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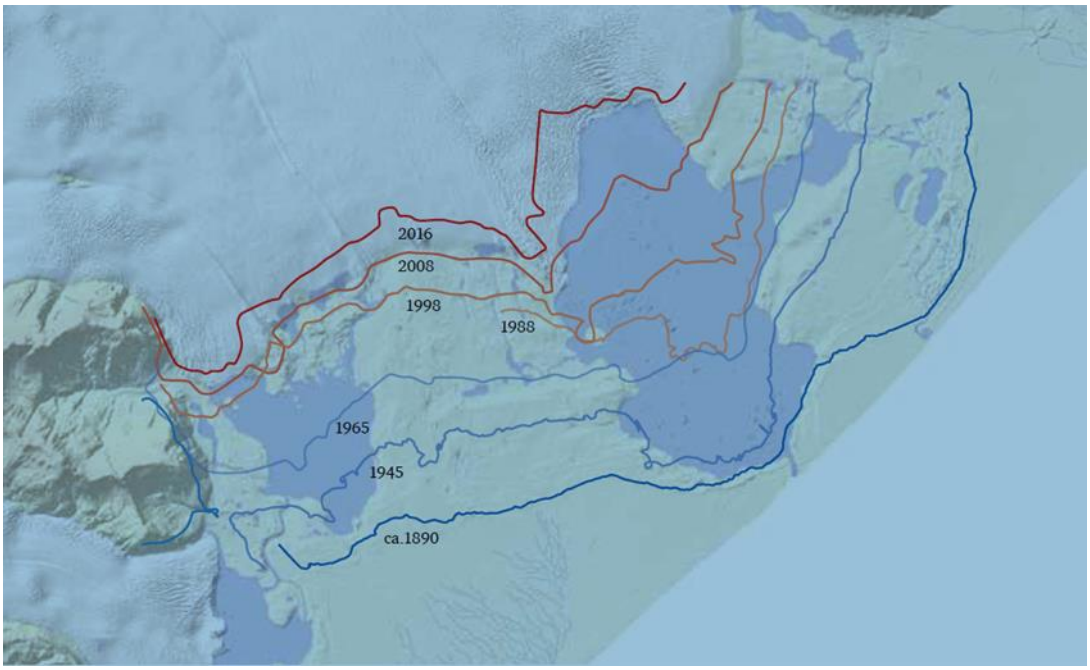
Social impacts of climate change and adaptation strategies in the region of East Iceland

A case study report from the ESPON project:
BRIDGES – Territories with geographical specificities



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1 The BRIDGES project

In late 2017 the project BRIDGES – Territories with geographical specificities was granted support from the ESPON program (European Territorial Observatory Network). The final report was delivered to ESPON in April 2019 (https://www.espon.eu/geographical-specifities).

The BRIDGES focuses on regions with specific territorial features who have received increasing attention in recent years, most notably in article 174 of the Treaty on the Functioning of the European Union (TFEU). The main purpose of this project is to address the opportunities and challenges of specific types of territories implies that these territories need to be considered in context rather than 'singled out'. These types of territories constitute the main focus for this project: sparsely populated regions; mountain regions; Islands, including island-states and coastal areas. A central question is: "How can place-based, smart and integrated approaches support the challenges encountered by territories with geographic specificities"?

In the project there are 15 different case study areas in Europe working with different tasks as examples of territories with geographical specificities: 1. Specificity of innovation processes 2. Perspectives and strategies for sustainable tourism 3. Accessibility and transport 4. Social innovation in the provision of SGI 5. Social development 6. Social and economic patterns 7. Residential economy as a component of development strategies 8. Physical environment, natural resources and Energy 9. Biodiversity conservation and sustainable development 10. Energy provision and production 11. Climate change.

In this paper we present one of the case studies on one of the topics (**11. Climate change**), which also is a case report in the project: Social Innovation in East Iceland.

2 Introduction

This case study concerns social impacts of climate change and adaptation strategies in Iceland with the focus on the region of East Iceland. As Iceland is within the Arctic region, climate change, as a result of human activities, is predicted to be considerable in Iceland. In this study, we will briefly look into

which adaptation strategies have been prepared, in what sectors of society and how these strategies are viewed by a few experts who were interviewed for the purpose of this study.

3 East Iceland

3.1 Geographical characteristics

Eastern Iceland is the region furthest away from the capital city and is the landscape is characterized by fjords surrounded by high mountains. The size of the region is 15,700 km^2 and thus 15.2% of the area of the country.

Figure 1. Eastern Iceland and location of Teigarhorn and Dalatangi meteorological stations. (Basemap: Google maps)

The population of eastern Iceland is around 12,500 and is divided between a number of small towns and rural areas. There are eight municipalities in the region which does not have any regional government as Iceland has a two-tier government: the state and 72 municipalities. In the region there is, however,

considerable collaboration among municipalities, and East Iceland and other seven regions have been used as a platform for organizing government services, for statistical purposes and more. Traditionally, basic industries in the region have been fishing and agriculture, but jobs have declined in both sectors. Tourism has become an increasingly important part of the economy of the region as in Iceland in general. Heavy industry is, however, reponsible for the single most important change in the economy of the region. Some 800 jobs were created in Alcoa-Fjarðaál in the fjord Reyðarfjörður, Iceland‘s largest aluminum plant. This was a result of the construction of Iceland‘s largest hydroelectric project Kárahnjúkar (690 MW) in the region and in the eastern highland from 2003 to 2008 (Jóhannesson et al., 2010). The project consisted of large dams, reservoirs, diversion of rivers, water tunnels, and a powerhouse. Most of the electricity is used by the aluminium plant.

