be a prerequisite for being accepted as a sheep farmer. Also included the objective of a family based business where the individual sheep farm should be allowed to keep a suitable number - typically 400 - to ensure the family a suitable income.
- Finally a seventh step was decisive namely the implementation of the new system in which a crucial element was the active participation by the sheep themselves, and eventually their contribution to cementing the existence of the characteristic of a sheep farming culture in South Greenland which had been developing through a little over three generations.

The consequences of the approach have been quite obviously looking at the development of the stock of sheep as shown below:

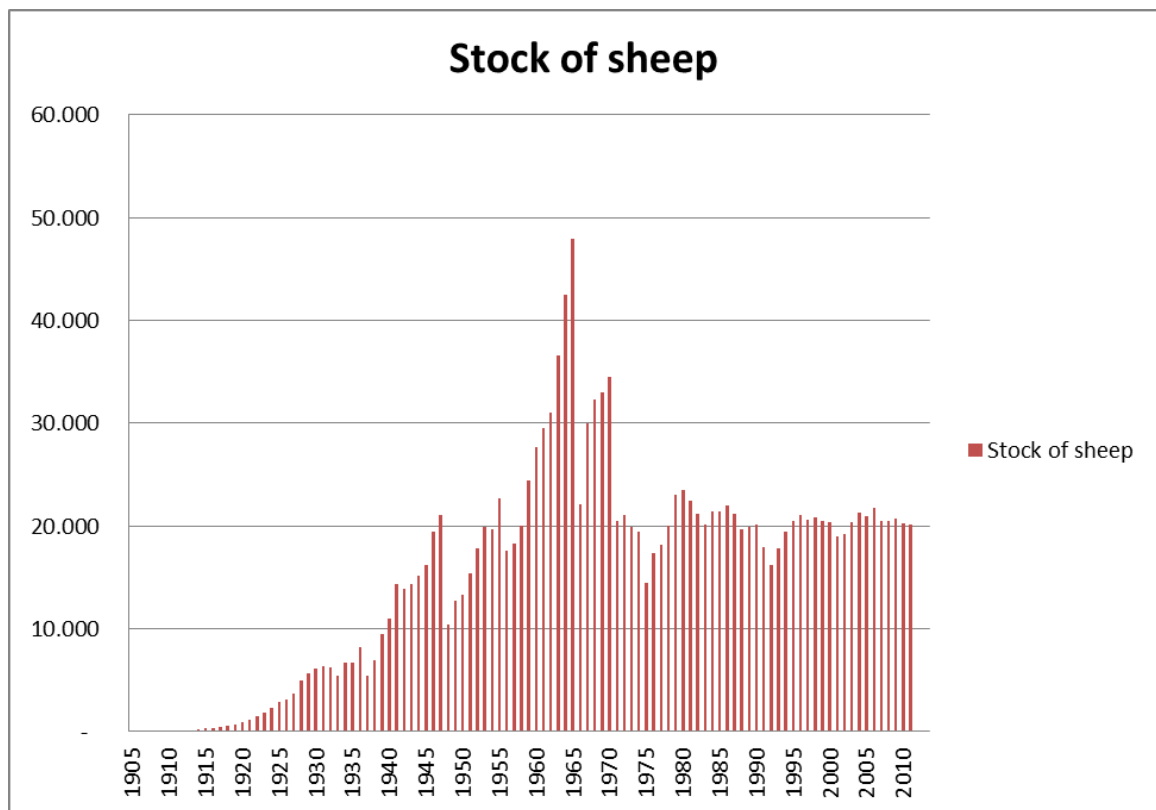


Figure1: Development of the sheep stock from 1905 till 2010. The marked variations from the start up till 1980 are quite obvious. But since the Sheepfarmers Organisation took the responsibility of developing a management strategy the variations between the years have been very limited.

8.3 Sustainable development

For many reason the concept of sustainability was not on the political agenda when the idea of the development of sheep farming as a commercial industry took place. The development plan was actually conceived three years before the Brundtland Report and its concept of a Sustainable Development was born. But nevertheless, there are many similarities between the objectives as defined in relation to sustainable development and the way the way sheep farming industry has been developed.

Briefly summarize the principles of sustainable development the basic idea of a development that meets the needs of the present without compromising the ability of future generations to meet their own needs is obviously a key issue in the development process. In addition, the seven so-called systemic processes of change have been met:

- A political system that ensures the participation of citizens in decision-making;
- An economic system that generates profits and technological knowledge as provides through a self-generating system;

- A social system that guarantees solutions to problems resulting from an unsustainable development;
- A production system that respects the need to maintain a sustainable basis for development;
- A technological system that develops and seeks new solutions;
- An international system that supports sustainable commercial and financial systems;
- And last but not least an administrative system that is flexible and responsive to the challenges.

The sheep farming development plan clearly helped to ensure appropriate economic units, with technological development with housing facilities and cultivation adapted to the conditions in Greenland, a socio-cultural level that ensures interaction between users, and a development process based on user's interest and active participation. And the result has been the establishing of a business that not only provides value when the implementation took place, but also creating a basis for future generations.

But that does not mean that the sheep farmers' organization just can rest calmly on the laurels. It is clear that there has not once and for all been created a business that will always contribute to sustainable development. Poor management of resources, lack of response to overgrazing, inad



Photo 1: A typical farming site situated in the South Greenland landscape. To the right is the barn and stable used for winter housing of the sheep and storage of the fodder. In the center the farm and to the left the fields with the recently harvested crops packed as silage in plastic containers. Photo: Rasmus Ole Rasmussen.

equate market price, etc. can all shift the balance. And today's market conditions and economic problems are already changing the picture. But the essence is that there has been created a foundation which would enable an opportunity which can be evolving further.

8.4 New opportunities appearing?

It is already recognized that the warming of the climate has had a positive impact on Greenland's economic possibilities and development. The ice conditions in South Greenland have improved, and as a consequence access to the towns and villages has become much easier. And the return of the cod to Greenland has slowly taken off, enabling the communities that were hit severely by its disappearance during the 1980's to regain some economic opportunities. But especially the farmers in the Southwest of Greenland are looking forward to longer summers and less severe winters, providing new opportunities to growing of crops and further expansion of the farming activities which were established back in 1905, and has become an important contribution to the local economy in South Greenland.

8.4.1 Expansion of produces

Since the early 1980s the number of sheep has stabilized at a reasonably high level of approximately 20,000 ewes. It has been possible to prevent the fluctuation typical from the earlier years of farming by keeping the sheep in stables during the winter, and feeding them the locally produced rather than imported fodder. The more recent opportunities created in connection with the ongoing changes in climate has been the introduction of cows in the sheep farming area. At the same time new crops have been introduced. It is expected that a part of the region's consumption of potatoes will be produced locally in the future, and that crops in the more luxuriant vegetation regions in the South will provide sufficient background to maintain the farming activities in a region that we often think of as cold and hostile!

8.4.2 Options for tourism

From the point of view of tourism, South Greenland is known as the area of the sheep farms, Norse and Inuit ruins, tiny villages and great scenery, and the major tourist season is mainly the summer season, from the beginning of July to the end of September.

During the 1970s and the 1980s in the South Greenland the Danish Hikers Organisation Dansk Vandrelaug was very active organising outdoors recreational activities such as trekking and hiking around the municipalities of Qaqortoq, Narsaq and Nanortalik. The main purpose was to offer specially targeted tourists the beauties of the landscape, to enjoy the sporting activities and have a pleasant stay at reasonable prices in direct contact with the inhabitants. An impressive landscape and an unforgettable possibility to meet the local population supplemented the sporting activity. On the other hand, the sheep farmers offered houses or cabins and provided facilities to the tourists-hikers. This kind of accommodation became very popular in many ways and for both tourists as well as the local population the special unique experience was possible without high expenses, and gave way to close contacts with the, relatively unknown, local population.

For the inhabitants, besides offering the accommodation, there was a possibility to sell souvenirs, such as carved and sewed items, and to sell local products like fresh lamb meat, which generated supplementary income. There has never been any continuous monitoring of the economic outcome of the South Greenland tourism. An analysis of the costs and benefits from sheep farming made in 1989 indicates that the total revenue directly for the sheep farmers was around 250,000 Dkk. for cabin rents, and another 41,000 for the local transportation [Rasmussen et al., 1989: 29]. In addition, the sale of sheep products directly to the tourists also generated income straight to the farmers, just as local boat transportation generated around 1,000 Dkk. per tourist.

An important aspect to highlight, and contrary to the organised package tours, the tourist expenditures were retained locally for the benefit of the local population, and despite the shortness of the “good” season this was an important source of additional and most of all, secure revenue. Accessibility to the area was not a problem thanks to the vicinity of the international airport of Narsarsuaq, and to bring the tourists to the settlements was not a problem either. Farmers provided the transport from harbour to cabin by tractor, and local outfitters managed the local boat transportation. Usually a two-week tour would mean subsequent staying in Narsarsuaq, and in two or three different villages, and finally a couple of days in one of the larger towns. The settlement structure in the region, with farms located along the coast, assured a good spread of potential possible accommodation in a large part of the territory, as well as a good spread of the generated revenues.

Already during the 1980s the population and official representatives were concerned about matters related to the physical environment. Reflections and talks took place about the necessity to preserve the environment - in general vulnerable in the Arctic zones and particularly vulnerable in an area already submitted to the sheep farming. The measures considered would imply some control with the tourist activities, and among the suggestions for solutions was to establish walking paths across the sensitive ground. These considerations were parallel to the management schemes of sheep farming, focusing on the fencing of larger grazing areas in order to control the grazing intensity. However, it never turned out to be necessary, as the hiking tourism in South Greenland started declining during the 1990s. Different reasons for the decline can be found, and probably the most important, at least at an institutional/decisional level, is that the Home Rule Government of Greenland by the deputy organisation for tourism: Greenland Tourism was seeking for a different image of tourism in Greenland. The strategy at that time emphasised the wealthy tourists seeking “ice-attractions” and all the activities related to the - by the tourists perceived as the traditional way of life in Greenland, such as the dog sledge activities, which are not in use in the south of Greenland. These types of tourists were generally perceived as visitors spending large amounts of money for the holidays unlike the hikers and trekkers.

8.5 Multi-functionalities

Mankind uses land and situate their activities in the landscape for a multitude of purposes. Some of these are directly related to available ecosystem and landscape services. Others are related to the territory due to other constraints. All together these activities generate a diverse set of functions (economic, environmental and social) from any particular form of land use.

While, during the previous 50 to 60 years, development and land use practice has led to spatial and functional segregations, land use strategies increasingly emphasise multi-functionality as an important characteristic of contemporary land use. The landscapes of the future will have to serve, simultaneously and in integrated ways, a number of different functions. It means that such functions should be employed in relation to analysis and policy proposals:

- Ecological (as an area for living organisms and natural environments),
- Economic (as an area for production and reproduction),
- Socio-cultural (as an area for cultural actions and identification),
- Historical (as an area for settlement, memory and identity), and
- Aesthetic (as an area for shaping and experiencing) .

The concept of territorial cohesion has to do with recognising the territorial diversity in Europe and the interaction of a complex system of functions as outlined above. And its implementation through policy measures involves endogenous development potentials and fragilities (the impact of developments in other territories, and the effects of different sector policies at various levels of decision making), as well as exogenous factors which importance needs to be recognised in the territorial context in its multifaceted dynamics.

The expression “multifunctional landscapes” refers to areas serving different functions and combining a variety of qualities, i.e. that different material, mental, and social processes in nature and society take place simultaneously in any given landscape and interact accordingly. Multi-functionality in landscape, therefore, means the co-existence of ecological, economic, cultural, historical, and aesthetic functions. Thus, landscape multi-functionality is not necessarily synonymous with multiple land uses.

Different land uses can be a criterion for multi-functionality in landscapes, but even a single land use can involve numerous functions. Paracchini et al. (2011) therefore emphasizes that the concept of multifunctional land use provides a favourable approach based on the recognition of that in order to maximize the benefits obtained from a given parcel of land, a more equitable balance of the competing economic, environmental and social demands on land is more sustainable in the long-term than an unbalanced system based on individual sector based rationale. In such a context there is, however, also a need for evaluation tools which allow a more sensible approach to the assessment of whether competing demands in a multifunctional land use system are sustainable or not. In particular, there is a need to integrate information and data from

a wide variety of sources into a single evaluation framework, recognizing that different land uses can result in different functions, but not all functions can be expressed as land uses.

The problem in this connection is that the concept “land use” often is only related to the physical characteristics of the land cover and the economic activities related to its use. This may have been correct when for instance agricultural used land was considered the main activity while for example, aesthetic, and recreational functions were secondary. Today, however, the previous secondary activities have become dominant, for instance when aesthetic or recreational functions are defining what kind of land cover would be acceptable. Another example showing change in valuing without any land-use change is taking place could be the change in image and importance due to social re-interpretation when for instance a stretch of farm land is declared “green infrastructure”, or part of a “Regional Park”, even without any land-use changes occurring (Caspersen, 1999).

Such considerations have become key questions in the on-going discussions of how the future CAP should be structured. In recognition of this more multifaceted aspects of landscapes the Landscape Convention recognizes landscape as having “...an important public interest role in the cultural, ecological, environmental and social fields”. Consequently, improving the understanding of the outcomes of landscape planning decisions is of high political priority, stressing the importance of stimulating the elaboration of landscape plans for the considering of landscape as a key territorial value, and constituting a resource favourable to economic activity and whose protection, management and planning can contribute to job creation (European Landscape Convention).

The approach to “land use” should therefore not only be seen from the land cover perspective but also from the perspective of “functionality”, which provides linkage with other transversal issues. “Functionality” could be a motivating approach in the integration of land cover, land use management, socio-economics, transportation, energy conservation, water management and climate change. While the concept of “land use” traditionally has been considered (to some extent) to be binary, i.e. one land use activity would exclude other activities, the situation in Europe is that the functionality of land areas has been increasingly diversified: on one hand towards exclusiveness with mono-functional large scale production, and on the other hand towards inclusiveness, which stresses the fact that different activities co-exists. In regards to the latter, policy and planning should develop methods where the question of harmonious and disharmonious functionalities could be a way of improving the planning process.

In the discussion of characteristics and changes in relation to land use a very common approach is to draw a direct connection between land cover and land use. An example of this approach could be, as done by Lambin et al by defining land use as “the purpose for which humans exploit the land cover”. The key element in this connection is the vegetation as a productive resource, and

the land cover categories by such therefore showing information related to vegetation as a basis for production.

4.6.1 The basis

Historically there have been many reasons for choosing such an approach.

First because it enables an analysis of what is immediately visible through the land cover, enabling the information to be connected to the economic activities to the extent land cover actually reflects such a relationship. And this is the situation in predominantly agrarian societies, just as in societies where forestry and other direct land cover uses provide the main economic activities. Typically this approach is very common in relation to discussions in relation to development in developing countries where these types of direct connections between economic activities are providing the mainstay of the society, for instance as discussed by Lepers et al , Turner et al , and more recently in a global scale by Lambin . In these approaches where the major part of both population and land are related to direct production on the land, it may make sense to rely on a land use definition as above, and as indicated by Lambin even important dynamics of societies are more or less related to land use characteristics, even it can be argued that the proposed relations to change in land use are missing important components.

Similarly an equivalent tradition has developed in relation to the situation in developed countries emphasizing the historical use of land as a background for understanding the present characteristics of rural areas, with Dovring representing the tradition, followed up by Reenberg and others, and the tradition carried on through many of the ESPON approaches discussed in connection with the definition of typologies discussed previously in this paper. Presenting the situation in developing and developed countries in separate paragraphs is not due to any fundamental difference in historical contexts, only that the on-going changes in for instance Europe as of today differ somewhat from the general pattern in most developing countries by increasingly de-connecting land cover and land use.

Second because the definition of land use characteristics by means of land cover information inherently includes a reflection of land use simply because the definitions of the land cover classes are based on such a characteristic. When looking into the land cover classes it is quite obvious that for most of the classes the definitions are based on land use patterns in Europe at the point of time when the land cover classes were defined! The only exceptions are the classes related to urban activities and sealed surfaces where the overall class (sealed surfaces) indicates the absence of land based production activities where the qualities of the land are determining the activities. Consequently the subdivision instead is based on functions independent of the quality of land, meaning that other qualities are determining the types of activities, for instance distances, proximities, access to infrastructure etc. It means that there is actually within the Corine land use classification a marked divide between these (sealed surface) categories where it is functions that are used as the subdividing characteristics (for instance the divide between housing and industries

where the buildings may be the same, but the functions differs), while most other categories are reflecting real land cover differences.

It is interesting to see how the definition of the different land cover classes has coped with the difference between land based activities where the qualities of the land are important – which are most of the Corine classes – and the residual land areas where other elements as indicated above are determining the characteristics of land use. And it points to a major problem in this connection, namely to base an analysis only on the Lambin definition of land use as “the purpose for which humans exploit the land cover”. By doing so it leaves out what tend to be an increasing part – if not the determining part – of what characterizes the use of the land resources in non-agrarian societies!

8.6 Future perspectives

Like most other renewable resource extraction in small scale also Greenland sheep farming is under decline. Figure 4 below show a very clear path of development that may be considered worrying for sheep farming.

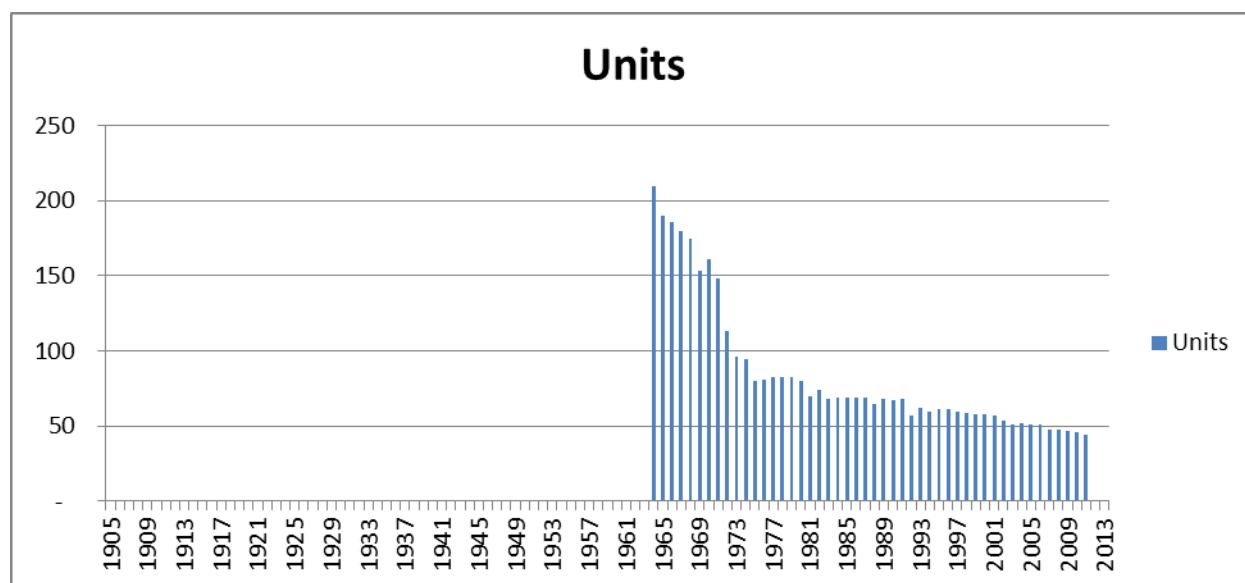


Figure 2: During the 1960ies and early 1970ies the total number of sheep farming units were at the maximum. With the establishing of the Home Rule governed farming activities a rather precise management scheme was introduced with 400 animals per farming unit as an optimal size for a sustainable economy for the farmers. But the situation has changed considerably. As indicated above the number of units has been declining.

The decline in number of farming units has been compensated by each of the remaining farms having a larger stock of sheep. But as indicated on table 1 on next page the decline in the number of farm units has been substantial, and may be not only an economic challenge for each of the farms, but especially a challenge for the initial initiatives in relation to farming by using

cooperation among the farmers as a basis to handle the rather large costs in supplying the farms with adequate equipment.

There have been ideas about establishing a food cluster in South Greenland where not only the production of the sheep and lamb, but also the processing of the product should be included as

activities in the region. What would be the outcome is to be seen during the

Table 1: Change in settlement structure in South Greenland with indication of number of active and number of abandoned farms and the number of persons involved.

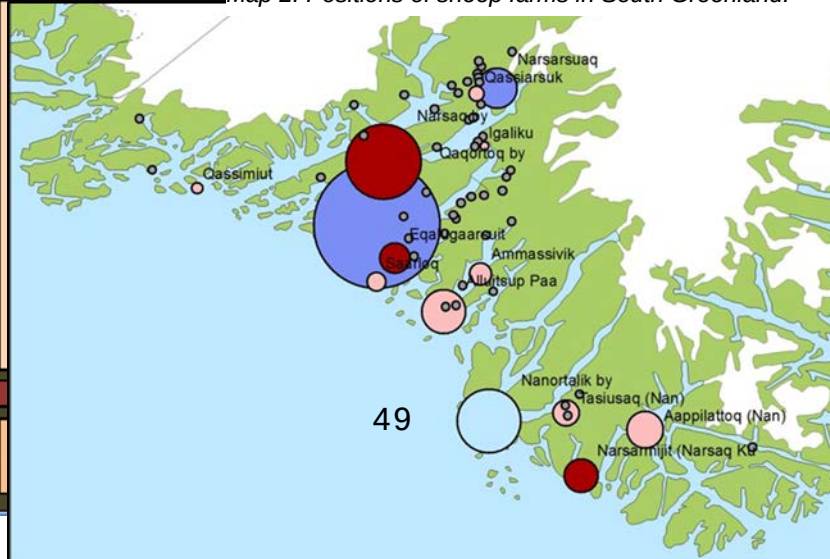
next years.

Population in towns, village, sheep farms and sheep farm clusters, mine areas and stations as of January 1st 2013								
Type of settlement		Place name	Population 2013	Summarized in categories	% age 65 and above	% below age 15	% women	% work force (15-64)
Towns	1	Nanortalik (by)	1337	1337	8	25	45	67
	2	Narsaq (by)	1503	2840	11	22,5	46	66,5
	3	Qaqortoq (by)	3229	6069	7	20,5	47	72,5
Villages	1	Qassimiut (bygd)	22	22	17,5	17,5	33	65
	2	Igaliku (bygd)	27	49	16,5	14	35	69,5
	3	Saarloq (bygd)	37	86	12,5	18,5	30	69
	4	Ammassivik (bygd)	40	126	16,5	14	46	69,5
	5	Qassarsuk (bygd)	47	173	18	13	41	69
	6	Tasiusaq (bygd i Kujalleq)	57	230	12,5	23,5	41	64
	7	Eqalugaarsuit (bygd)	79	309	12	15	43	73
	8	Narsaq Kujalleq (bygd)	98	407	10	21,5	42	68,5
	9	Aappilattoq (bygd i Kujalleq)	110	517	6	30	39	64
	10	Narsarsuaq (bygd)	143	660	2,5	17,5	43	80
	11	Alluitsup Paa (bygd)	263	923	12	18	39	70
Closed villages	1	Alluitsuq (Nedlagt bygd)	0	0				
Sheep farms and sheep farm clusters	1	Qallumiut (Fårehold)	6	6				
	2	Qaqortoq (Fåreholdersteder ved)	7	13				
	3	Upernaviarsuk (Fårehold)	10	23				
	4	Igaliku Kujalleq (Fårehold)	10	33				
	5	Igaliku (Fåreholdersteder ved)	10	43				
	6	Qorlortorsuaq (Fårehold)	11	54				
	7	Narsaq (Fåreholdersteder ved)	12	66				
	8	Tasiusaq (Fåreholdersteder ved)	14	80				
	9	Eqalugaarsuit (Fåreholdersteder ved)	29	109				
	10	Qassarsuk (Fåreholdersteder ved)	48	157				
Closed sheep farms and sheep farm clusters	1	Qunnermiut (Fårehold nedlagt)						
	2	Niaqornaarsuk (NAN) (Fårehold nedlagt)						
	3	Narsarsuaq (NAN) (Fårehold nedlagt)						
	4	Akuliaruseq (Fårehold nedlagt)						
	5	Qaarsutsiaq (Fårehold nedlagt)						
	6	Eqaluit (Fårehold nedlagt)						
	7	Tatsip Ataa (Fårehold nedlagt)						
	8	Akia (QAQ) (Fårehold nedlagt)						
	9	Qeqertarsuaq (Fårehold nedlagt)						
	10	Arpatsivik (Fårehold nedlagt)						
	11	Iteklak (Fårehold nedlagt)						
	12	Qingua Kangilleq (Fårehold nedlagt)						
	13	Qimarnuffik (Fårehold nedlagt)						
	14	Itilleq (Fårehold nedlagt)						
	15	Itilleq Killeq (Fårehold nedlagt)						
Mine sites	1	Nalunaq (Mineområde)						
Stations	1	Angisoq (Loranstation nedlagt)						
	2	Nuussuaq (NAN) (Loranstation nedlagt)						
	3	Icecan (Station nedlagt)						

Map 2: Positions of sheep farms and sheep farm clusters

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Map 2: Positions of sheep farms in South Greenland.



9 Monitoring demographic changes in light of administrative restructuring – the case of Kujalleq Municipality in Greenland

Lisbeth Greve Harbo¹¹

Monitoring socio-economic changes is relevant for acquiring evidence of the development patterns as well as the effectiveness of implemented policies and other measures.

In 2009, Greenland underwent a municipal restructuring that saw the previous 18 municipalities merged into four larger municipalities; four municipalities that are more coherent in terms of population size and urban structure than the rather large variations between the old municipalities. The decision behind the restructuring was partly a wish to be able to restructure the task allocation in the Greenlandic planning system, i.e. to move some planning tasks from the national level to the municipal level, and partly, an economic reasoning in the diminishing of the total number of administrative units.

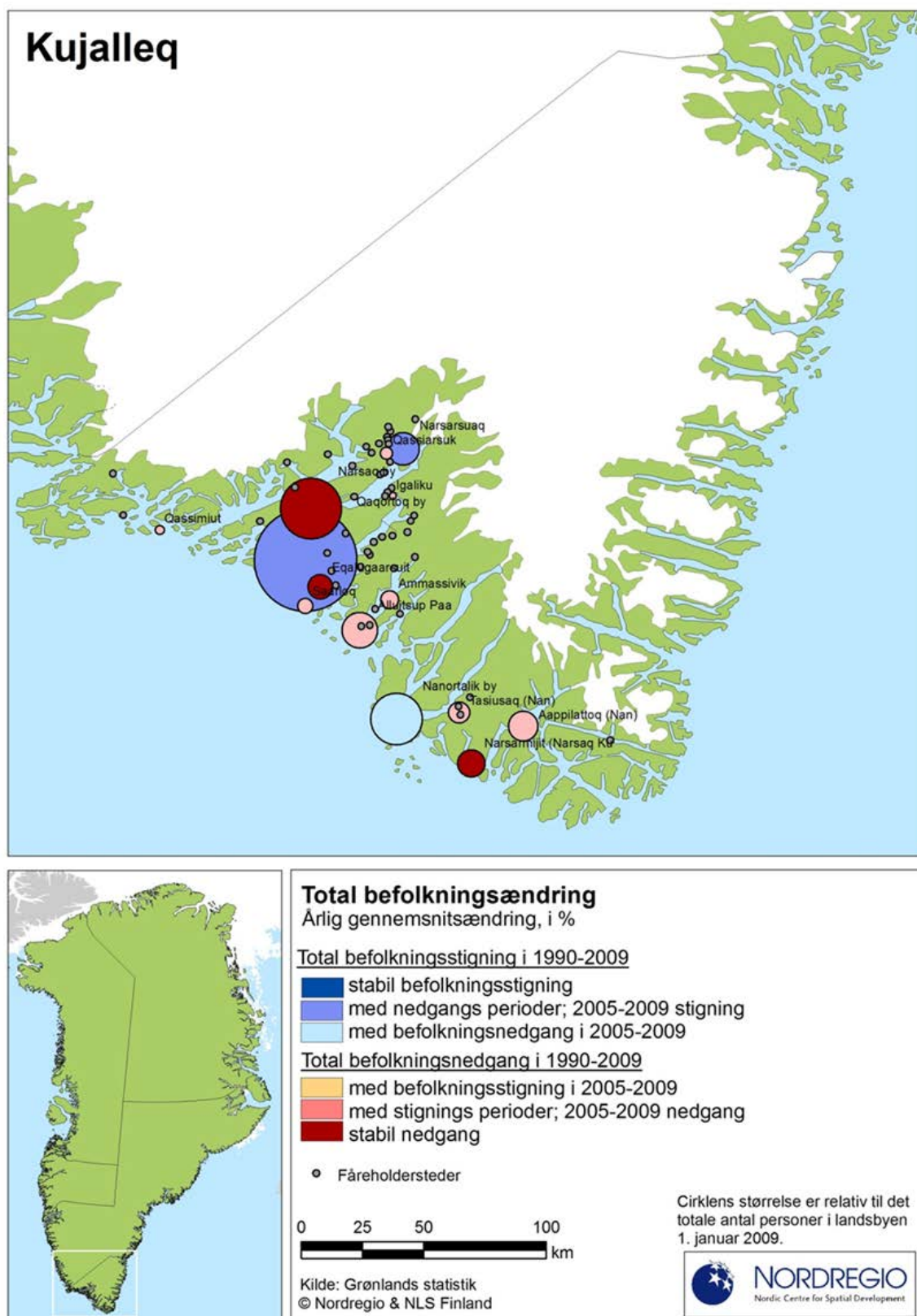
While the restructuring thus had implication for the administrative structure of Greenland, it was also envisaged that the bigger units would bring other planning possibilities, e.g. that larger units would have better capacity to make more long-term strategic regional and local planning which in turn would be beneficial to the economic development of the region as a whole. However, the potential consequences of these municipal changes in terms of changes to the local urban dynamics were less explicitly addressed.

The most Southern municipality in Greenland, Kujalleq Municipality, was a merging of the 3 previous municipalities of Qaqortoq, Narsaq, and Nanortalik. The cities of Qaqortoq, Narsaq and Nanortalik were also the main centres in the previous South-Greenlandic municipalities and are thus the biggest towns in the new Kujalleq municipality. The status of ‘town’ in the Greenlandic urban hierarchy is not necessarily aligned with size but is an administrative status that was given to the main town of the previous 18 municipalities - although bigger population size has in most cases also been an outcome of this administrative status.

The 2009 municipal restructuring contained no intention of changing the existing urban hierarchy; rather the discursive reasoning was that the new administrative structure would be of benefit for the whole region. However, reviewing the demographic changes in the towns of Kujalleq Municipality since the administrative restructuring, it seems that Qaqortoq has benefitted the most from the administrative restructuring in terms of population - and therefore also potentially jobs and economic activity in general – at the cost of the towns of Narsaq and

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Nanortalik. Thus, it can be argued that a consequence of the municipal restructuring has been a greater centralisation in Kujalleq Municipality.



Map 1: Kujalleq Municipality showing total population change in the settlements 1990-2009

10 Urbanisation and land use management in the Arctic - An investigative overview

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10.1 Introduction

Land use management and settlement structure is one of the most hotly researched and discussed planning topics in the context of the sustainable urban development. Debate over the social, economic, and environmental misgivings of urban sprawl and solutions to associated urban land use “problems” typically dominate this discussion. Problems are often referenced in terms of loss of productive land for agriculture, disruption of ecosystems services, pollution associated with car dependency, and reduced quality of life due to increased commuting distances (Nilsson et al., 2014). Proposed solutions include planning principles that increase the density of settlements while also attempting to improve the sense of place. They are “branded” as interrelated planning frameworks such as compact and mixed use development, brownfield and infill development, public transport oriented development, mobility management, investment in urban public space, blue/green infrastructure and a range of others. However, these are relatively narrow European and North American perspectives, bound to territorial contexts dominated by the perspectives of mid-latitude, well-developed countries where the discussions both originate and are largely maintained. In reality, many other types of interaction between the densely and the more sparsely or uninhabited surroundings adds to the planning complexity, and it therefore requires that analysis of urban land use issues is conducted with an absolute recognition of the territorial context. In this case our focus is on urbanisation in the Arctic.

Since the mid-1950s European cities have expanded on average by 78%, whereas the population has grown only by 33% (EEA, 2006). A similar trend – that urban areas expand approximately two times faster than the population – can also be observed in both the United States and China (Nilsson et al. 2014). Increasing economic welfare and living standards, together with smaller

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household sizes but increasing household numbers, are important drivers behind this development.

The European/North American discourse involves scales of urban development for cities with populations in the hundreds of thousands, or millions. It involves development storylines where private cars were promoted as an essential component of everyday life, as well as certain contexts of land rights and ownership that dictate how urban land use management strategies have evolved. It involves urban-rural interactions and how sprawl has dissolved productive agricultural land on the periphery of cities. And in speaking of the environmental context, it especially involves proposed solutions that convince people to get out of their cars, walk and cycle more, spend more time in outdoor public spaces, etc.

A key component of a successful urban land use strategy - and any strategy for that matter - will be that it merges future goals with local context. This local context includes spatial factors of scale, geography and environment, socio-cultural factors of the people who feel the effects of decision in their everyday life, and political and economic factors that engrain both explicit and hidden agendas into the development discourse. Much of this information can be gained by looking into the recent history to assess how planning strategies have been designed and implemented, and what the effect has been on settlement patterns and land use. We will use this approach to determine what factors are associated with urban land use processes in Arctic cities. We explore the storylines that have resulted in the spatial arrangement and management of Arctic cities today to share a place-based context to sustainable urban land use management for the Arctic. As such, land use issues are seen each as reflecting, bearing the consequences and providing opportunities in relation to Arctic urban development over the last decades.