3.2 Climate changes

Data obtained from the Icelandic Met office from two of the meteorological stations in eastern Iceland (see Figure 1) indicate changes in temperature, wind and precipitation.

Figure 2 shows the temperature development in Teigarhorn, eastern Iceland from 1873 to 2015 which is the meteorological station in eastern Iceland that has the longest time series[1] (Figure 1 shows the location of Teigarhorn). The general trend towards higher temperatures can clearly be observed, however there are three periods of colder climate within this this time frame, that is during the last two decades of the 19th century, during the second decade of the 20th century and finally during the late 1960s when there was considerable sea ice around the country.

[1] The station with the longest time series of temperature measurements is Stykkishólmur in W-Iceland, since 1823.

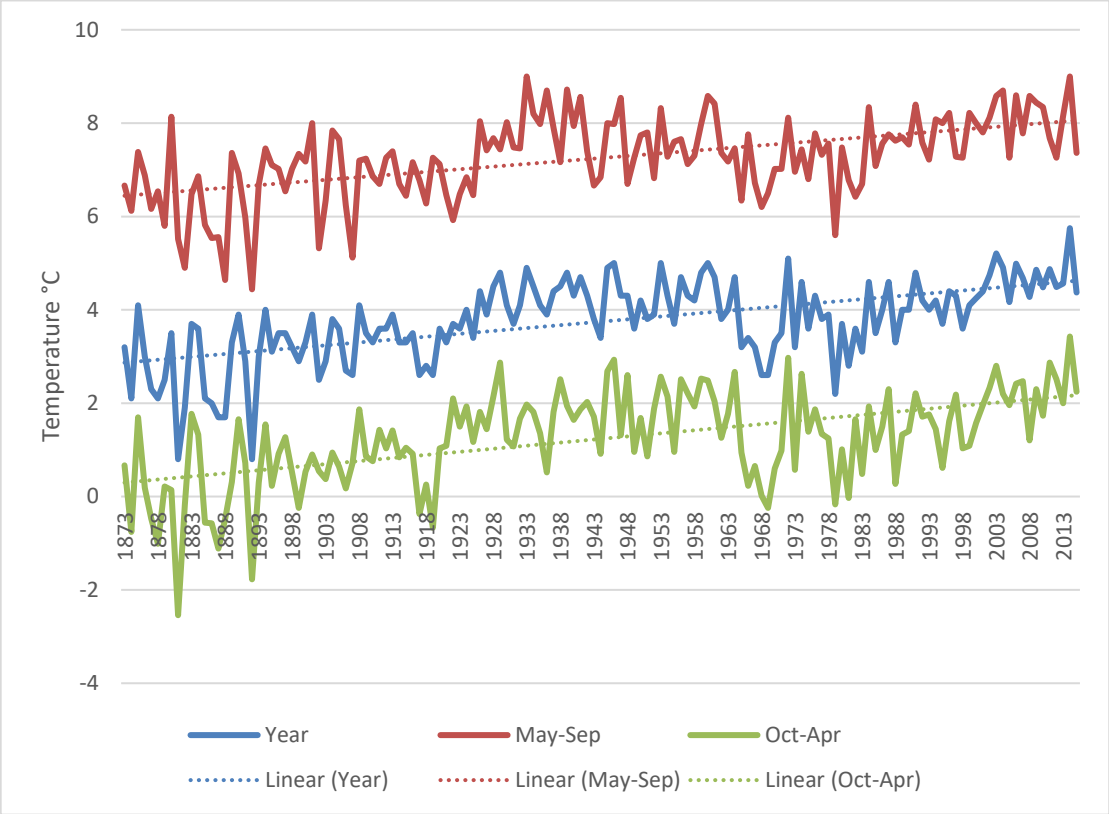

Figure 2. Teigarhorn mean temperature 1873-2015 (Icelandic Met Office, n.d.).

The data on the Icelandic Met Office for Dalatangi meteorological station, the easternmost location in Iceland (see Figure 1 for location) is more accurate and diverse than for Teigarhorn but the data series is only from 1949. The information for temperature, average wind speed and precipitation is however very interesting. The figures below show a trend towards higher average temperatures, higher windspeed and more precipitation on an annual basis.

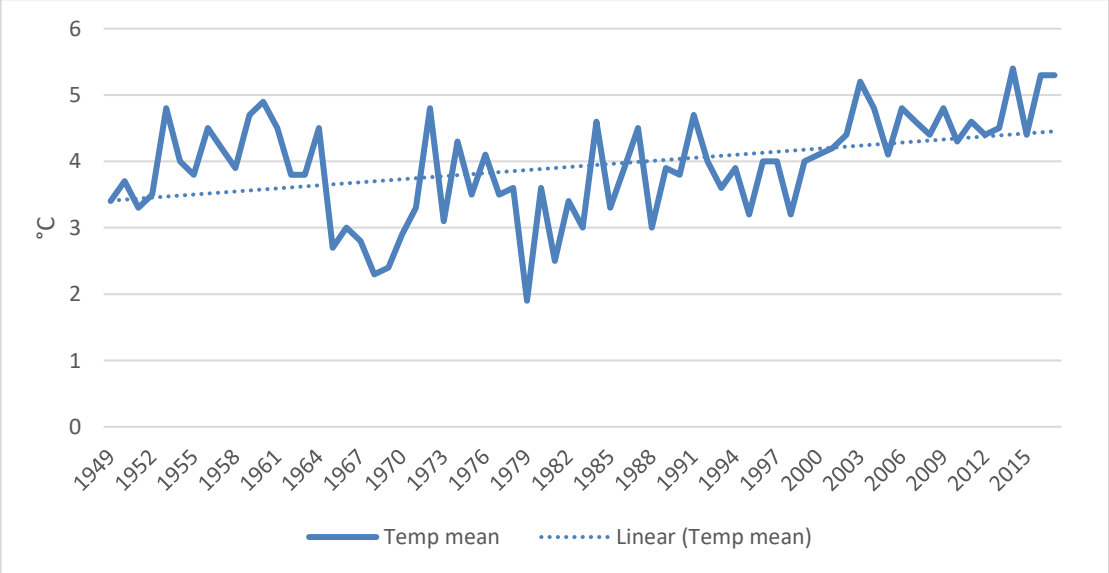

Figure 3. Dalatangi, mean annual temperature 1949-2015. (Icelandic Met Office, n.d.).