This investigation will begin with a qualitative recount of the important socio-cultural, economic, political and/or environmental processes of change that have led up to the current settlement structure, as well as some basic spatial data showing its evolution. Then the five short, semi-structured case studies will be presented: Reykjavik, Iceland; Rovaniemi, Finland; Nuuk, Greenland; Kirovsk, Russia; Thorshavn, Faroe Islands; and Kiruna, Sweden. By semi-structured we mean that each case study author was given some general guidelines, but each case was able to be developed independently in order to emphasise key local factors. In this context, the general guidelines were to present the historical development and current land use management trends for the five case cities, with a focus on how these development and current strategies promote “urban sustainability” in the Arctic. Through this analysis we will finish by highlighting key messages, including land use planning challenges and solutions related to the case studies. These are used to illustrate important Arctic perspectives to sustainable urban land use management.

10.2 Overview of urbanisation processes in the Arctic

In 2010 we reached a global milestone whereby over 50% of the population was deemed to be living in urban areas. In Europe, the level is even greater; upwards of 75% of the population lives

in cities of different sizes (EC, 2011). The Arctic region is no exception to this trend, since the 1960's, most of the population growth has occurred in urban centres. As an example, 80% of Iceland's population lives within commuting distance to Reykjavik and 94% live in an urban context. Based on its geographic position, Iceland could therefore be seen as simultaneously the most sparsely populated and the most urbanised country in Europe.

The interesting aspect of urbanisation lays in the complex social, economic, cultural, political, and lifestyle processes underpinning the spatial transformation. Not only do these changes affect what is being produced and what affect production has on the environment, but it has implications on who people are, how they live in terms of well-being, political organisation/distribution of power and social relations. Previous studies have addressed this issue through the aspect of housing (e.g. Hansen, Bitsch, & Zalkind, 2013), but relatively little analysis has been conducted on the manner in which land use management strategies reconcile these complex changes to deliver sustainable urban futures in the Arctic.

10.2.1 Socio-economic development

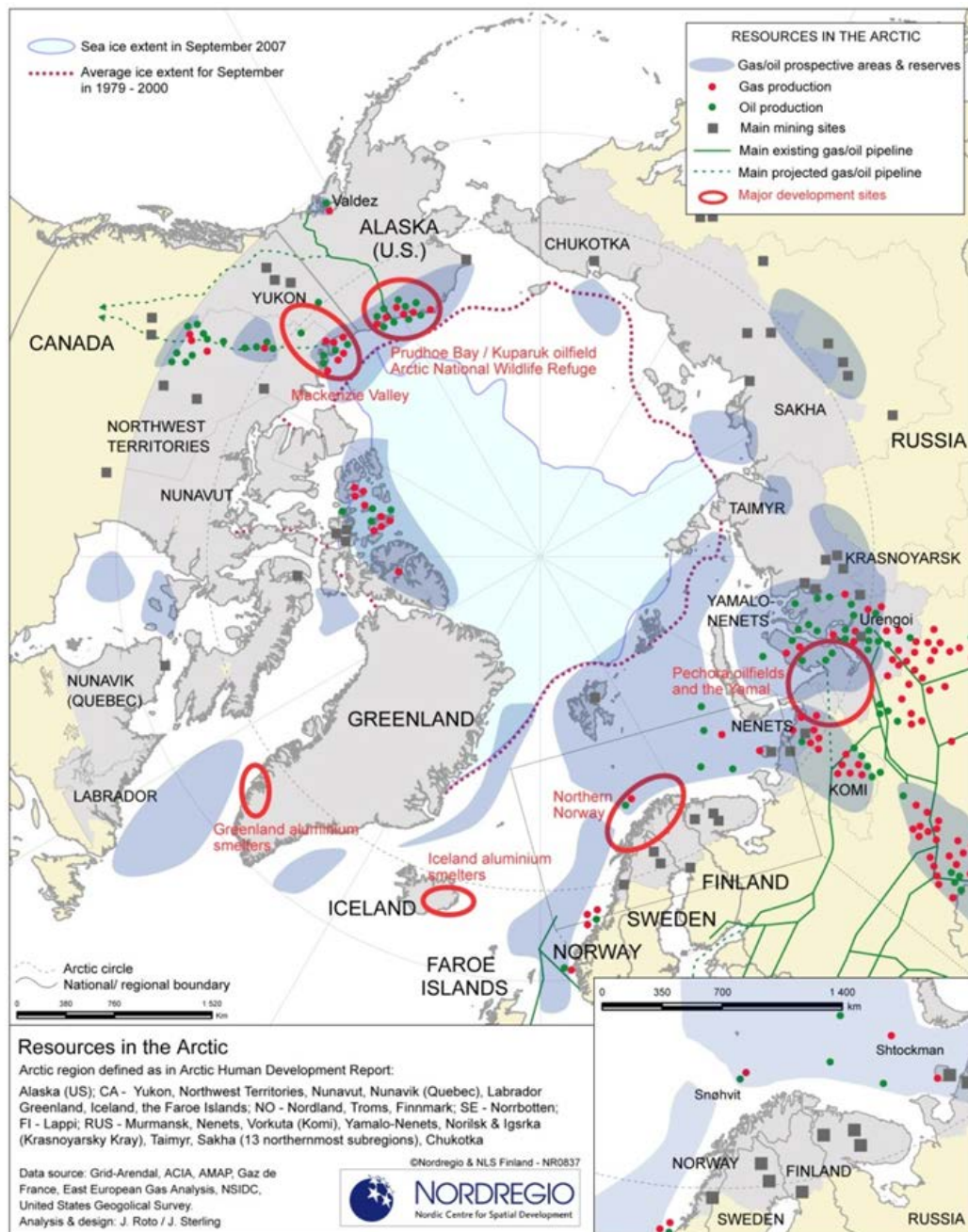
Arctic urbanisation is largely taking place due to economic development via natural resource exploitation. The Arctic has always been rich in a variety of natural resources and under subsistence and local economies this was the reason why communities located there as semi-nomadic land and sea settlements for centuries. Natural resources, including renewables, still play an important role however the political and economic landscape has shifted enormously. Since WWII, most regions in the Arctic have begun experiencing large scale industrial exploitation of natural resources due to international demands, which coincided with in increased influence of national/international institutions in terms of political and economic "management" (Hansen & Rasmussen, 2013). Whether development of these potentials has been led by capitalism tendencies in the west or socialism or communism in the east, the common denominator has been concentration and centralization of the population as a means of achieving social and economic development of the society.

As a result of this process, we can say that the Arctic economy contains three distinct but related parts:

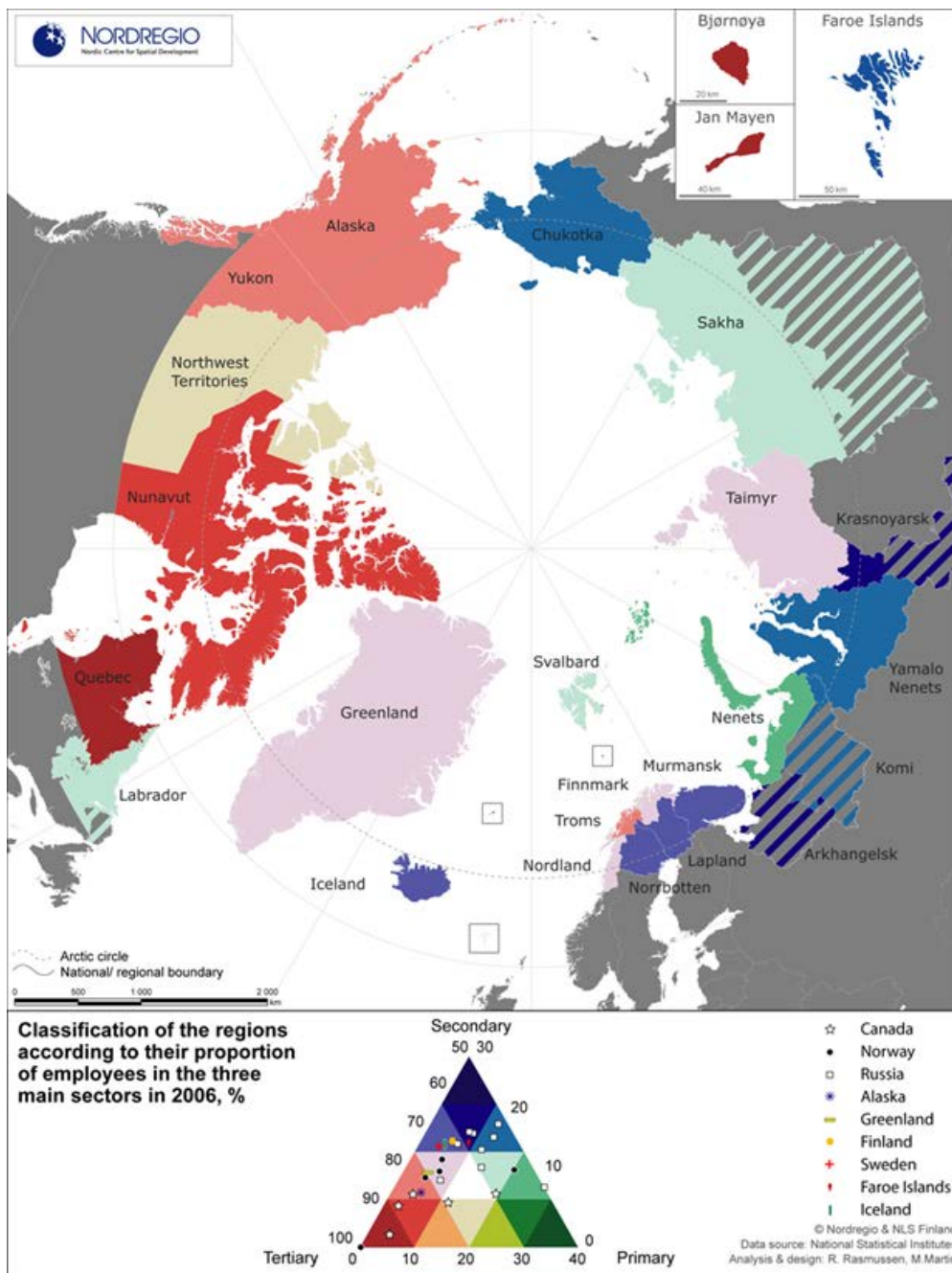
1. The international resource economy serves worldwide markets producing resources such as diamonds, gold, zinc, oil, natural gas, energy for resource refining and fish (See for instance Map 1);
2. The traditional economy is centred on resources but production, through fishing, hunting, herding and gathering is for local consumption;
3. The transfer economy brings funds into the region from different levels of government to support society and public services, which contributes as the main source of income to for many Arctic dwellers. (Rasmussen, 2011)

Map 2 shows pan-Arctic regions according to the share of the population in three main economic sectors: primary, secondary and tertiary¹⁹. As a result of the urbanisation process there has been a major shift in the economic basis for most Arctic communities. While the primary sector in most cases employs less than 10% of the population and the secondary sector between 5% and 20%, the tertiary sector corresponds to a minimum of 50% employment or involvement in every region of the Arctic (in some regions as high as 93%, i.e., Nunavut). The clear indication is that many people engaged in the tertiary sector are in reality benefitting from social services, including compensation for being unemployed. When considered in conjunction with the intense resource exploration taking place, this shows that even though people tend to think of the Arctic economy to be primarily related to hunting, fishing and other activities, the formal economy is very much a region of economic contrasts - complex and diverse, both large scale and communal, both innovative and traditional, both active and inactive (Megatrends). And on top of this, informal activities related to subsistence and exchange of products from hunting and fishing add to the complexity of the socio-economic situation.

¹⁹ Primary: hunting, fishing and mining. Secondary: processing, production and construction. Tertiary: generation of public services, retail and wholesale and administration.



Map 1: The Arctic region provides the global market with significant shares of a variety of non-renewable natural resources. In 2002, more than 16% of the world's petroleum and 25% natural gas came from the Arctic. This map shows hotspots of resource production by general type in the Arctic.

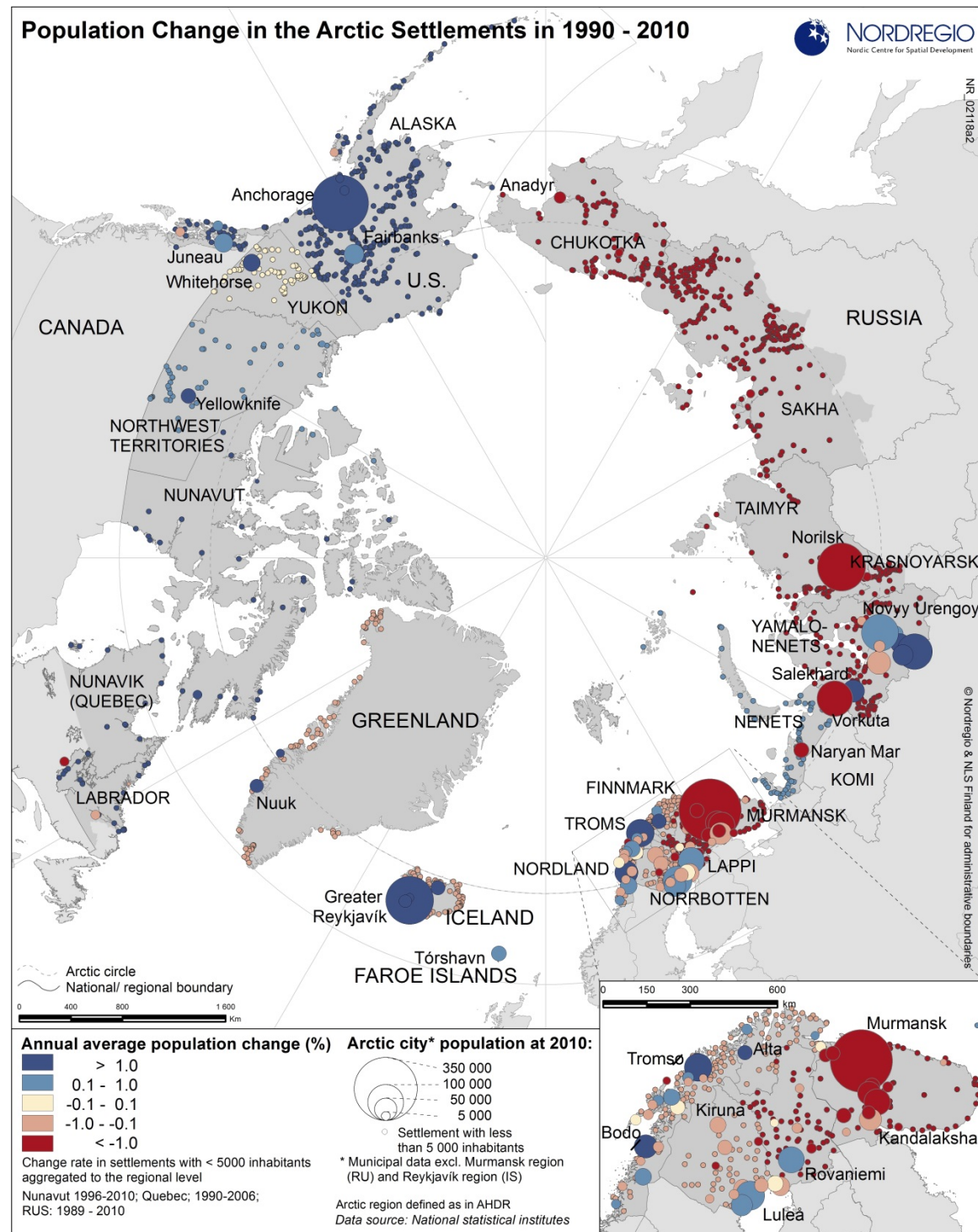


Map 2: Classification of the regions in the Arctic according to their proportion of employees in the three main sectors: Primary, Secondary, and Tertiary. The graph shows with colour codes the level of employment, and on top of the graph the different regions are plotted according to the division of activities.

10.2.2 Spatial patterns of urbanisation

While the majority of the Arctic population lives in large settlements ranging in scale from metropolitan areas, towns or villages, the spatial arrangement is also one of contrasts. Map 3 reflects well how half of the population in the Arctic North America and North Atlantic (Alaska, Canada, Greenland and Iceland) lives in towns larger than 25,000, half of the total settlements are populated by less than 250 people. Thus, the trend of a few large settlements in combination with many small settlements is a general characteristic of the Arctic spatial structure.