The relatively cold period in the 1960s can clearly be observed in the graph but the general trend is towards higher temperature.

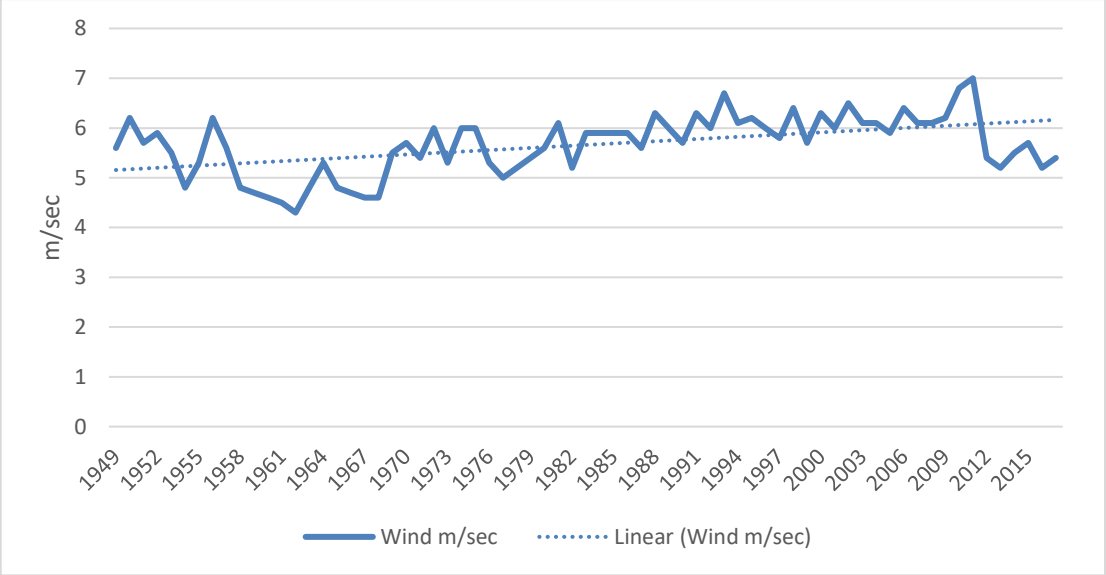

Figure 4. Dalatangi, mean annual windspeed in m/sec 1949-2015. (Icelandic Met Office, n.d.).

Similarly, there is a general trend towards higher windspeed even if there are periods with some exceptions such as in the 1960s and in the past few years. According to data from the Icelandic Met Office there seems also to be some trend towards increasing frequency of easterly wind directions.

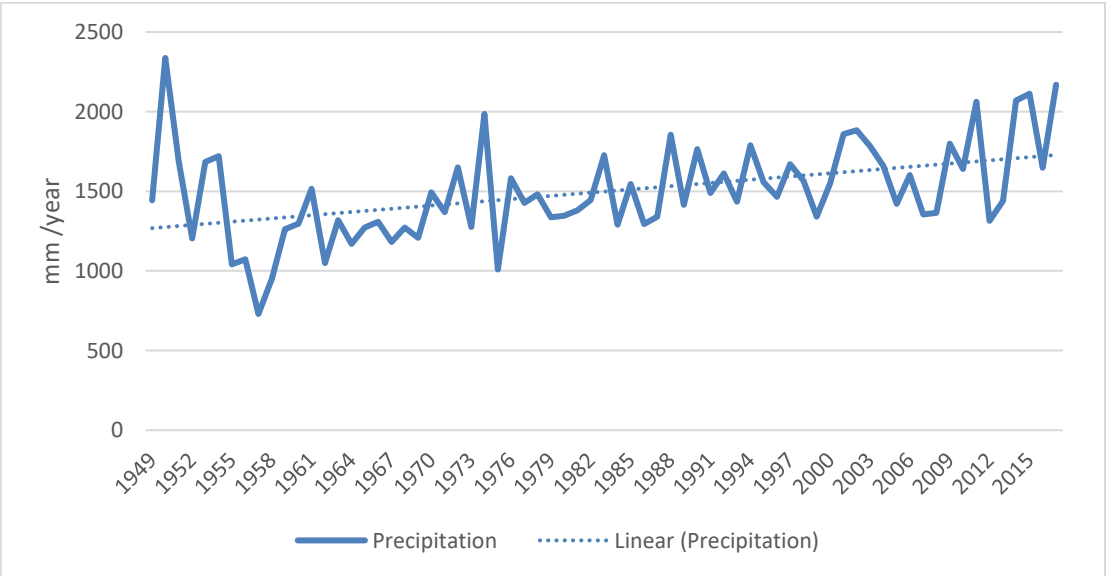

Figure 5. Dalatangi, annual precipitation 1949-2015. (Icelandic Met Office, n.d.).

Annual precipitation in Dalatangi has increased during the period from 1949 to 2015 (Figure 5). There are more fluctuations towards the beginning of the period.

Due to changes in the climate, there has been more tree growth and in eastern Iceland measurements show that Sitka Spruce has grown by 60 cm annually on average 2011-2016 There are also examples of spruce growth by some 70 cm. (Iceland Forest Service, n.d.). According to the same source, species which are also grown in similar latitudes in Scandinavia even grow faster in Iceland.

There has been an increase in mackerel catch in recent years and this has been related to warmer sea and better conditions (Table 1). Eastern Iceland is very important in the mackerel fishing and this has had important socio-economic impacts for the towns and villages along the eastern shoreline, e.g. the village Vopnafjörður (Arnarsson, 2013).

Table 1. Mackerel catch of Icelandic ships by fishing areas 2010-2017 (Directorate of Fisheries, n.d.).

Fishing area	2010	2011	2012	2013	2014	2015	2016	2017
Within EEZ	120273	156489	148866	140418	155160	147223	150393	104452
Norwegian EEZ	8							
Eastern Greenland			1520	11503	12683			2414
Faroe Islands	1180	2461	2027	1940	74	1549	1433	697
International waters	573			22	3314	19507	11356	57536
Total catch	122034	158950	152413	153883	171231	168279	163182	165099

Vatnajökull national park was established in 2008 and covers a large part of the eastern highland (Figure 1). It was a merger of two national parks along with an enlargement of the area including the Vatnajökull glacier itself. Kárahnjúkar hydro station is located just east of its boundaries. The park has been nominated for inclusion in the World Heritage List (Baldursson et al., 2018). A part of the justification for its nomination is how visible climate changes are in the area, especially with the retreat of Vatnajökull glacier, the largest icecap in Europe (Figure 3).

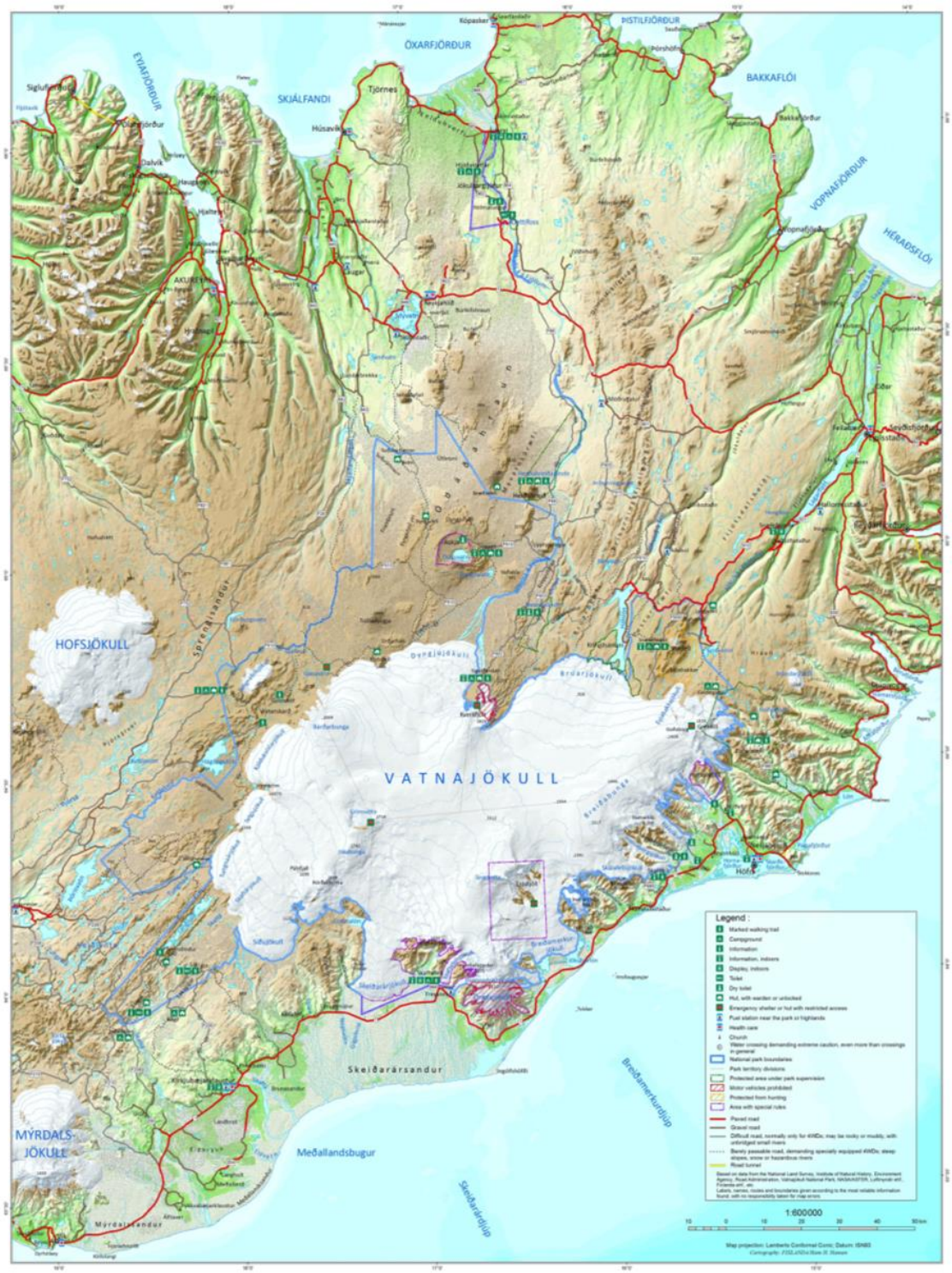

Figure 6. Vatnajökull national park (Jóhannesson et al., 2011).