In terms of growth and development, Map 3 also shows changes in settlement size between 1990 and 2010. On top of the general characteristics it shows that the many small settlements are generally dwindling while larger urban settlements are growing. This is especially evident in the Nordic Region. Related research reflects the following general trends:



Map 3: Change in settlement structure in the Arctic. Average annual population change (%)

In larger settlements:

- Population growth
- Dominated by administrative and educational activities
- Provision of public services to rural areas

In small settlements

- Population decline
- Located on the coast or along rivers where the possibilities for fishing and hunting of sea mammals are abundant
- Significantly aging populations

As a result, we can describe the general settlement patterns as a conglomerate of a conscious and rather similar settlement policy, which has been the result of the traditional use of renewable resources. The traditional resource usage required a dispersed and flexible settlement structure, but through the process of modernization and industrialisation it became necessary to create infrastructure and labour markets, just when the social institutions, which were required for the reproduction of the labour force, became necessary. Above all, it created a requirement for a much more centralized instead of the traditionally dispersed structures (Rasmussen, 1998). The concentration process has been continuing, with growing population in the large settlements and a decline and aging of the share of the population living in the small settlements.

But bringing together all the elements of this complex discussion – the drivers of growth, the spatial arrangements that formed by those patterns and the socio-economic changes that take place – the common denominator must be the realization that this is a new process for Arctic societies. Regardless of which economic activities Arctic residents are participating in, including the recipients of transfers, there must be an utmost realization that historical activities associated with the subsistence economy are still very much a part of the Arctic culture in many regions, both in terms of the informal economy and in terms of leisure activities. Therefore, a key question is how such activities shape land use management strategies for urban areas where more and more of the Arctic society is living. This is important because there is no doubt that eliminating these types of rural activities would completely undermine the views toward economic growth that have taken place. In turn, the question can be more clearly positioned as to how land use strategies combine the demands of urbanisation with the social and environmental needs of the population? Alongside environmental impacts of development this appears to be a key “sustainability” question taking place in many places of the Arctic.

10.3 Case Studies

The next five case studies aim to assess land use development and policy in Arctic city-regions of different sizes and national contexts: Reykjavik, Iceland; Nuuk, Greenland; Rovaniemi, Finland; Kirovsk, Russia; Thorshavn, Faroe Islands; and Kiruna, Sweden. In each case we will present the historical settlement development in each city and connect this to land use management dynamics that have evolved up to the present day. Through these cases we will then summarise our key conclusions in the next section.

10.3.1 Reykjavik, Iceland

With a population of around 201,000 in the metropolitan area of Reykjavik²⁰ (consisting of 7 municipalities: Reykjavík, Kópavogur, Hafnarfjörður, Garðabær, Álftanes, Seltjarnarnes and Mosfellsbær) the capital area covers an area of 1062 km², ten times larger than the size of Paris (105 km²). Greater Reykjavík makes up around 80% of the total population in Iceland, which not only makes Iceland a predominantly urban nation, but also a country with a very polarized settlement structure towards the capital region. The asymmetrical population distribution in terms of land-use has few other similarities (maybe Alaska, Australia and Newfoundland). In this respect the population distribution has some similarities to ‘urban at the edge’.

10.3.2 The urbanisation process

Since then a decade before independence of the Icelandic Republic in 1944, the Capital has incrementally grown in several different phases, which has led to considerable urban sprawl. Copenhagen was the “functioning” capital of the Icelandic Republic prior to 1944, and growth of the built environment around Reykjavik was mainly initiated following the British invasion during the Second World War and formation of a NATO American Military Base in the immediate post-war years.

²⁰ In this paper, we use the term “Reykjavik” in reference to the Reykjavik Municipality and the term “greater Reykjavik” in reference to the metropolitan area, which includes the Reykjavik municipality and the six municipalities that surround it.



Photo 1 Höfðaborgin in the forties, part of barracks that were torn down in the mid 1960's Ljósmyndasafn Reykjavíkur 2011.

Urbanisation has not always been favoured in Icelandic politics however. Strong political currents following independence and throughout the 20th century (even to this day) advocated that the “Icelandic farmer culture “was the “haute couture”, describing the essence of the country (or the national culture) (Entrikin, 1984). For instance, Jónas Jónsson was a prominent Icelandic political figure in the early 20th century who was deeply convinced that urban settlements like Reykjavík was a wrong place for human beings. Though this was the peak of the anti-urban campaign in Iceland, contemporary political agendas are still influenced by grains of this belief till this day (Hall, Jónsson, & Agnarsson, 2004).

Nevertheless, since the early 1950's the general characteristic has been high growth in Reykjavik and exponential growth in the surrounding municipalities of the greater region. This meant that Reykjavik was driving overall urbanisation in Iceland, which went from a 56.5% share in the 1930's to 94% in 2010 (Sveinsson, 2007, 2011) (National land survey, 2011). Between 1945 and 1965 alone, Reykjavik's the population grew by 70% and the built landmass increased by 700% (Bjarnason & Gylfadóttir, 2004).

Between 1950 and 1990 a few key points highlight the land use development process, particularly in terms of housing:

- There was consistently a housing shortage as well as a lack of funding to support construction. Those who managed to build their own houses in lived tightly (Bernharðsson, 2002) and military barracks throughout the city-region were slowly taken over by Icelanders as the military left.
- The continuous inflow of new inhabitants from the rural to the urban was a base for building more permanent housing and neighbourhoods.
- The first legislation for facilitating individual and family fundraising for housing construction was initiated in 1952. This led to a more formal institutionalisation and the

establishment of the state housing institute from 1957. Over the years, the housing institute became a key lender to the families seeking to build a home.

- As shown by Photo 2, land use development that is consistent with urban sprawl was already taking place in the 1950's and 1960's.
- In the 1970's and 1980's the modernisation and expansion toward the neighbouring municipalities contributed to urban sprawl. The neighbouring municipalities in the capital region were hardly discernable as separate towns anymore. The capital region had become one coherent urban structure.



Photo 2 Modernisation in the east part of Reykjavík in the fifties and sixties. (Source: Þjóðminjasafn Íslands)

10.3.3 Home ownership, competitiveness and urban sprawl

Land use development in Reykjavík appears to be inseparable from the nature state support for housing ownership and municipal competition for land development. In the 1970's the state's housing fund started to lend housing loans for buyers and not only for construction as earlier. While these loans in most cases only funded 30-35 % of the cost of buying housing (Sveinsson, 2007), the ratio of families living in their own housing grew as inflation and economic growth made housing relatively affordable. According to a survey conducted in 1979, 83 % of families in Reykjavík own their dwelling, compared to 91 % in neighbouring municipalities (Sveinsson, 2007). Put together, private single-family homes dominated as the preeminent market conditions that controlled land use development.

While public opinion on land use development in greater Reykjavík is mixed, strong convictions over inefficient planning and land use management are evident. For instance, author Hallgrímur Helgason commented,

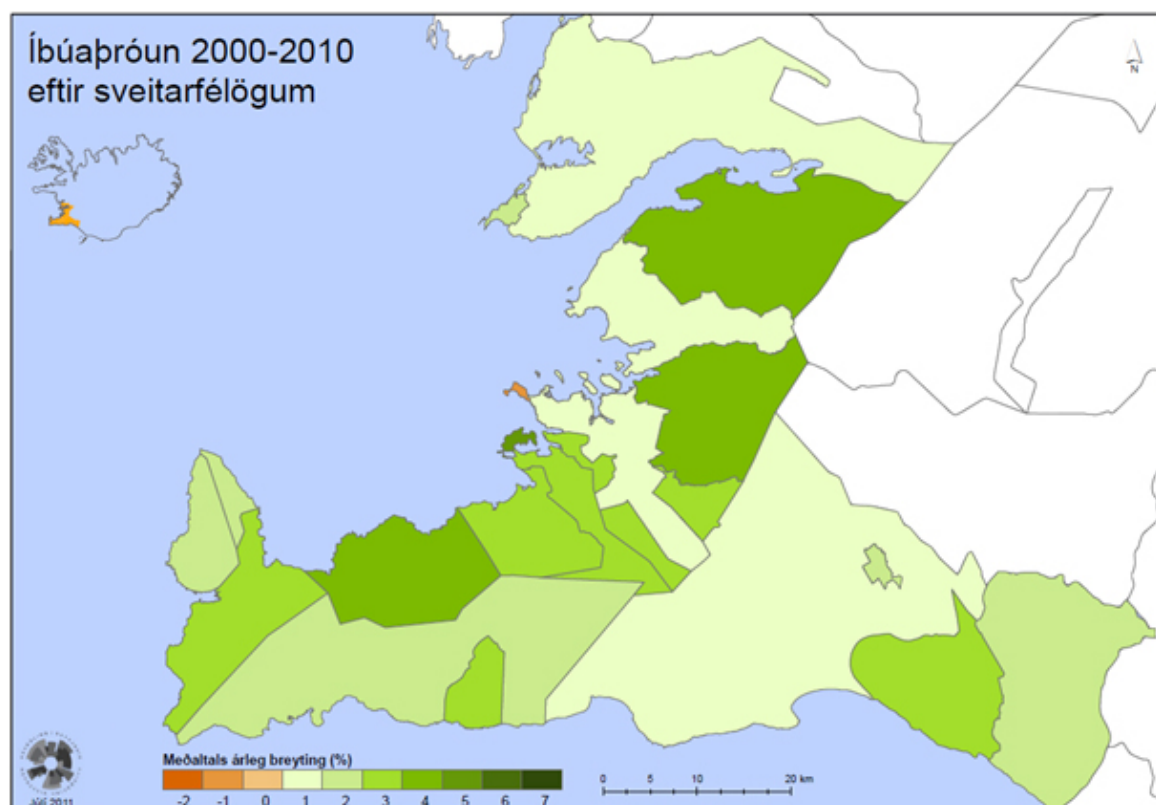
“In only fifty years it went from being a lovely little harbour town to becoming a concrete monster tied up by motorways. Copenhagen was based on Paris and still looks sort of like a Paris of red bricks, while Reykjavik looks like Rönne in Bornholm surrounded by Los Angeles. I’m not kidding, Reykjavik is the most spread out city on the planet. It’s one of the major achievements of modern city planning how they managed to make people who live in a city of 100,000 spend on average one hour per day in their cars.” (Helgason, 2012, p. 4)

“...for the latter part of the twentieth century we made it a rule: There had to be a space of 30 metres between houses and 30 metres from door to street, 30 parking spaces for each apartment, and every neighborhood surrounded by a freeway. Reykjavik is like one big car festival. It has more gas stations than cafes.” (Helgason, 2012, p. 4)

The more recent processes of urban sprawl are evident in Map 4 showing the average annual change in population development by municipality (2000-2010). It shows little or no growth in Reykjavik proper, as populations are increasing in many of the municipalities surrounding it (Theodorsdottir et.al 2012). Research by a University of Reykjavik study group identified the essence of Reykjavik’s recent urbanisation being urban sprawl, a process shaped by co-evolving influences:

- Municipal competition on land bids and for residential growth, especially in the years leading up to the 2008 financial crisis. The master plans of 19 municipalities in greater Reykjavik have been built on premises on unrealistic population development projections, indicating each municipality was assuming they would “win the competition” for new residents.
- A Market preference for single family houses.
- More and more people accepting long commutes as a way of life.
- Americanisation of the building mass was perhaps inherited from the legacy of the military barracks. (Theodórsdóttir, Jónsdóttir, Guðmundsson, & Hreggviðsson, 2012)

Reykjavik’s 2013 release of their Municipal Plan 2010-2030 mention a number of aspects of integrated land use management and sustainability. This includes: increased density and land use mixing, less use of new land, more environmentally friendly transport systems and conservation of green areas (Municipality of Reykjavik, 2013). Unfortunately this is on the municipal scale and in a broader city-regional perspective the trends of low density urban sprawl appear to be winning out over more integrated and truly sustainable planning. The findings raise further questions about the need for regional allocation of housing units, by a regional planning authority or the national government, as well as a need for regional and/or national policy on urban growth boundaries and sustainable land use (Theodórsdóttir et al., 2012).



Map 4 Population development (%) in municipalities around the Capital 2000-2010 (Theodórsdóttir et al., 2012)

Main findings, Reyjavik

- Urban development resulting in today's urban structure is mainly the result of development over the past 60-70 years, since the Second World War.
- Urbanisation was not always favoured as the ideal settlement structure in Iceland; many were opposed to the loss of the "rural ideal". However, domestic migration toward the capital region is the dominant settlement trend in Iceland.
- Driven mainly by its role as the commercial and administrative centre of the country, population growth was the base for developing more permanent housing and neighbourhoods, which since the 1950's and 1960's has been consistent with typical notions of urban sprawl and automobile dependence.
- In the 1970's and 1980's the modernisation and expansion toward the neighbouring municipalities contributed to urban sprawl. The neighbouring municipalities in the capital region were hardly discernable as separate towns anymore.
- Public housing has had very limited or no impact on the development. The private sector has been decisive for the expansion. And during the decades up to the financial crisis, favourable conditions for home loans made home buying realistic. By the early 1980's upwards of 91% of people in suburb municipalities "owned" their own home.
- Development over the past two decades has reinforced urban sprawl. Average population development by municipality (2000-2010) shows little or no growth in Reykjavik proper, as populations are increasing in many of the municipalities surrounding it.
- In addition to the acceptance of long commutes and the private car as a way of life in Reykjavik, urban sprawl seems to be driven predominantly by inter-municipal competition for growth through land bids and residential growth.
- The current state of sprawl and municipal competition raises questions about the need for regional allocation of housing units, by a regional planning authority or the national government, as well as a need for regional and/or national policy on urban growth boundaries and sustainable land use.

10.4 Rovaniemi, Finland

Situated only ten kilometres south of the Arctic Circle, the Municipality of Rovaniemi is the administrative and commercial capital of Lapland, the northernmost region in Finland. The urban area sits between the hills of Ounasvaara and Korkalovaara where the Kemijoki river and its tributary, the Ounasjoki, meet. The city and the surrounding Rovaniemen maalaiskunta (Rural

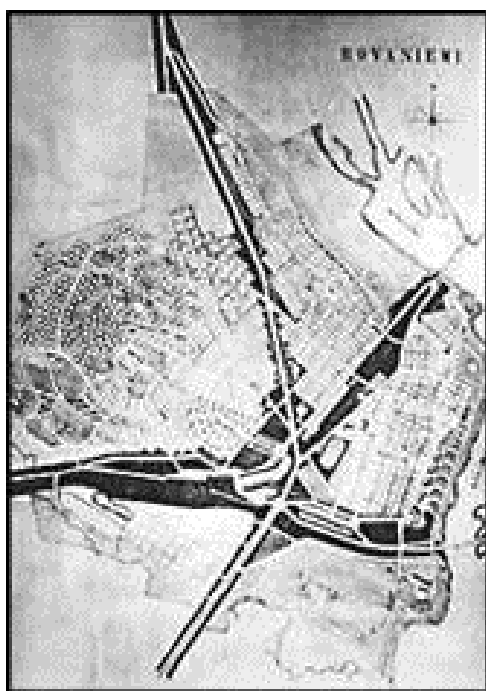
municipality of Rovaniemi) were consolidated into a single entity on January 1, 2006. As a result, the new municipality has a population of 61,000, making it the 13th largest municipality in Finland, but includes an area of 8,016km², making it the largest municipality in Europe!

10.4.1 The urbanisation process

Traditionally part of the vast territory settled by the Sami indigenous population, the term Rovaniemi was first mentioned in official documents in 1453. This was in reference to a set of small villages mainly surviving off of small scale agriculture and animal husbandry. Rovaniemi became the business centre of Lapland during the 1800s, benefitting from extensive forestry, gold mining and other natural resources.

Rovaniemi suffered near unanimous destruction during the Second World War and a driving force behind its redevelopment was the realisation of the town plan established by Alvar Aalto (Figure 1). This master plan (referred to as the antler plan for its aerial resemblance) resulted in extensive low density development which had restrictions on the height of buildings. It has been stated in land use planning documents (i.e. Rovaniemi Municipality, 2012) how this has run counter to the more densely populated, compact, mixed-use, models that create potential for better resource efficiency and sustainability.

Redevelopment was being supported by population growth, as Rovaniemi attracted rural residents from the surrounding land looking for work, particularly during the 1960s and 1970s. Even



though it was destroyed during the war Rovaniemi had been the business and administrative centre of Lapland since the 19th century and rebuilding the city was unquestioned.

As shown in Figure 2, the population growth took place slowly but stably between 1985 and the late 1990s before a short downturn in the late 1990s and early 2000s. Since 2003, population growth has returned and the trends suggest slow and steady development for the coming decades.

As the capital of Lapland, Rovaniemi has a large public sector with many government institutions having their offices there. Likewise, between 15-20% of the population is made up of university students, mainly attending either the University of

Lapland or Rovaniemi University of Applied Sciences.