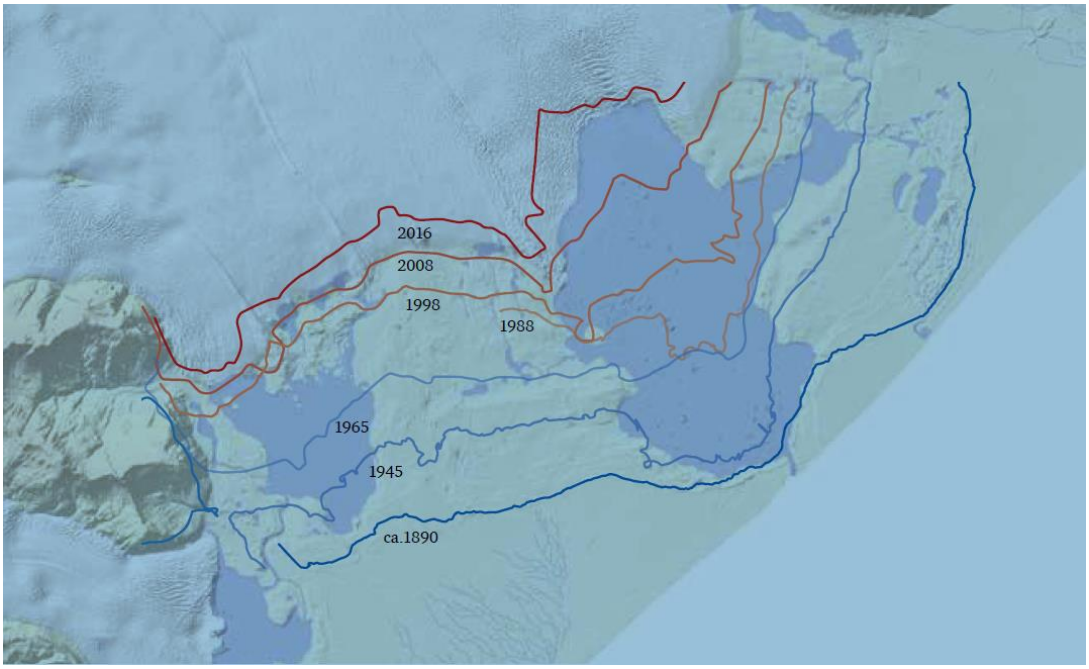

Figure 3. Retreat of the terminus of Breiðamerkurjökull outlet glacier from Vatnajökull, since 1890, a total of 7-8 km (Baldursson et al., 2018).

In an interview with a climatologist he was very cautious as to how much we can oberve climate change in other than temperature change itself. However, as we can observe in figures 2-5 there appear to be clear indications that precipitation and windspeed have also been increasing. Regarding impacts on communities he also said that in some fields or instances the community was more vulnerable to climate change. An example of this would be transportation because mobility is ever increasing and thus need for good transportation network and to be able to go somewhere whenever you want. Also, as developed areas increase in size there are more risks that buildings and other infrastructure may be located in risk locations. However, the planning and building acts prohibit location of buildings where it is known that avalanches or or landslides have occurred. On the other hand in some field the community would be less vulnerable such as at sea. There have been great improvements in security equipment, navigation technology, ship building, design and training of crew members. Therefore there are less risks at sea even if higher general winds may be observed as well at storm surges.

4 Climate change adaptation strategies and associated governance structures

We examined a number of policy documents in order to search for examples of adaptation strategies in the field of climate change. These are both documents that concern Iceland as a whole as well as documents focusing specifically on eastern Iceland. There do not appear to exist any local/regional climate change adaptation strategies for eastern Iceland; according to an interview with a climatologist, the situation is similar for other regions of Iceland. The documents we examined are thus produced for different purposes such as land use, transportation, civil protection and so on.

4.1 Local, regional and national climate change adaptation strategies

General action plan on climate issues

A *general action plan in climate issues for the period 2010-2020*[2] has been produced for Iceland (Umhverfisráðuneytið, 2010). In relation to eastern Iceland, it is noteworthy that there was an increase in greenhouse gas release by heavy industry by 140% 1990-2008. The big aluminium smelter plant in Reyðarfjörður in eastern Iceland, which began its operation in 2008, further added to this release. This type of release is part of tradeable greenhouse gas releases. But other release than heavy industry increased during the same period by 14%. “When looking at release other than heavy industry, it can be seen that it has increased by 14% from 1990 til 2008. If subtraction because of carbon sequestriation from the athmosphere with forestation and vegetation reclaim is taken into account in this context, net release would be almost unchanged in 2008 as it was in 1990” (Umhverfisráðuneytið, 2010)[3]. This applies to Iceland as a whole.

While on average around 80% of primary energy use in the world is based on fossil fuel burning this is the opposite in Iceland. Around 80% of primary energy use comes from renewable energy sources. This good position of Icelanders limits their possibilities to decrease release. While other European countries can achieve decrease of 40% with a mixture of actions in the fields of energy production, house heating and transportation, Icelanders have primarily the

[2] Icelandic: Aðgerðaáætlun í loftslagsmálum 2010-2020.

[3] Authors’ translation.

transportation and fisheries sectors to work with (Friðleifsson, 2017). In TGS such as eastern Iceland this may prove more difficult then in Iceland in general as there are more distances, more need for larger vehicles with capabilities to tackle demanding winter conditions and the fishing sector is a very large share of the local economy.

Eastern Iceland has the largest forest areas in Iceland and a potential for further increase as local conditions for forestry are good. The action plan however does not make any specific reference to eastern Iceland.