*Figure 1 AlvarAalto's "antler like" city plan
(source: <http://lapinkavijat.rovaniemi.fi/aalto>)*

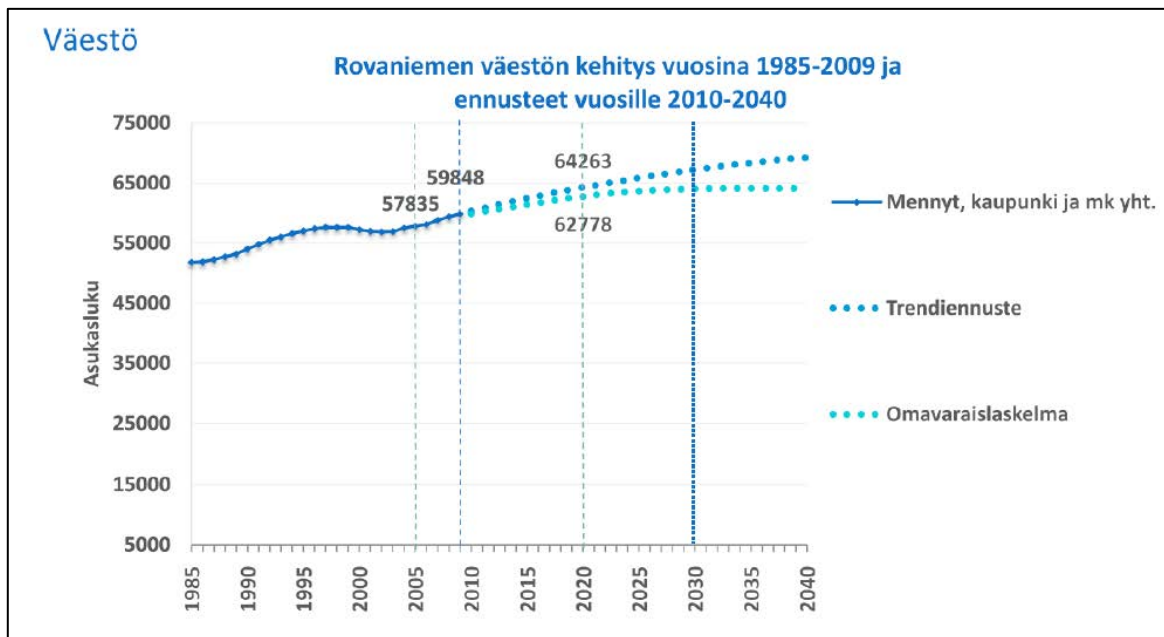


Figure 2 Population development in Rovaniemi since 1985, including two growth scenarios through 2040 (Rovaniemi Municipality, 2012)

Tourism and recreation

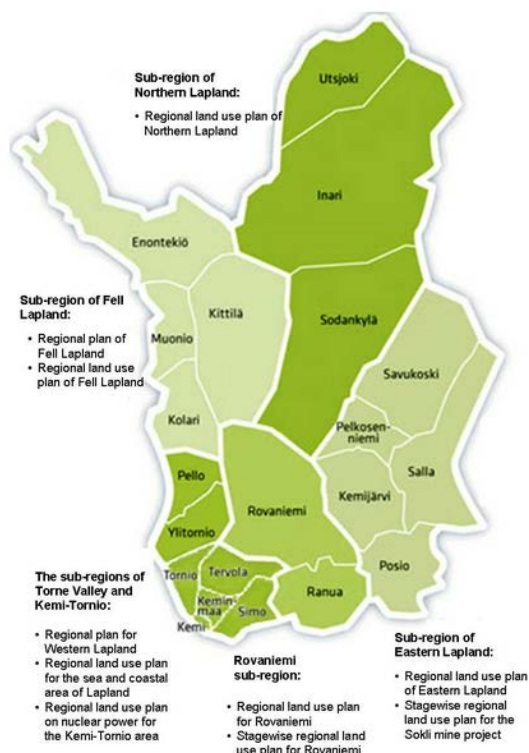
Another important engine of economic growth and social welfare relates to the region's unspoiled nature and numerous recreational opportunities. As a result regional, domestic and international tourism are important contributors to the economy, bringing upwards of 500,000 visitors each year. In 2005 the amount of registered overnights in Rovaniemi exceeded 404 000, of which more than 60% were foreign. According to the Climate Change Adaptation Strategy of Rovaniemi (Järviluoma & Suopajarvi, 2009), the important local attractions include:

- Rovaniemi as the official home town of Santa Claus, including Santa Claus Village and Santapark attracting tourists from around the world. It makes winter (November-April) the busiest and by far the most profitable tourist season of the year. For instance, each Christmas, more than 200 charter and special flights bring visitors to Rovaniemi.
- Cultural landmarks, including the Jätkäkynttilä Bridge and the Arktikum House, the Rovaniemi Town Hall and the Lappia House (which serves as a theatre, concert hall and congress centre, and the library). All three buildings were designed by the famous Finnish architect Alvar Aalto.
- Ounasvaara ski centre.
- Prime viewing of the Aurora Borealis, seen up to 200 days per year.

Thus, within 10 kilometres from the city centre one can find a landscape of contrasts: a pristine natural landscape or a busy international airport.

10.4.2

Current structure of land use management in Rovaniemi



Map 5 Lapland's five sub-region's for developing the regional land use plan (Regional Council of Lapland, n.d.)

Land use planning in Rovaniemi fits into a general Finnish planning structure where different levels of government have differing roles and responsibilities. In contrast to other Nordic countries (i.e. Sweden, Denmark and Iceland), where municipalities have the dominant responsibility for land use planning, the situation is more varied between levels of government in Finland with the regional authorities having a notable role. From the bottom-up, general structure involves municipal master and detailed plans, but these *must comply* with regional plans. Therefore, the regional councils have greater planning authority than in other Nordic countries (Smas, Damsgaard, Fredricsson, & Perjo, 2012). Furthermore, each of these plans must be ratified by the Finnish Ministry of Environment's Land Use and Building Act, and is the only sub-national plan that must be ratified by a government official (Regional Council of Lapland, n.d.)

According to the Regional Council of Lapland's website, Lapland's Regional Land Use Plan presents the principles of land use and the community structure, and defines the areas that are significant for the development of the region. Apart from this more general role, the only time more specific details are applied are when they are needed to meet the national or regional objectives or reconcile the use of land areas of more than one municipality. Therefore, the most pivotal legal effect of the regional land use plan is its use as a guideline for drafting and changing the master plan and town plan.

As shown in Map 5, Lapland's regional land use plan is drafted by sub-region, with Rovaniemi and neighbouring Ranua forming the Rovaniemi sub-region. Lapland's regional plan is translated locally by Rovaniemi's Regional Land Use Strategy, (last updated in 2012) which, aims to increase the attractiveness of Rovaniemi as a locomotive of Lapland. It has the following (very general) vision: "The regional structure of Rovaniemi in 2020 consists of a comfortable city centre and residential areas, lively villages with service areas close-by, traffic connections and logistics serving the companies, and combines both the city centre and surrounding villages as accessible zones of travel" (Rovaniemi Municipality, 2012, p. 9).

10.4.3 Current land use challenges

The municipality of Rovaniemi drafted its Climate Adaptation Strategy in 2009 (Järviluoma & Suopajärvi, 2009), which concentrated on three themes that are both significant for Rovaniemi and exposed to climate change: 1) tourism, 2) energy sector and waste management, and 3) urban planning and traffic. While the first two of these issues impact land use, the third is really the essence of sustainable land use planning. Therefore, the adaptation strategy goes on to describe the importance of integrating the community structure – which means strategic densification of the city by concentrating development to already built-up areas, thereby limiting shortening commuting trips and more effectively benefiting from more eco-friendly means of travel, such as public transport, walking and cycling.

However, the climate adaptation strategy notes a number of planning related challenges in terms of land use and urban development:

- The aforementioned original town plan by Alvar Aalto following the Second World War (see Figure 1) has resulted in a sprawled urban form that is not conducive to sustainable mobility patterns.
- The growth of satellite, commuter villages since Rovaniemi and the surrounding Rovaniemen maalaiskunta (Rural municipality of Rovaniemi) were consolidated. This counter-urbanisation has put a strain on services and infrastructure, increase private car use and in turn has raised further questions regarding community planning within the municipality.
- Public opinion appears to be divided in terms of developing a more sustainable urban form. According to the findings of interviews and questionnaires, some people favour strategic densification around the existing urban centre, while others expressed concern over existing green space and preserving the current built form near the city centre. Likewise, the attitudes toward taller apartment buildings was divided and for those people living outside the town centre, they fear that densification of the inner city more or less means a prioritisation of the town centre over their neighbourhoods. Many of those living outside the centre feel that a weakening of the service structure of Rovaniemi's rural villages has led to them being forced to seek the basic services in rather distant locations.

Put together, the main tension in Rovaniemi is in terms of sustainable urban land use development of the Rovaniemi city centre vis-à-vis the village nodes surrounding it. Likewise, it appears that the existing villages face the dual challenge of a lack of services (i.e. commercial locations and public service offerings) as well as a lack of effective public transport toward Rovaniemi city centre. While these villages may not be large enough to sustain a comprehensive public transportation network, there does seem to be the need for improved local bus service as well as some concentrated, mixed use development within these suburb communities.

Main findings, Rovaniemi

- Rovaniemi suffered near unanimous destruction during the Second World War. The town plan was established by Finnish architect Alvar Aalto and has resulted in extensive low density development, including restrictions on the height of buildings.
- Economic welfare is mainly driven by Rovaniemi's role as the political and administrative capital of Lapland, coupled with important contributions from other sectors such as tourism and energy (hydro). In this respect, it can be said that Rovaniemi is supported by a rather balanced economy.
- In Finland, roles and responsibilities for land use planning are integrated through multiple levels of government. Lapland's regional land use plan provides guidelines that local authorities must comply with. This is in contrast to other Nordic countries (Denmark, Iceland, Sweden) in which the regional authority has no formal responsibility for land use planning.
- Since smaller villages around Rovaniemi were consolidated into one municipality their growth has increased. This counter-urbanisation has put a strain on services and infrastructure, increased private car use and has raised questions regarding the sustainability of community planning.
- The main tension in Rovaniemi seems to be urban land use development of the city centre vis-à-vis the village nodes surrounding it. Public opinion appears to be divided in terms of developing a more sustainable urban form in Rovaniemi. Some people favour densification of the existing urban centre while others have concerns over threats to existing green space near the centre and preserving the qualities of the current urban form (i.e. continued restriction of building heights). Those people living outside the town centre also fear that densification of the inner-city more or less means a prioritisation of the town centre over their neighbourhoods.
- The existing small villages are challenged by a lack of commercial and public services, as well as a lack of effective public transport toward Rovaniemi city centre. While these villages may not be large enough to sustain a comprehensive public transportation network, there does seem to be the need for improved local bus service as well as some concentrated, mixed use development within these suburb communities.

10.5 Nuuk, Greenland

As shown on the graph (Figure 3) Nuuk is today by far the largest city in Greenland and in most aspects of society, economy and government, has evolved into a completely dominant position compared to other towns and villages. With a population of approximately 16,000 it is home to

about 25% of Greenland's population and the city has especially gained its importance since development strategies from the 1950's and 1960's when the urbanisation process really took off (Petersen & Rasmussen, 2007; Rasmussen, 1998)

10.5.1 Historical development

In 1721 the missionary Hans Egede established the first Danish colony in Greenland on an island situated on the north side of the mouth of the Godthaab fjord. He called it Hope Island, but by 1728 he moved the colony to the current location of Nuuk (Gad, 1984). Until 1774, trade, whaling and the daily administration were mainly handled by private merchants who, by the Danish government, were granted a monopoly on the continued service of the Greenland colonies (Kjær-Sørensen, 1983). After 1774, the Danish government created a government trade department -

"The Royal Greenland Trade Company" which forbid all other sailing and fishing trade through until 1950 (Viemose, 1976). In practice the Danes possessed all authority and controlled the Greenlandic trade market (Gad, 1984).

Settlements were scattered primarily along the west coast in a large number of relatively temporary locations until 1950. The settlements were organized by the Danish government in 12 colonies, each headed by a colony manager who was in charge of trade and administration (Viemose, 1976). Each had their "own rules" and as growth took

place, many of the settlements evolved into centre towns surrounded by a number of villages.

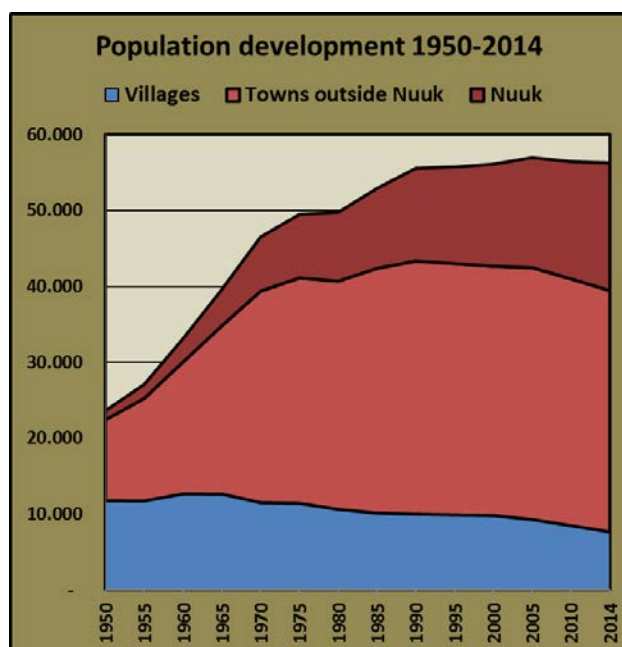


Figure 3 Population development in Greenland 1950-2014 subdivided in population in villages (blue), towns outside Nuuk (medium red) and Nuuk (dark red). Data: Statistics Greenland. Design: Rasmus Ole Rasmussen.

But with the focus on social and economic development as formulated in the G50 and G60 development plans the need of increased centralization became obvious (Kjær-Sørensen, 1983). The modernisation and development of the fishing industry was a first crucial step and, in addition to a growing public service sector, nearly half of the Greenland fishing fleet was for a period of time based in Nuuk and a few of the larger settlements along the west coast (see Nuuk's growth between 1950 and 1970 in Figure 3).

Since the Second World War Nuuk has been the centre of all administration in Greenland. This meant that a lot of national planning issues were either based out of Nuuk, or by authorities located in Denmark i.e. GTO (Greenland Technical Organisation) responsible for the state's

technical duties in the municipalities; KGH (Royal Greenland Trade Company) in charge of the retail trade system but also running the fish factories keeping production in the municipalities alive).

The establishment of Home Rule in 1979 brought another wave of urban growth in Nuuk as many decision and management duties were transferred from Denmark to Greenland. Consequently, half of the Greenland government employees ended up living in Nuuk and around 60% of the city's workforce is employed in public and private services - many of them are Danes or with Danish as their first language. Between 2000 and 2010 Nuuk experienced a net inflow of just over 2,500 people, almost 95% of which came from the other municipalities in Greenland.

10.5.2 Land use development associated with Nuuk's growth

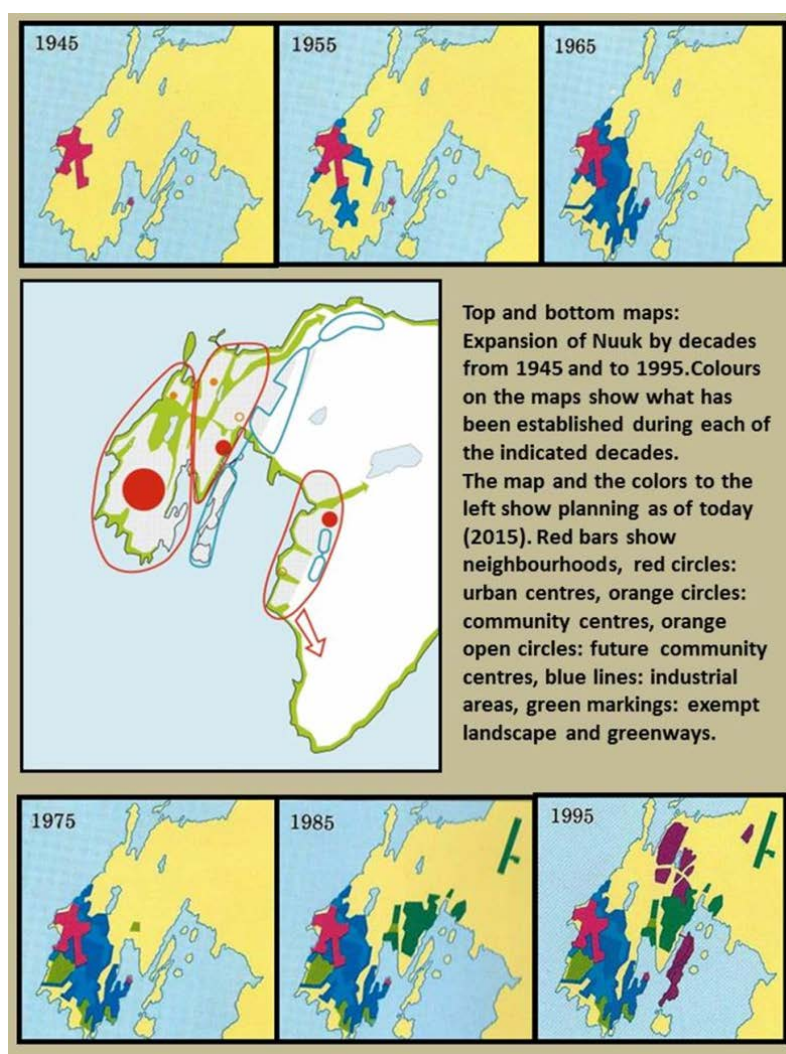


Figure 4 Territorial development of Nuuk since 1945. Maps for 1945 to 1995 based on (Atuakkiortik, 1993). 2015 plans based on Nuuk Kommunea (2015). Design: Rasmus Ole Rasmussen.