A new report with a general action plan on climate issues and how Iceland can fulfil its obligations according the Paris agreements on climate issues until 2030 was issued in the spring of 2018 (Björnsson et al., 2018).

Civil protection plan

According to a *civil protection plan*[4] prepared by the Civil protection agency (Ríkislögreglustjórinn, 2011) natural hazards include avalanches and landslides, sea floods, bad weather (storms). Climate change and possible changes in risk related to this are not referred to specifically in the plan. The terrain is often characterized by steep slopes and high mountains. Towns and villages are frequently located under steep mountains along the shoreline. In some cases, roads are located in steep slopes where there is a risk of rock fall. Some rivers in the region are prone to increase and flooding during heavy rainfall.

East Iceland is located outside the main volcanic active area in Iceland. However, during eruptions there can be heavy flood surges (jökulhlaups) in glacial river when volcanic subglacial eruptions occur, melting the ice (Baldursson et al., 2018). Furthermore, ash, pumice and toxic gases can reach the area and cause problems. This risk is probably most true for the most northerly part of the region. With regard to climate change, many of the biggest and most active volcanoes are buried under the glaciers and it is predicted that with warmer climate and glacial melt, eruptions in these sub-glacial volcanoes may become more frequent as the mass of the glaciers decreases. The municipalities in the region of East Iceland have stressed the need for an *action plan regarding risk of volcanic eruptions* (Vopnafjörður, 2018).

[4] Icelandic: Áhættuskoðun almannavarna.

National land use planning strategy

Iceland has a *National land use planning strategy for the period 2015-2026*[5] which in a few places makes reference to climate change. However, it does not make specific reference to eastern Iceland in that regard. Apart from the two topics mentioned below; *Planning in rural areas and settlement pattern and distribution of settlement,* there is a third topic concerning *the central highland and its specific issues*. The central highland is a special case since there is no settlement. However, it is important for tourism especially during the summer. In the case of research focusing on East Iceland, we considered that this was largely outside the region and thus not highly relevant in the context of this study.

In relation to *planning in rural areas,* the National land use planning strategy places importance on preparedness and states that the master plans of municipalities shall consider risks relating to nature and climate change (Skipulagsstofnun, 2018b). Those mentioned are avalanches, floods, eruptions, glacial bursts (jokulhlaups) and earthquakes, also forest fires and possible changes in river flow and flooding.

Regarding *settlement pattern and distribution of settlement,* the National planning strategy stresses that in the master plans of municipalities, ways shall be sought to reduce greenhouse gas release. Furthermore, impacts of climate change such as sea level rise, natural risks such as avalanches, landslides, glacial bursts (jökulhlaups) and earthquakes shall be taken into account in planning, in order to prevent accidents and damage to structures. Information from the Meteorological office shall be used in relation to decision making in planning (Skipulagsstofnun, 2018a).

Strategic regional development plan

The *Strategic regional development plan for Iceland 2014-2017*[6] made no reference to climate change and its implications for the development of the settlement in the country (Parliamentary Resolution on a Strategic Regional Plan for the years 2014–2017., n.d.). A new regional development plan has been proposed for the period 2017-2023 but has not yet been passed by the government or parliament. On the webpage of the Institute for Regional

[5] Icelandic: Landsskipulagsstefna 2015-2026.

[6] Icelandic: Stefnumótandi byggðaáætlun 2014-2017.

Development in Iceland, there is information on work on the new policy and its has been put forward as a proposal for a parliamentary resolution for the period 2018-2024 (Tillaga til þingsályktunar um stefnumótandi byggðaáætlun fyrir árin 2018–2024., n.d.). Among the many tasks of the policy is adaptation to the impacts of climate change. Also there will be several actions such as to increase the use of alternative energy sources in transportation and improved infrastructure such as charging stations for cars and electric connections for cruise ships and other ships while in harbour.

Regional growth plan

For each of Iceland's regions, there exist specific development or growth plans (Sóknaráætlun): one of these is the *Regional growth plan for East Iceland 2015-2019*[7]. These plans further determine how to carry out the regional development based on the different conditions or paths that individual regions may be following. The 2015-2019 plan for eastern Iceland has no specific reference to climate change and how that might pose specific risks or opportunities for the region (Samráðsvettvangur um gerð sóknaráætlunar, n.d.).

Transport policy

Iceland has ratified a *Ministerial resolution on embracing the new era for sustainable inland transport and mobility* (UNECE, 2017). This resolution addresses the challenges faced as a consequence of climate change in a general way and pays special attention to the promotion of sustainable transport. The present *Transportation policy of Iceland 2015-2018*[8] makes reference to climate change in stating that the negative impacts of transportation on climate shall be reduced. An important part of that is reduction of greenhouse gases by transportation with increased use of other types of energy, public transport and other modes of transportation. No specific reference is made to individual regions such as East Iceland in this regard.

Municipal master plans

To a different degree the municipalities appear to make reference to climate change in the *municipal master plans*. Three examples of how climate change is being dealt with in these plans are presented below.

[7] Icelandic: Sóknaráætlun Austurlands 2015-2019.

[8] Icelandic: Þingsályktun um fjögurra ára samgönguáætlun fyrir árin 2015–2018.

The master plan of *Fjarðabyggð municipality*, the largest in the region (Fjarðabyggð, 2008)makes reference to climate change in a few places, such as regarding flood risk in low lying areas along the shore and rivers. The majority of the population of around 5,000 lives in six fishing towns and parts of these towns are low lying along the shore. Additionally there is some agricultural settlement.

Fljótsdalshérað municipality is the second largest municipality and its master plan refers only once to climate change. This is reference made to the obligations Iceland has made regarding international reductions of greenhouse gases (Fljótsdalshérað, 2009).