Figure 4 shows the evolution of Nuuk's built form from the Second World War and up till today. In the colonial town (1945, red shading) most activities were concentrated around the harbour to the northwest of today's town centre. However, its limited growth capacity was obvious to planners and the decision was made to find a more suitable place for updated harbour facilities. As a result, development through 1955 (light blue shading) took off with the construction of a road toward the upcoming new harbour, which was designed to serve Atlantic freighters and large fishing vessels.

By 1965 (dark blue shading) development evolved into what could be characterised

as a town, including power facilities, a hospital, heliport, oil storage tanks and fish processing

plant and the development of much needed housing (i.e. rapidly built, industrial-style concrete housing blocks). During the next ten years, the explosive population growth put further pressure on the construction of newer, higher quality apartment blocks (i.e. using wood and drywall) as well as colonial-style houses with bright colours (1975, light green shading). At this point of time three schools and two churches had been erected, just as the central administration buildings had been extended to accommodate the expanding public administration.

By 1985 (dark green shading) land use development included an airport (1979), 45 km of roads and three bus routes. Expansion of the fish industry and new types of industries were established in the area between town centre and the Atlantic harbour while new colourful 3-4 story blocks and terraced houses based on wood and dry-walls accommodated the growing population. By 1995 (purple shading) housing development started moving into areas previously deemed unsuitable for development. This land was reclaimed by blasting away landscape protrusions and using the rubble to fill-in rocky crevasses. Industrial growth included a bottling and mineral water production facility and further development of fish processing.

Since 2000, housing development has included the replacement of the concrete apartment blocks from the 1950s and 1960s with up to 8-story apartment buildings prioritising new and better materials as well with focus on better views and infrastructure. A completely new housing district in Malene Bay (Figure 4, centre map, right-hand red circle denoting urban centre) is also being constructed and a planned extension of the airport to enable take-off and landing of trans-Atlantic flights has been introduced.

10.5.3 Land access and land rights

The general mobility of both resources and humans has always made it difficult and impractical to divide land areas into delimited areas of specific use. Instead, commons and the collective exploitation of the resource was the basic principle (R. Petersen, 1981). Commons refers to the accessibility of the landscape and its resources to all members of society.

According to Brøsted (1981), the question of property rights in Greenland played a central role in the preparation of Greenland Home Rule. The discussions were primarily for political more than legal reasons. But the discussions were essential and generating the present situation regarding the public perception of ownership to land. Ownership is in his interpretation not a fixed concept, exposed to re-negotiations over time.

Under Home Rule, a fundamental task in the process of the establishing Greenland as a self-governing country related to Greenlanders and Greenland's ownership to resources. As a result, the former responsibility of the Danish political authorities was transferred to Greenland political authorities, who took over responsibility for a number of tasks from the Danish state, including the responsibility of planning and managing land-based resources.

Within Greenland, however, there are different levels of potential conflict between central and local governments. For instance, while the national level often has general requirements for planning tasks, the municipal level is the main authority in terms of shaping land use development. The national authority has the right to object based on a few grounds (e.g. conservation interests, exploitation of natural resources). Furthermore, the recently completed structural reform in 2009 amalgamated 18 municipalities into four, and has further strengthened municipal responsibilities and planning related competencies. However, these authorities can no longer be characterised as purely “local” in the traditional sense. For instance, Sermersooq is one of the four new municipalities, which is home to Nuuk, but it covers an area of 531,900 km²!

10.5.4 Current land use management in Nuuk – issues and plans

Nuuk will continue to be the undisputed commercial and administrative hub for Greenland. In terms of urban development including land use issues, the municipality’s plans are strategized within Sermersooq’s “The Digital Municipal Plan” – a website replacing the individual municipal plans for Nuuk, Ivittuut, Tasiilaq, Illoqqortoormiut and Paamiut. The main idea behind “going digital” has been to increase the availability for citizens, social workers, authorities and politicians to impact the overall vision of planning in the municipality.

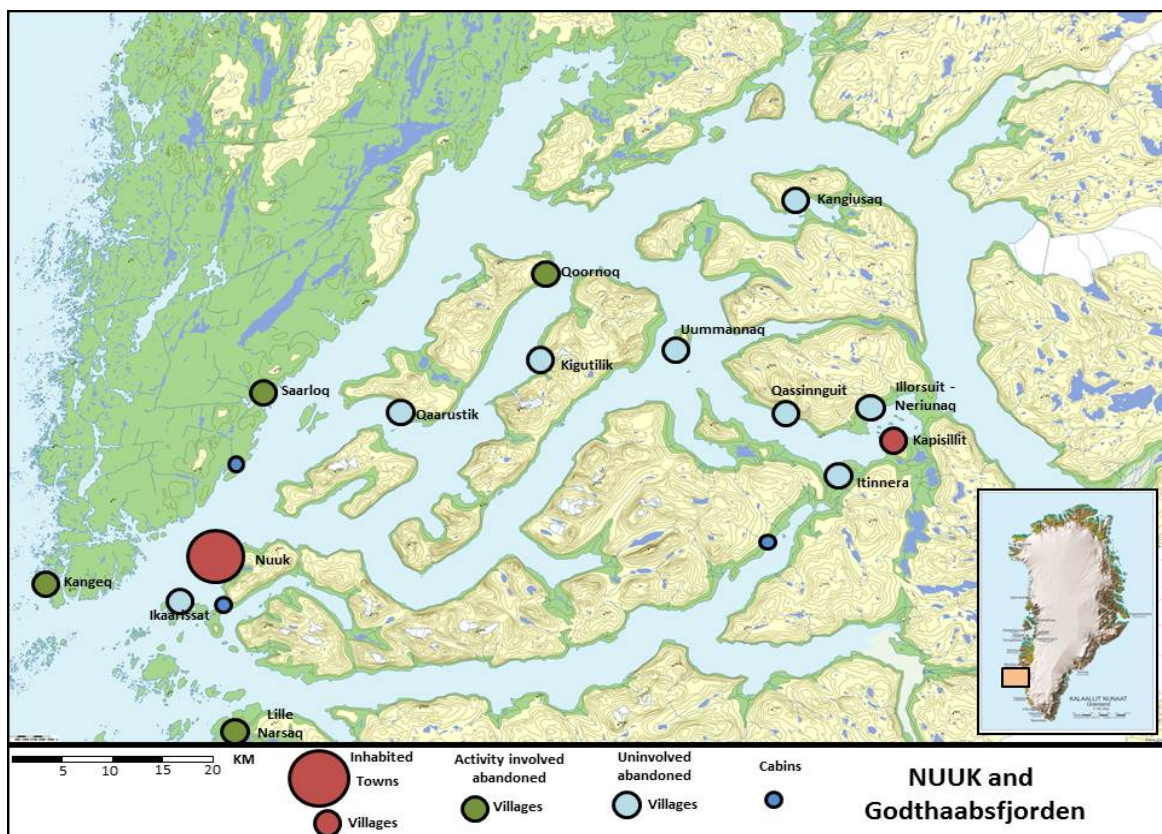
The Digital Municipal Plan promotes a “robust and sustainable” urban development strategy for Nuuk. “Robust” refers to its ability to take external developments and decisions into account – largely referring to the need for improved airport service to the capital (see above) and paying attention to the development possibilities in the raw materials sector, which can lead to increased trade and settlement for Nuuk. Airport expansion has been a highly disputed issue for several decades; seen from a Nuuk perspective it would enable much closer connections to partners and labour markets outside Greenland. But for other settlements in Greenland, it would, in some cases drastically reduce accessibility, service provision, and future development possibilities.

The term “Sustainable” reflects Nuuk’s goal to be designed in a way that strengthens and develops the special qualities of Nuuk in an environmentally and economically sound manner. Relating to land use, this has a number of dimensions that are acknowledged in the online plan, including densification of the existing city in ways that might serve as a model for preserving and promoting urban and architectural heritage in Arctic cities. Specifically, it should reduce the amount of land needed for residential and commercial buildings and enable the maintenance of green and open space in the city. As a result, the objective is to strengthen both the quality and quantity of the existing residential focus areas, including the main city centre, two town centres and a few smaller community centres (see Figure 4).

The transition from a rural settlement structure (of villages and semi-nomadic settlements) to the a large urban centre is so fresh in Greenland that another of the most important land use issues in a sustainable urbanisation process is how rural landscape features are maintained for the enjoyment and economic benefit of Greenlanders. In the municipal plan “open countryside” is a

collective term for all areas not zoned for settlement. In the past, development of open space was treated on a case-by-case basis (i.e. no comprehensive strategy) because of the impression that there would always be plenty of room available.

However, the open countryside can no longer be considered an area of no potential land use conflicts, as a wide range of actors (and their associated interests) are increasingly vying for space. Consequently there is an increasing need for a comprehensive approach to spatial planning reflecting the various interests. As a result, the municipalities have taken over planning authority of the countryside from the central government since 2011. This includes the division of the open country into sub-areas and the establishment of general provisions for these subareas. The municipality can update and revise the overall regulations and develop detailed plans on the sub-areas.



Map 6 The settlement structure (inhabited, involved and abandoned towns and villages) in the Godthaab Fjord in West Greenland. Map generated by Rasmus Ole Rasmussen by means of the on-line tool NunaGIS (<http://dk.nunagis.gl/>). Activity involved abandoned villages are abandoned villages where organized activities such as tourism education and leisure are known to take place.

The importance of planning the open countryside especially applies to the planning of the abandoned settlements, second home/cottage areas and areas immediately surrounding the urban area being in view to Nuuk residents on a daily basis. As shown on Map 6, a number of abandoned villages still exist, but some of them have been re-born (shown in green circles) with important new land use functions and need to be planned with these new uses in mind. In terms

of cottages and second homes, there are 17 free range plans that were prepared by the former Municipality of Nuuk in order to ensure that infrastructure connections (such as roads, small port facilities or telecommunication infrastructure) are managed properly, even though they often bisect open, “common land”. And in terms of open space immediately surrounding Nuuk (within 5km) some of it is designated as “pristine or near-pristine land” where development is restricted and the rest as common wilderness.



Photo 3: Kangeq was abandoned in the 1970s but some of the houses are being restored by individuals and organisations from Nuuk and the area is very popular for summertime leisure activities. Photos 2 and 3: Saarloq was an abandoned fishing village but many of the houses have been revitalized and converted into residents for school classes to access the wilderness for education. The church has also been totally restored and several houses (photo 2) have been turned in to individual or family owned summer-houses. As shown, some of these houses are even experimenting with solar panels and windmills for energy.

Even though free-range plans remain in place there appears to be a need for revisions of the open land planning strategy, toward a more consistent and integrated strategy for these historically un-planned areas. This should also integrate the fact that the marine environment is tightly connected to land use and urban rural interactions in Nuuk. For example, according to the planning authority, 1.700 small boats are already registered in Nuuk: 500 dinghies and small fishing boats for semi-commercial and commercial fisheries and 1.200 leisure-boats. This is expected to grow to 2.000 in the next years and with a total population of 18.000 inhabitants it implies that almost every family has some kind of direct access to a boat. This reflects the fact that there are no road connections outside of the Nuuk internal road network so much of the recreation opportunities around Nuuk are connected to marine transport. This is emphasised further when considering that as recent as 40 years ago small-scale, local trade

fishing was the dominant economic activity in Greenland.

Main findings, Nuuk

- The first wave of growth took place via the G50 and G60 development plans, where the development of the fisheries and public administration sectors were crucial first steps. It has evolved into a completely dominant position compared to other towns and villages and is home to 25% of Greenland's population.
- The establishment of Home Rule in 1979 brought another wave of urban growth in Nuuk as many decision and management duties were transferred from Denmark to Greenland.
- While the G50 looked for private initiatives in the development process, the lack of initiatives resulted in increased public responsibilities by the Danish Government in the G60. This especially included housing development and shortages in the 1960s were met with rapidly built, industrial-style concrete housing blocks built close to today's city centre. In the following decades the quality of the housing stock improved and since 2000 the concrete apartment blocks have been undergoing a process of deconstruction, being replaced by up to 8-story apartment buildings prioritising new and better materials and infrastructure.
- Since structural reform in 2009, 18 municipalities were amalgamated into four. While this has strengthened the municipal roles regarding land use planning, it also means that they can no longer be characterised as purely "local". However, these new economies of scale allow for a concentration of competencies and abilities in terms of urban planning, for which the new "Digital Municipal Plan" for Sermersooq is a key example.
- The Digital Municipal Plan promotes "robust and sustainable" urban development for Nuuk. This focusses on improved airport service to Nuuk which would support growth in Nuuk but would have dramatic consequences for almost all other settlements in Greenland.
- The term "Sustainable" reflects Nuuk's goal to be designed in a way that strengthens and develops the special qualities of Nuuk in an environmentally and economically sound manner. The plan states how Nuuk should reduce the amount of land needed for residential and commercial building to maintain the green and open space within the city.
- The recent transition from a rural settlement structure (of villages and semi-nomadic settlements) to a large urban centre is so fresh in Greenland that one of the most important land use issues is how rural landscape features are maintained for the enjoyment and economic benefit of the inhabitants. While examples related to the preservation of vacated villages within boating distance are positive, the importance of "the rural" reiterates the need for a more comprehensive approach to spatial planning.-

This will allow the urban and surrounding landscape to be managed with a view to its important social and cultural value.

10.6 Kirovsk, Russia

Kirovsk is a town of approximately 28,000 inhabitants in the Murmansk Region of Northwest Russia. Known until 1934 as Hibirnogorsk the town was established due to discovery and exploitation of apatite-nepheline deposits in the Khibiny mountains situated in the core of the region. These resources were identified during the 1920's as the Soviet government was seeking to decrease their dependency on imported resources. The discovery of apatite-nepheline therefore resulted in Kirovsk being quickly established within the mountain valley, as close to the discovered deposits as possible.

10.6.1 The urbanisation process

Prior to the settlement being established, the area of Kirovsk was basically characterised by unspoiled nature with no resident population. The valley included the lake Big Woodjavr with a relatively flat area on its south shore, which could accommodate the planned population of 32,000 people. As shown in Figure 5 mine during the years 1929-1930, and by the end of 1931 a population of 17,000 workers, their families and associated population was in place.

The first wooden barracks and stone houses and administration buildings were built in 1932 and the population quickly reached the targeted 31,700 people. A vast majority of them were working in the mine during the day and built their homes in the evenings (Kirov History Museum, 2014).

Origins of urban land use planning in Kirovsk dates back to 1938 when the first planning project took place – the establishment of a new main street. This was ultimately a bad decision as the mountainous terrain was not taken into account, and it was impossible to drive on the street in the winter time. In the meantime, new buildings had been constructed along the previous route so it was impossible to restore it (Romm, 2001). As a result the town plan was abolished and a new master plan conceived. This new plan featured the development of a new, oval shaped, town centre from which streets diverged in a typical hub-and-spoke pattern. The main street, now Lenin Avenue, was focused on the top of the dominant height above the city where the Town House of Culture is now located.

However, the master plan was only partially implemented due to overall poor coordination. On one hand, the economic realities that originally motivated the development were not overly stable, and on the other hand the topography of the area was still not reflected well enough in the planning process. For instance, the need for a new road in the city which arose almost immediately after the establishing of Kirovsk due to the destruction of the old highway was not

replaced until the 1970's, when a new ring road was constructed around the city to solve the problem of heavy vehicle getting access to the mine.

Following the Second World War the development authority in Kirovsk was handed over to another design institute which had the idea of creating "terraced hillsides" around Kirovsk as an ode to the Italian Renaissance palace style (Romm, 2001). This special era, which is still evident in today's urban landscape in Kirovsk, was followed by a period of Soviet minimalist architecture where mass construction of housing took place. These dwellings were mainly built along hillsides, giving the appearance of terraced apartment blocks on the hillsides. Even though mining facilities were mainly kept separated from the town centre, one factory (ANOF-1) was built in the centre of the town in order to have good access to the lake for water used in its industrial processes.

As shown in Figure 5, Kirovsk has experienced several phases of growth and decline in population, which has impacted the nature of land use development. For instance, population was at an all-time high from the 1960's to 1980's due to the expanded labour force needed for the growing mining and associated heavy industry activities. This was well above the 32,000 which was originally expected to be the limit for development on the lakeside flats, and it therefore required new strategic land use decisions to be taken. As a result, mass construction of high-rise buildings with central water, heat and electricity began. However, due to the limited flat areas for the construction of houses, it was decided to create three new settlements: Titan (6 km from Kirovsk) and Koashva (32 km from Kirovsk), which were later included in the Kirovsk urban area, and one new town – Apatity (18 km from Kirovsk) - which began a new phase of concentration of workers in developing new mines and factories.

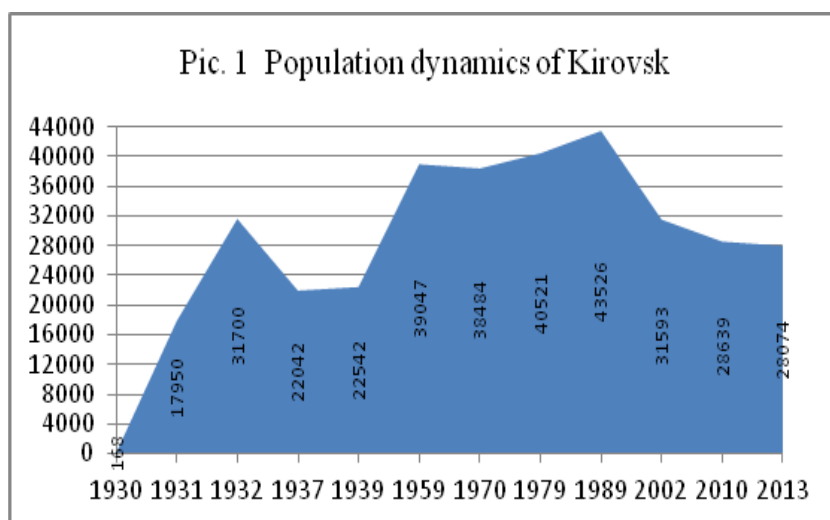


Figure 5: Population dynamics of Kirovsk (Kirov History Museum, 2014)

As a result of these growth processes, 42% of the houses in Kirovsk were built in the 1970s and 51% in the 1980s. However, significant population decline took place in the 1990's and 2000's due to demographic changes and industrial decline.



Photo 4: Snapshots of Kirovsk land use and built environment. Clockwise from top-left. Terraced apartment dwellings on the hillside, from the intense 1970's and 1980's construction period; mining activities on the edge of town; local ski and tourist infrastructure in the Khibiny Mountains around Kirovsk; urban land use mix and building design in the city centre. Photos by Rasmus Ole Rasmussen.

10.6.2 Current structure of land use management

Until the 1990's the state was the single land owner, and they granted land rights to individuals for the right to use land as "land users". The state divided land into specific land uses according to the "primary intended use of the land", which strictly governed the extent to which land users could decide upon how to use the land (Romm, 2001). State control was managed by local authorities that distributed land to the users²¹ which, due to the limited power they had for affecting land use, were more custodians of state land than holders of land rights in a more liberal perspective (Erofeev, 2004).

In 1991, however, changes in land relations began as rights of individuals, and companies gradually gained increased rights to develop land for their specific use. As a result, the 1990's could be explained as a period where opposing views to land use control were hanging in the balance: state control over the ownership and use on one side, and increasing rights delegated to the private owner (Chubarov, 2008). In 2001, a new Land Code was adopted which legalized private ownership of land, and set general land use zoning rules to be followed by the private sector. From an urban land use perspective this was a major shift as the Land Code required the development of new territorial planning schemes in each municipality which furthermore included outlining of master plans and the adoption of local land use acts.

Land use and management in Kirovsk is currently governed by three main policies:

1. Local rules of land use and development which was adopted in 2013. In accordance with these rules there are two key types of zoning: general zoning, which includes residential areas, public and business areas, industrial zones, utilities and transport infrastructure and recreational areas; and zones with special conditions, which includes areas of historical, cultural and natural heritage.
2. The Master Plan of the town and surrounding villages of Kirovsk adopted in 2008. It contains the main directions of development of the town as industrial and tourist centre.
3. The Multipurpose Investment Development Plan, adopted in 2010. This aims to "increase the quality of life of Kirovsk based on its sustainable, social, economic and environmentally sound development."

These documents are complimentary and interrelated, promoting two directions of development: industrial growth via mineral extraction and tourism growth, particularly skiing in the winter.

10.6.3 Land use and multi-level governance challenges for future development

²¹ "Urban land recognized land inside the city limits, with the exception of land for special purposes. Urban areas are the responsibility of city councils " From: §11 "General principles of land use and management". Approved by the Resolution of the USSR Central Executive Committee, December 15, 1928.

Further mining development around Kirovsk took place most recently in 2012 with the Deer Creek (Oleniy ruchey) apatite-nepheline mine on the east side of the Khibiny Mountains. There is also planned construction of the “Partamchorr” mine on the north side of the Khibiny Mountains. The construction of the new mines and factories are basically conflicting in land use with the project to found the National Park "Khibiny ". This park would be organized in the Khibiny and Lovozero Montaints.

Development of tourism and capitalising on the natural landscape

Kirovsk was the national base of Russian skiing during the late Soviet Era, but by the 1990's the skiing infrastructure was obviously aging and being poorly maintained. Around the turn of the millennium, investments in new lifts and pistes were a response to new consumer demand. The challenge now is that the rest of the tourist and recreation infrastructure that is necessary - hotels, cafes, recreational facilities, roads, etc. – still lag behind.

The town's population actively uses the forests and foothills surrounding Kirovsk for recreation and production of agricultural produces in leisure time gardens. In the early 1980's the local started a gradual allocation of land to employees for dachas and gardens. One rationale for this was the overall socio-economic crisis and food shortage in the country, which particularly affected northern sparsely populated regions. Promoting dachas and private gardens allow the population to survive these conditions, and nowadays people continue to actively use these plots for holiday stays and growing vegetables and potatoes for home consumption or informal market sale.

The proposed Khibiny National Park

The Idea to create a national park in the Khibiny Mountains was first proposed by the Murmansk Oblast's regional environmental organization in the late 1990's. The aim was to preserve the unique natural landscapes, the rare animals and plants, and to develop nature-based eco-tourism. The proposal is currently within the Russian Government Decree "On Approval of the Concept of Development of Specially Protected Natural Territories of Federal Significance for the period up to 2020" (Russian Government, 2011). According to this plan, the park should be established by 2015. The Murmansk Oblast's program for the protection of Natural areas, adopted in 2007, also supports the creation of the Khibiny National Park, but with a deadline of 2018.

Multilevel governance challenges associated with land use management

A notable portion of the proposed Khibiny National Park is under jurisdiction of the Municipality of Kirovsk, but after the proposed creation of the park ownership should be passed to the National Park Administration. However, the idea to establish the park is not mentioned within the Kirovsk's planning documents, even though some aspects of it would directly support development of the tourism economy which they support. As stated in their planning documents, land use development should take place in support of the tourism economy, including:

- Expansion of sports and recreational area to the ski slopes on the eastern and northern sides of Kirovsk.
- Organization of a new ski slope on the west side of town along the road between Kirovsk and Koashva.
- Development of nature preservation measures in the Khibiny mountains, in particular along the Umba River with the construction of tourist facilities such as trails and campgrounds.
- Construction of docks and berths for pleasure boats on lake Big Woodjavr.
- Conversion of abandoned and dismantled buildings for the development of tourist and recreational functions within the urban district.

However, the formation of the park is not supported by the local government because it would significantly relinquish their control over the area, thereby limiting the full spectrum of development plans they have for the area. Most importantly, Kirovsk prefers a more balanced approach to local development where nature preservation and development of tourist infrastructure is matched by the ability to still develop additional mining activities in the area, which they view as critical to sustaining the livelihoods of the current population.

Put together, the case of land use planning in and around Kirovsk critically highlights the importance of considering scale when envisioning sustainable land use management strategies. On one hand, the national government is taking a relatively territorially blind approach to sustainability with their national park proposal. They view that forming the national park will support national cultural and environmental goals, while apparently also believing that the current status of industrial development is sufficient for sustaining the economic welfare of the region. In contrast, the local government believes that the current extent of mining is not sufficient to provide stable jobs in the long term, and the current, relatively balanced economy would be in danger if they are not provided with the flexibility to develop the mining industry in the future.

In turn, it shows that different levels of government can have very different views on what sustainability entails, and that top-down impressions can very easily disrupt the local socio-economic balance. As a result, the general principle of subsidiarity is a crucial principle to sustainable land use development, especially in arctic regions where a “national influence” can also be an “outside influence”.

Main findings, Kirovsk

- Kirovsk was founded around 1930 as a natural resource town (apatite-nepheline) and still runs that way. The initial experiences with urban land use planning were in response to a clear need, but came with little foresight or strategy.

- The first planning project was the establishment of a new main street, which was built on terrain that made it impossible to use in the winter. In the meantime, new buildings had been constructed along the previous route so it was impossible to restore it. A new town plan was conceived, but has been only partially implemented due to overall poor coordination.
- Much of the housing stock in Kirovsk reflects both a public sector dealing with the responsibility of housing the population, but furthermore a period of Soviet minimalist architecture where mass construction of housing took place during the 1970s and 1980s. These dwellings were mainly built as terraced apartment blocks on the hillsides. 42% of the houses in Kirovsk were built in the 1970s and 51% in the 1980s.
- Until the 1990's the state was the single land owner, and they granted land rights to individuals for the right to use land as "land users". In 2001, a new land code was adopted which legalized private land ownership and required the development of master plans and local land use acts.
- The municipality is now the main authority for land use development. Their planning documents promote two directions of development: industrial growth via mineral extraction and tourism growth, particularly skiing in the winter.
- The main land use conflict is in terms of mining development versus a national park, and local versus national control. Mining development around Kirovsk took place most recently in 2012 and there is another which is stalled in the planning phase. The construction of the new mines conflict with the Russian Government's plan to found the National Park "Khibiny ". Under the formation of a national park, a notable portion of land currently held by the Kirovsk municipality would be transferred to national control. While the local government understands that both local residents and domestic tourists actively use the surrounding landscape for recreation (especially hiking, berry and mushroom picking, camping, skiing and the establishment of second homes) they are against plans for the park because it would remove their ability to provide the economic growth needed to sustain the city's welfare.
- Kirovsk prefers a more balanced approach to local development where nature preservation and development of tourist infrastructure is matched by the ability to still develop additional mining activities in the area, which they view as critical to sustaining the livelihoods of the current population.

10.7 Thorshavn, Faroe Islands

In 1975 more than 11.000 people lived in Tórshavn, which was approximately 28% of the total population of the Faroe Islands. During the period of 1975-90 several development projects were implemented in the municipality of Tórshavn, which were quite different (more comprehensive) compared to former plans. As a result, Tórshavn has expanded out toward Hoyvík and Argir which were originally small settlements in the vicinity of Tórshavn, and since the construction of subsea tunnels expansion has continued to Streymoy and the other surrounding islands, especially to Eysturoy. Population and settlement wise the islands have always been challenged by their size and characteristics, an issue that still shows influence the development: Insularity with 18 islands of which 17 are inhabited; settlement structure with 48,000 inhabitants distributed over 100 villages and towns and with over 1/3 living in the metropolitan area of Tórshavn; and with an area of 1400 km² the population density is around 34 inhabitants per km².

10.7.1 Early settlements and migration

The early rural settlement of the Faroes was organised into 85 settlements (villages), each with their own well defined part of the land. All rights were connected to either land ownership or land leasing, and those without land were not allowed to move freely and were bound to work as servants for the land-owners before they were allowed to settle themselves.

Tórshavn had roughly 300 inhabitants by the early 18th century, making it one of the largest settlements in the northern part of the North Atlantic. After the reformation half the land in the Faroes became the property of the Danish Crown (kongsjørð). The other half was so called 'self-owners' land (óðalsjørð). While the Crown's land throughout the centuries was kept in its original form, as large or semi-large farms, the self-owners land was gradually divided into smaller and smaller parcels of land, making it difficult to live off the land in the traditional way. This development combined with a growth in population resulted in some fundamental settlement changes from the second half of the 18th century.

During the 19th century open boat fisheries on the banks around the Faroes became of growing importance and as a consequence many new villages were founded. During this period people without land migrated to Tórshavn where many of them became either servants to government officials or 'day-workers' (bønarfólk) finding jobs at the trade-posts of Tórshavn while others learned new crafts. The disintegration of the older form of settlement was (more or less) inevitable as the trading centre around Tórshavn evolved

10.7.2 The urbanisation process

Before the mid-19th century most houses did not resemble houses in a modern sense of the word but were wooden houses or huts slapped up against each other with a distance of one or a few feet. The miserable conditions of the houses combined with their chaotic placement posed a threat to

the security of Tórshavn because of the risk of fire spreading throughout the whole town being immanent.

The abolishing of the Danish Trade Monopoly by the mid-19th century created new opportunities for investments and growth, especially in the fisheries. From around 1875-80 the sea-going fisheries, so called sloop- or smack fisheries (sail-ship technology) took over. Faroese fisheries expanded and moved away from local fishing grounds to the open waters of the North Atlantic around Iceland and Greenland.

This shift once again changed the settlement structure of the Faroes. Some villages bloomed, especially those where the trade houses were located. Young people moved to these places such as Tvøroyri, Klaksvík and into Tórshavn.



Photo 5: Tórshavn at the head of Eystarvág 1865 (Johansen, 2006)

The economic growth and the growth in number of inhabitants in Tórshavn created a demand for new and larger building sites which were placed “sprawling” out in the infield surrounding the town expanded in a more orderly manner through these development plans. The land in the immediate vicinity of Tórshavn was parcelled out typically standardized in size, around 100-200 m² each, streets were laid in straight lines and houses were from 38m² to 54 m² in size.

The ‘sloop-fisheries’ peaked around the First World War but the lack of local Faroese capital resulted in a long period of economic and urban stagnation during the interwar period. But from the late 1950s to the early 1970s the Faroese economy was restructured and modernized, partly through loans and subsidies from Denmark and through the Marshall Plan. The result was the building up of a modern fishing fleet and the establishing of a modern fish processing industry on land. Parallel to this the physical infrastructure was developed throughout the country, the roads became paved and the first tunnel opened to traffic in 1963. At the same time a modern welfare state based upon the Nordic model began to emerge.



Photo 6: Bridge between the two main islands in the Faroes, Streymoy and Eysturoy, open for traffic in 1973 (Photo by author).

By the mid-1960s close to 60% of the Faroese population lived in three centres in Tórshavn, in Klaksvík and in the settlements surrounding Skálafjørðurin. These were the places where the modern fishing vessels and the fish processing industries were located, creating jobs in their own sectors as well as in connected sectors.

10.7.3 The long road to real town planning

During the early post-war period authorities around the Faroes became aware of the need to modernize the regulation of building and make town plans. The parliament adopted new building regulations and in 1954 the Faroese parliament agreed on passing a law on town planning and building regulations. Accordingly, the municipality of Tórshavn was required to provide a town plan within 3 years, but it took more than 12 years before a final version was adopted in 1972. During the intermediate period (late 1950s to early 1970s) the expansion of Tórshavn happened without any plan, even though Tórshavn expanded more rapidly than before, including 150 plots for residential developments (detached houses). During the same period some of the first row houses were built in Tórshavn although these modern town houses did not catch on with the Faroese ‘modern family’.

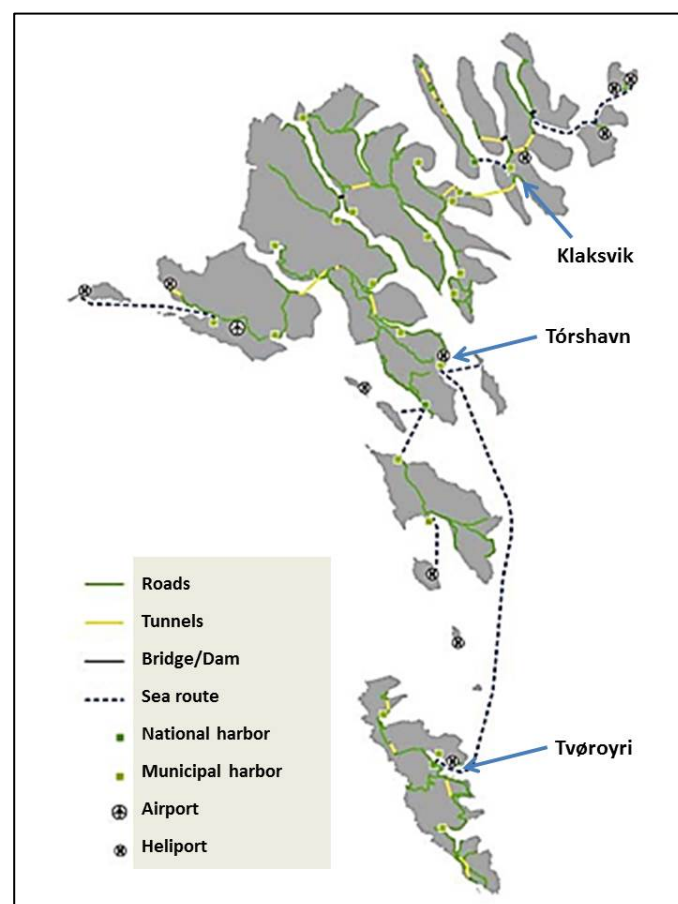
“Village development”

While centres experienced a rapid increase in population some villages were vacated, especially by the young people. This created a political demand for a counter-urbanisation policy, known as ‘village-development’ (bygdamenning). The implementation of ‘bygdamenning’ meant huge investments into the physical infrastructure between the settlements as well as within them and was meant to keep people in villages because they basically now were served by the same services available in the larger places. Every village had its own harbour, the roads between the villages expanded rapidly and included tunnels, bridges etc. In 1973 one of the most important

infrastructural structures had been established, namely the bridge between the two largest islands Streymoy and Eysturoy, thereby connecting almost 2/3 of the population by road (Photo 6 above).