Breiðdalshreppur municipality is one of the smallest municipalities in the region with around 180 inhabitants[9]. Its master plan makes a few references to climate change from different perspectives[10]. An example is that an estimate of risk areas shall be carried out to prevent damage by sea floods, avalanches and landslides. Furthermore, reference is made to the national planning strategy and its guidelines concerning climate change. This appears to be related to the planning office that carried out the planning work and the standards of practice it sets (Breiðdalshreppur, 2018).

Tourism has during the past few years become one of the main pillars of the Icelandic economy. The majority of tourists however visit the capital area and regions within easy reach. Eastern Iceland is however the region furthest away from the capital region. Keflavík airport is 45 min drive from Reykjavík and 98% of tourists to the country arrive there. The other main entry point in the country is with a ferry that arrives at Seyðisfjörður in eastern Iceland. In 2015, a Road map for tourism in Iceland was published (Ministry of industry and innovation, 2015). This policy document for the development of tourism, focusing on the period 2015-2020 does not make a single reference to climate change and greenhouse gas emissions.

[9] Breiðdalshreppur has in a general voting 24 March 2018 agreed to merge with Fjarðabyggð municipality.

[10] http://www.breiddalur.is/images/stjornsysla/skipulagsmal/A%C3%B0alskipulag%20Brei%C3%B0dalshrepps%202018-2030,%20Greinarger%C3%B0%20-%20forkynning.pdf

4.2 Local and regional strategies and linkages to higher levels

There do neither appear to exist coherent plans in eastern Iceland in the field of climate change nor how to prepare for it. As we can see from above, diverse plans and policies make reference to natural risks of different kinds. However this is seldom related to climate change and how that might change the frequency of different types of events or risks.

It is interesting to see that the present policy relating to regional development made no reference to climate change, as this may both contribute to opportunities as well as risks for the region and have economic implications. However, a proposal for a new policy 2018-2024 does make reference to this. Examples of such are changes in migration of fish species (e.g. herring and mackerel) due to a warmer sea. According to an interview with a marine biologist, eastern Iceland is the region which will experience most change in this regard. There are few ocean areas more interesting in this regard than the ocean off eastern Iceland, and the changes in this area can become dramatic. Due to warmer sea temperatures, cod has moved closer to the shore and there is more mackerel and herring. According to the interviewee, eastern Iceland is gaining much from this development. However, due to a transferable fishing quota system fishing, companies in eastern Iceland (and other regions) often need quotas for the right species if a certain species begins to be caught in large quantities in a new location due to different migration patterns. According to the interviewee, changes in eastern Iceland were observed as far back as 1870s, so this may also be a part of a larger cycle. The largest fishing companies in Iceland have at least part of their operation in eastern Iceland, and this is where the largest share of pelagic fish is landed. The companies therefore adapt to the changes and organize their operations e.g. according to different migration patterns of the fish stock. Adaptation is according to the interview more obvious in their operation than in public policy.

There are observed changes in agriculture and forestry, both good and bad; some tree species, such as Siberan larch, are already in trouble due to climate change, especially warm spells during the winter. According to an interview with the manager of the Icelandic forest service, there is an increase of pests in Icelandic birch and other species due to warmer climate and 1-3 types of insects and diseases causing this appear each decade. Some tree species however can grow better in Iceland and new ones are being introduced. Forest cultivation

has been one way to create jobs and income for farmers in the region, as traditional sheep and cow farming has been decreasing. According to the same interview, there is an action plan in forestry but this has not been published. However, information in this plan about the development of the different tree species exists and this is being used as a tool to e.g. choose which tree species will be cultivated in the next decades. According to the same specialist, there is a general lack of planning by the Icelandic government and its institutions and of measures taken in order to change consumer behaviour and environmental consciousness. Among the areas where our interviewee would like to see more active policy making is in reclaiming of targe wetland areas drained during the 20th century[11] and more steering of sheep grazing, diverting this from vulnerable and eroding highland areas to cultivated lowland areas with better vegetation conditions.

The master plans of municipalities in the eastern region generally do not make much reference to climate change. However, the Icelandic national land use planning strategy places relatively high importance on climate change. It states that in municipal planning ways shall be sought to reduce greenhouse gas emissions and to minimize risks related to climate change. We did not find any policy document on the municipal level dealing specifically with climate change in eastern Iceland and how the municipalities in the region should or could adapt to these changes.

As tourism has become one of the three main pillars of the national economy, it deserved a special consideration in this case study. Impacts on the tourism sector in some ways can be considered similar as on different economic sectors and members of society in general. This e.g. includes natural risks, risks and disturbances of weather/climate for transport and similar. Due to the economic importance of tourism, the long distance travelled to the country by air and the fact that most tourists in Iceland visit the country to see its nature, it is interesting that the main policy document, the *Road map for tourism in Iceland*[12] makes no reference to climate change and greenhouse gas emissions.

[11] This resulted in high CO^2 emissions from these areas and reclaiming wetland is considered among the most productive way to decrease CO^2 emission in Iceland.

[12] Icelandic: Vegvísir í ferðaþjónustu.