Center town development

The ‘village-development’ provided support for establishing the fisheries and fishery-processing industry to smaller settlements in order to keep jobs and people living outside of the centres. The idea was to prevent migration from the smaller settlements to the centres, especially Tórshavn. - ‘Village-development’ became the main steering mechanism of the politics of the 1970ies and the 1980ies. At the same time this policy, through redistribution of resources and loans from abroad, kept the system from the 1950ies and 1960ies artificially alive until the late 1980ies. It, however, collapsed in the early 1990ies, resulting in an outmigration of more than 10% of the population within 3-4 years.



Map 7: The contemporary transport structure (Steinhólm, 2007)

The results of the new approaches to accessibility is shown on Map 7 and Figure 6 where the main roads, the tunnels and bridges are shown together with harbours heliports and other infrastructure components impacting the urban development and significantly reducing travel time. And this approach has been followed up with what is called “a new vision for the transport plan” emphasizing “Good transport links to support and ensure the growth and well-being of the Faroe Islands; The infrastructure to make it easy, safe and affordable for everyone to travel; Both domestically and internationally.” (Steinhólm, 2007).

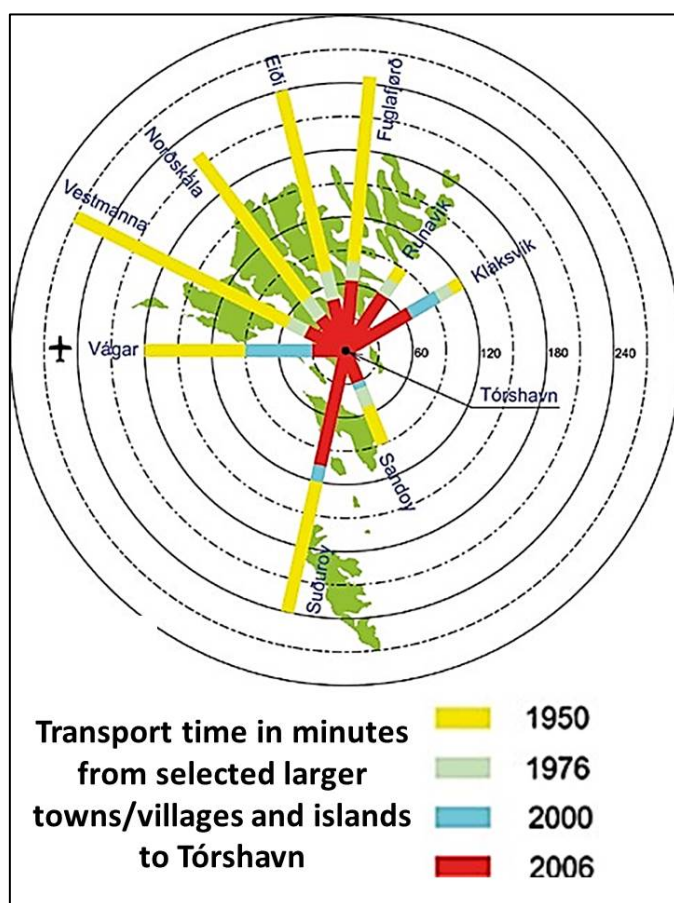


Figure 6: Development of transport time from 1950 to 2006. The colors show how long time it would take to move from Tórshavn to other towns/villages and islands (Steinhólm, 2007).

the services provided, and eventually keep them in the small places, the opposite happened. Instead of staying they moved to the larger places within commuting distances to Tórshavn or directly to Tórshavn. Today, 72% of the total land area and 86 % of the population in the Faroe Islands are linked to fixed road. The new traffic plan for the Faroe Islands 2008 - 2020 should be backbone of the vision of the Faroe Islands as one city enabled by the main transport network linking the various regions of the country together through the most important roads and sea routes. The main transport network should enable the community having access to important functions which include max ½ hour to important functions such as medical, business, etc.; Transport time to Tórshavn from any location in the country within a maximum of 1 hour where fixed roads are link, up to 1 ½ hours, where there is no fixed road, maximum 2¼ hours from Suderø (the southernmost island), and maximum half an hour from the airport to Tórshavn.

10.8 Kiruna, Sweden

Kiruna is Sweden's most northern municipality and more than 20,000 km² it is also the country's largest. Its establishment was a consequence of a decision of the Swedish parliament in 1898 to

This resulted in the present situation where people and activities are concentrating around the centres, especially in Tórshavn. The dense infrastructure enables most of the population to interact with the urban centres, because the expansion of the Faroese transport contributes to reducing both the physical and mental distance of the Faroe Islands. As outlined in the plans: In modern traffic planning objectives and requirements for the infrastructure are becoming more complex than ever. It's not "only" to establish a road link, but to follow a holistic perspective in all planning, where many more aspects and circumstances than before must be considered. While the intentions

were to give access for the villages to larger towns in order to give the population the opportunity to enjoy

extend the railway from Gällivare to Narvik in order to exploit the iron ores at Kirunavaara and Luosavaara mountains. In 1909 Kiruna became a municipality and in 1948 the town got its city accreditation. The municipality has more than 23,000 inhabitants, 18,000 of them living in the city of Kiruna, situated in the sub-alpine birch forest 140 kilometres north of the Polar Circle. The population peaked during the 1970's, but after a long period of decline it has now started to increase again with the development of additional mining opportunities.

10.8.1 Moving the city

Through the impacts of mining development Kiruna's city transformation is unique. Nowhere else has such a big community had to be relocated because of an industrial operation. In Germany, brown coal mining has resulted in the relocation of more than 100 villages, but these were only small villages with a few hundred inhabitants. In contrast, approximately 18,000 people live in central Kiruna and the relocation of the city centre affects more or less all of them. It is a project that involves huge challenges, but it also means new possibilities for developing a new and more sustainable city.

The iron ore in Kirunavaara was first excavated from the surface as an open mine, but has gone underground since the 1960s. Today, the main level lies 800 meters below ground, but a new main level that goes 300 meters further down has been inaugurated by the state-owned mining company LKAB. This will extend the mine's life until 2030. And from now on, the city will be highly affected by the mining.

In the mining operation voids occur in the rock where the iron ore is mined and transported away. These voids are filled with collapsing rock from above and the more ore that is excavated the more the rock above sinks - finally affecting the ground at the surface. In the first stage, this is called ground deformation. Eventually, ground fractures and subsidence will arise, but buildings and other constructions must be abandoned many years earlier.

Recent forecasts in Kiruna showed that ground deformations and fractures are approaching the city at such a pace that the railway had to be rerouted by 2012. The City Hall and some 100 houses will be affected by 2016. A survey of the new main level of the mine indicates that major damage is to be expected in the future.

As a result, on 19 September 2011 it was decided that a new city centre should be identified and developed east of the city. Work with a development plan for the new city centre is in progress based on an architectural competition. This work is carried out in close cooperation between Kiruna municipality, LKAB, private investors, the regional council of Norrbotten and other stakeholders. The first phase of the new city centre construction will start in the fall 2014 and be completed in 2016. It will include the new town hall placed by the new town square and surrounded by 150-200 dwellings, shopping, a hotel, a library and a tourist office. By 2033,

approximately 3000 apartments, 750 beds in hotels and hostels, and nearly 200,000 m² of retail, office, school and health care space will be affected by expansion of the mine.

The residents of Kiruna have realised the necessity of removing the city and the plans have been met with surprisingly few protests. At the same time it is obvious that the removal will be followed by a lot of sorrow. Therefore, the removal process proceeds with frequent meetings and in a close dialogue with local residents. An outspoken objective has been to map the residents' demands and expectations to the new city centre.

Zackrisson & Cars (2014) summarises the residents' opinion in four different demands. (i) Accessibility to the city by car is seen as important by most residents, at the same time as they state that they do not want to see the city centre dominated by cars. Streets should be narrowed, speed should be reduced and parking should be located so that the negative impact on city life and urban quality is avoided. Transport by foot, bike and public transport should be encouraged. (ii) Another opinion that strongly comes out the dialogue with the residents is a desire for mixed land use. The dominating post-war Swedish urban planning philosophy of separating housing, workplaces, commercial services and green space has no support amongst the citizens of Kiruna. They want mixed functions, e.g. by allowing retail shopping on the ground floor of residential houses, by mixing housing, working-places and public services in the same block etc. (iii) A third preference is the request for public spaces of high quality, e.g. parks, squares and streets that attracts social life and interaction. Related to this demand is a desire to see creative meeting places by mixing public open spaces with facilities that enhance social interaction, such as libraries, art galleries, cafés and restaurants. (iv) Finally, many residents underline the importance of architectural quality.



Map 8: Moving of the city centre of Kiruna. (<http://strangesounds.org/2013/09/the-whole-city-of-kiruna-in-northern-sweden-is-forced-to-move-after-mining-caused-massive-cracks.html>)

The final demand might be special for Kiruna. Ever since the city was founded art and architecture have been characteristics of the city. The still widely respected first director of LKAB,



Photo 7 The community church will be completely dismantled and reassembled in the new city centre (Source: Zackrisson & Cars, 2014)

city.

Hjalmar Lundbohm placed an effort in developing Kiruna as a role model for urban planning. The old city plan from 1900, designed by one of the leading contemporary Swedish urban planners PO Hallman, differed in several ways from the dominating ideal of a rectangular street network. Hallman's plan followed the natural terrain forms and instead of one central square he located several public open spaces in different parts of the

Another result of the early high architectural ambitions is the church of Kiruna, shown in Photo 7. It was constructed in the early 20th century and in a public competition held a few years ago it was nominated to the award “the most beautiful building in Sweden. To the residents it is important to keep some of its proud built history, so the church will be taken down and reassembled in the new city centre.

The residents’ demands are included in the new comprehensive plan for the city of Kiruna that is exhibited for the public from April to June 2014 (Kiruna Kommun 2014). Other topics that are dealt with in the plan are the green infrastructure including the establishment of an Urban Mining Park in the areas demolished by the removal of the city centre, the preservation of core areas and transfer corridors for the reindeer herding of the Salmi communities of Laevas and Gabna, and the road system including public transportation with free bus fares.

10.9 Conclusions

In some respects it is difficult to make broad generalisations because of the different political contexts in which planning has taken place among the different countries. But perhaps the goal of attempting broad generalisations would be to miss the point of what sustainable land use development should be about: making strategic decisions based on the array of local context – economic opportunities, political challenges, cultural histories, spatial factors, etc. This is why land use planning is so typically handled at a relatively local scale, and why we can see problems arise when plans are administered from the top-down, be it from national authorities, through impacts of international actors, or through individuals that manage to transcribe their own vision into development.

Nevertheless, some interrelated main messages come out of the case studies presented in this report, and can be generalised as potentially common land use issues facing cities and towns in the Arctic:

In many cases Arctic urbanisation is a new phenomenon. For instance, urban development in Reykjavik and Rovaniemi have storylines coming directly out of the Second World War and growth of Nuuk and Kirovsk followed fundamental changes to the economy - development of the fishing industry in Nuuk and the mining sector in Kirovsk.

In Nuuk, it was especially notable how the very recent socio-cultural shift in Greenland is recognised by land use planning. As a result, the nostalgic values of Greenlanders centred on traditional economic activities (especially small scale fishing) in a rural setting are incorporated in the land use strategies of urban development through preservation of the unique green space in the city as well as the nearby abandoned fishing villages.

Some Arctic cities face challenges associated with urban sprawl and strategic densification is a necessary planning response. In Reykjavik and Rovaniemi, the impacts of urban sprawl are clearly evident. In both cases the relatively recent urban development – since the end of the Second World War – appears to be root causes. In Reykjavik’s case, research pointed to the fact that the “Americanisation” of the building mass was perhaps an inherited outcome of the U.S. military presence there. But regardless, the reality was that the main period of urban development took place while the car was seen as an ideal form of personal mobility. This is similar to the perspective noticed in Rovaniemi, which was rebuilt following the war. In both cases the challenges associated with urban sprawl and the pursuit of urban sustainability is well understood by local planners, but active responses are limited by clear governance challenges.

Multi-level relations in governance reflect key urban sustainability challenges and solutions in Arctic cities. Each case highlighted how the division of roles and responsibilities for land use planning have directly impacted the ability to pursue the vision of urban sustainability. One of the most interesting cases was in Kirovsk where the vision of what entails sustainable development is seen fundamentally differently between the national government (which is pushing for the area around Kirovsk to be reserved as a national park) and the municipality (which wants a more balanced development approach whereby mining development and a prioritisation of the natural landscape can coexist). This deep land use conflict shows how the impact of different conceptualisation of sustainability coming from different scales can have major consequences on land use planning at the local level. It also shows that power from above, even though no longer exercised through direct command and control, can be forced in much more conspicuous, and perhaps dangerous, ways. It also reiterates the need for a more territorially aware approach to planning where local interests must be the guiding rationale for development. As a result, the general principle of subsidiarity is a crucial principle to sustainable land use development, especially in arctic regions where a “national influence” can also be an “outside influence”.

At the same time a scaling up of decision making appears to be a benefit for urban sustainability in Nuuk, where the municipal consolidation appears to have contributed to a consolidation of knowledge and improvement of planning practices that can help achieve sustainable urban development.

However the importance of governance *scale* was blatant in terms of contributing to urban sprawl in Reykjavik, where the intense competition for investment among the municipalities making up the city-region has contributed to rather incredible sprawl. Planners acknowledge the challenge as well as the need for infilling and more sustainable mobility solutions, as well as a comprehensive and integrated land use management strategy for the city-region as a whole, but negotiating this among the actors involved is a major hurdle.

However, the Rovaniemi case explained how after a municipal consolidation a counter-urbanisation process took place where the growth of small villages outside the city centre

increased. Seemingly counter intuitive to the necessary policy response for Reykjavik, it goes to show how an attachment to nature is a crucial aspect of what makes living in an Arctic setting attractive. This in turn reiterates the need for an explicit focus on prioritising the right types of green infrastructure alongside development of the built environment.

Primary sector interests in mining, fishing or other activities appear to have a powerful effect on urban land use in the Arctic. In both Nuuk (fishing) and Kirovsk (mining), urban development was founded upon the presence of a single natural resource based industry. In both cases the initial settlement structure and subsequent land use development hinged exclusively on maximising accessibility of the labour force to the central locations of work. For instance, the maps in the Nuuk case study showed how urban development followed along with proximity to port areas, while urban development in Kirovsk was concentrated around the accessibility to the mining locations. In the case of Tórshavn each shift in resource and technology has shown as changing patterns in the urban characteristics.

The interesting factor, however, seems to be that the lack of a single industrial presence in Reykjavik or Rovaniemi as had an impact on the land use pattern of the city and has contributed to sprawl. In contrast, both Nuuk and Kirovsk have maintained a relatively dense settlement structure, and in the case of Nuuk this appears to be a factor in being able to sustain an effective public transportation network.

Arctic cities have unique relationships to the nature that must be prioritised. Promoting green infrastructure investment and preservation of natural values of the surrounding landscape are essential. A combination of the recent growth of Arctic cities and the incredible natural landscape creates unique land use planning issues that must be acknowledged by planners to achieve sustainability in urban land use planning. This was made particularly clear in Rovaniemi where small villages have grown while densification of the inner city is stalled. It is also abundantly clear in Kirovsk where debate over how the natural landscape should be managed and preserved is the main land use challenge, which could perhaps affect the long-term economic sustainability of the city.

But more generally, a common characteristic for all five cases has been the role of the relations to the surroundings and the contact to nature being an integral part of the lifestyle and therefore also an integral part of the planning process. As outlined in the analysis of Arctic Social Indicators (ASI-I by Larsen et al (2010) and ASI-II by Larsen et al (2014)) Arctic communities are faced with multiple stressors and complex interactions of changing social, natural and physical systems. The wellbeing of Arctic residents and the ability to adapt has long been a focus of attention because the discussion of wellbeing has been moved beyond the usual domains included in the UN Human Development Index (UNHDI) by describing aspects that are considered prominent features of wellbeing in the Arctic.

Especially the concept of Contact with nature through the opportunity to interact on a regular basis with the natural world constitutes a supplementary dimension of human development. For instance, hunting, fishing, berry and mushroom picking, hiking and camping, sailing, skiing are all activities that are included as an integral part of living in the Arctic, and are key planning issues in all four cases; not only as a leisure time activity, but also an important part of subsistence related to the dietary needs and informal distribution mechanisms, where access to “commons” that provide these opportunities must be integrated in the planning process.

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