Regarding the question what could be the most effective governance structures or mechanisms for addressing specific challenges (risks, vulnerabilities etc.) and opportunities in TGS such as eastern Iceland this is not easily answered. As Iceland only has two government levels, i.e. the state and the municipalities, a mechanism dealing with the regional level does not seem to be effective. However, as the tasks or problems may be different from one sector to the other, one might consider if the governance mechanism should address specific sectors or be partly multi-sectoral similar to the ministy division. For the government established in 2017 the division is the following (*Govermnent offices of Iceland*, n.d.):

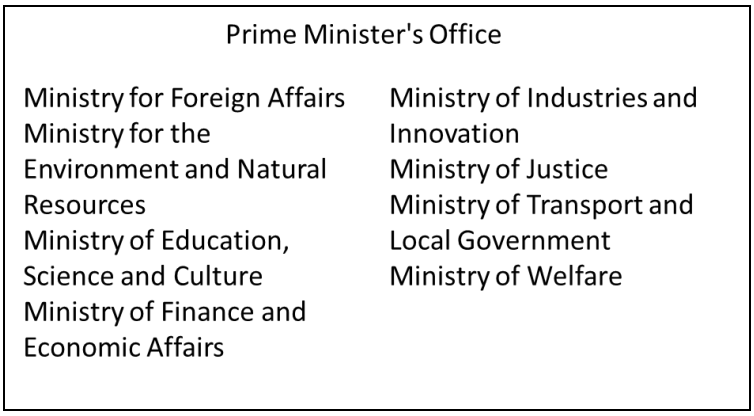

Figure 7. The division of the Icelandic government into ministeries.

Looking at the figure above it is apparent that climate change adaptation strategies may be more relevant as a central task to some ministries than other. The Ministry for the Environment and Natural Resources is responsible for planning issues and the National land use planning strategy might be a venue to address climate change adaptation across multiple sectors but in a more general way than policy documents for individual sectors.

The Icelandic government announced September 10th 2018 a new Climate Strategy, intended to boost efforts in cutting net emissions. These measures shall help Iceland meet its Paris Agreement targets for 2030 and to reach the government‘s ambitious aim to make Iceland carbon neutral before 2040. The strategy consists of 34 government measures. These include an increase in reforestation, a ban on new registration of fossil fuel cars by 2030 and transformation of the transportation system from using imported fossil fuels to renewable energy. The plan will be subject to public consultation. Actions include measures such as: launching of a new fund to support low-carbon

technology; phasing out for landfilling organic waste; phasing out climate-warming chemicals and participation in emissions-trading for industry, aviation and other sectors; public education campaigns, and more (Government offices of Iceland, 2018).

4.3 Stakeholders' view on climate change strategies

We interviewed experts and stakeholders who could provide further insight into climate change, how it will impact eastern Iceland and how the region is preparing for possible changes. Since there are not many strategies in the field of climate change adaptation we chose to interview persons with general knowledge in this field. One of them is a climatologist from the Icelandic Met Office who has a good overview of the policies in the field. Another one is the director for the Icelandic Forest Service and has a good overview of both that field and on state of vegetation in general. The third is a university professor and marine biologist who has good knowledge about the conditions in the ocean off eastern Iceland and the development of the fisheries sector. These interviewees were all concerned over the lack of policy making by the Icelandic authorities and that there was a lack of foresight and planning. Generally, the few Icelandic policy documents that exist in this field derive from international agreements that Iceland was a part such as recently the Paris agreement of and in fact from pressure from outside. An important part of this is that Iceland is a member of the European Economic Area (EEA) and thus is obliged to adopt the majority of EU regulations. However, we did not analyse these transnational policy documents but according to the meteorologist we interviewed, some of those regulations do not apply particularly well to the Icelandic context. Furthermore, too much of the regulatory framework about restriction of greenhouse gas emissions in order to slow down climate change has evolved in the direction of trading and even speculation. A couple of examples of this in the Icelandic context were also mentioned i.e. a special fund about carbon sequestration "Kolviður"[13] and another fund on the reclaiming of wetlands, "Votlendissjóður"[14] in order to decrease CO^2 emissions from previous wetland areas which have been drained by digging trenches; these areas are among

[13] http://kolvidur.is/

[14] https://www.land.is/2017/03/23/auglyst-eftir-umsoknum-um-styrki-til-endurheimtar-votlendis-2/

the largest contributors of CO^2 in Iceland. According to the same interview, it is also apparent that benefits and opportunities resulting from climate change are rather publicized by politicians than the risks involved.

5 Summary

Eastern Iceland has already experienced some changes as a result of climate change. However, some of this might be due to natural fluctuations. This is most noticeable in the fisheries sector as migrating species have been more abundant in Icelandic waters than before. Fishing companies have adopted their operations according to this. Climate changes are also clearly observed in the glaciers which are among popular tourist destinations. Policy documents prepared by either the government and its institutions or by municipalities, e.g. master plans very seldom refer to climate change and adaptation measures. The Climate strategy announced by the Icelandic government in September 2018 is however very ambitious and it appears that the issue of climate is becoming more of a central theme in policy making. Interesting is that a central policy document for the major economic sector of tourism does not refer to climate change, its consequences and adaptation measures. Interviewees were unanimous that there was a general lack of foresight and planning as regards policies in the field of climate change and social impacts. The majority of existing policies in the field were a result of international agreements Iceland has ratified, such as through its membership in the European Economic Area. Policy documents rarely refer to TGS such as eastern Iceland. Since Iceland only has two government levels, the state and the municipalities a mechanism dealing with the regional level does not seem to be effective. As the tasks or problems related to climate change may be different from one sector to the other, possibly the governance mechanism might deal with sectors or be partly multi-sectoral similar to the division into ministries in the country.

6 References

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6.1 Interviewees

Hreiðar Þór Valtýsson, Marine biologist, assistant professor (UNAK). Interview 22. March 2018.

Trausti Jónsson, Climatologist. Iceland Met Office. Interview 20. March 2018.

Þröstur Eysteinsson, Director. Icelandic forest service. Interview 20. March 2018.