Mapping Arctic Research in Iceland

ICELANDIC ARCTIC COOPERATION NETWORK

STEFANSSON ARCTIC INSTITUTE
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Editors: Egill Þór Níelsson and Þorsteinn Gunnarsson
Authors: Emil Ísleifur Sumarliðason, Santiago Villalobos and Sóley Ólafsdóttir

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Prologue

In these uncertain times of warming climate, the Arctic Region is becoming even more important for the global community. The ice cover of the Arctic, the temperatures and currents in the Arctic Ocean have a huge impact on the climate and weather in the lower latitudes. Iceland is an integrated part of the Arctic region where approximately 4 million inhabitants live. For those living in the Arctic, research on the region is a priority in order to understand the changes which are occurring and what they might expect in the future.

Mapping Arctic Research in Iceland was carried out in collaboration between the Icelandic Centre for Research, the Stefansson Arctic Institute and the Icelandic Arctic Cooperation Network. Through a Government supported Summer Work Scheme, three summer interns were hired to work on this project. The purpose of this project is to introduce the Arctic research environment in Iceland and make it more accessible for the international scientific community. As Iceland is preparing for co-hosting the third Arctic Science Ministerial Meeting (ASM3) and is holding the chairmanship of a new ASM initiative, Arctic Funders Forum, this overview could be of use for these kinds of missions.

The report first gives an overview of the main actors having a role in Icelandic policy and coordination on Arctic research and international cooperation. Next it presents a profile of the main performers of Arctic research in Iceland, namely universities, research institutes, agencies, companies and infrastructures. This is followed by an analysis of those domestic and international competitive funds which are supporting Arctic research. Finally, the report describes selected international Arctic research projects with Icelandic participation and platforms that serve Arctic issues which are often relevant to Arctic research. It is my hope that this report may function as a useful source for a younger generation of scientists who might be seeking new opportunities for research in the Arctic region.

This report would not have been possible without the contribution of many individuals and institutes. Sincerely, I would like to acknowledge the input of many people representing the universities and other research performers who are profiled in this report. In particular, I would like to thank our cooperating partners; Níels Einarsson at the Stefansson Arctic Institute, Embla Eir Oddsdóttir at the Icelandic Arctic Cooperation Network, Gunnar Már Gunnarsson in the Northern Research Forum at the University of Akureyri, as well as Ásgerður Kjartansdóttir and Lindsay Elizabeth Arthur at the Ministry of Education, Science and Culture.

Special thanks go to our summer interns Emil Ísleifur Sumarliðason, Santiago Villalobos and Sóley Ólafsdóttir, who compiled this report, and the editors Egill Þór Níelsson and Þorsteinn Gunnarsson.

Hallgrímur Jónasson,
General Director Rannís

Formáli

Á tímum örra loftslagsbreytinga eru norðurslóðir enn mikilvægari en áður fyrir alla heimsbyggðina. Íshella norðurskautsins, hitastig og sjávarstraumar í Norður-Íshafinu hafa mikil áhrif á bæði loftslag og veðurfar á suðlægari slóðum. Ísland tilheyrir norðurslóðum en á því landsvæði búa um 4 milljónir íbúa. Fyrir íbúa á norðurslóðum eru norðurslóðarannsóknir mikilvægt forgangsmál til að greina þær breytingar sem eiga sér stað og hvers vænta megi í framtíðinni. Að stunda norðurslóðarannsóknir er umfangsmikið verk sem mikilvægt er að framkvæma í öflugu alþjóðlegu samstarfi.

Kortlagning norðurslóðarannsókna á Íslandi var unnin í samstarfi á milli Rannsóknamiðstöðvar Íslands – Rannís, Stofnunar Vilhjálms Stefánssonar og Norðurslóðanets Íslands. Verkefnið var unnið með fulltingi styrks frá Vinnumálastofnun. Í tengslum við átak vegna sumarstarfa námsmanna voru þrír sumarstarfsmenn ráðnir til að vinna verkefnið, tveir hjá Stofnun Vilhjálms Stefánssonar og einn hjá Rannís. Tilgangur kortlagningarinnar er að kynna umhverfi og umfang norðurslóðarannsókna á Íslandi og stuðla með því að frekara alþjóðlegu rannsóknarsamstarfi á þessu sviði. Skýrslan er jafnframt hugsuð sem innlegg í undirbúning Íslands, sem meðstjórnanda, fyrir þriðja fund vísindaráðherra sem hafa með málefni norðurslóða að gera (ASM3) og formennsku Íslands í nýju framtaki ASM, Arctic Funders Forum.

Skýrslan gefur yfirlit yfir þá aðila sem þjóna lykilhlutverki í stefnumótun á sviði norðurslóðarannsókna og í alþjóðlegu samstarfi. Þar að auki kynnir hún helstu aðila sem stunda norðurslóðarannsóknir á Íslandi, þ.á m. háskóla, rannsóknastofnanir og fyrirtæki, auk þess sem fjallað er um rannsóknarinnviði. Enn fremur er birt greining á innlendum og alþjóðlegum samkeppnissjóðum sem styðja við norðurslóðarannsóknir. Að lokum er fjallað um valin alþjóðleg norðurslóðaverkefni með íslenskri þátttöku og ýmsa aðila sem þjóna norðurslóðarannsóknum. Það er mín ósk að þessi skýrsla nýtist sem upplýsingamiðill fyrir upprennandi rannsakendur sem hafa hug á að stunda rannsóknir á málefnum norðurslóða.

Þessi skýrsla hefði ekki orðið að veruleika ef ekki væri fyrir framlag fjölda aðila og stofnana. Ég vil þakka þeim fjölmörgu einstaklingum sem leitað var til um upplýsingar um einstaka háskóla og aðrar rannsóknastofnanir sem fjallað er um. Sérstakar þakkir fá samstarfsaðilar verkefnisins, Níels Einarsson hjá Stofnun Vilhjálms Stefánssonar, Embla Eir Oddsdóttir hjá Norðurslóðaneti Íslands, Gunnar Már Gunnarsson hjá Rannsóknaþingi norðursins í Háskólanum á Akureyri, auk Ásgerðar Kjartansdóttur og Lindsay Elizabeth Arthur hjá mennta- og menningamálaráðuneytinu.

Að lokum vil ég þakka starfsmönnum verkefnisins, þeim Emil Ísleifi Sumarliðasyni, Santiago Villalobos og Sóleyju Ólafsdóttur, ásamt ritstjórum skýrslunnar, Agli Þór Níelssyni og Þorsteini Gunnarssyni.

Hallgrímur Jónasson,
Forstöðumaður Rannís

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Executive Summary

The scope of Arctic research in Iceland has been increasing during the past decade and the amount of grants allocated to Arctic research projects has risen. This report contains an overview of governance of Arctic policy in Iceland and a profile of Arctic research performers, such as universities, institutes, companies and infrastructure. An analysis of both domestic and international funds supporting Arctic research is the main content of the report. Both domestic and international funds were examined, however the main focus was on the Icelandic Research Fund and EU Horizon 2020. Selected Arctic research projects with Icelandic participation and international platforms that serve Arctic-related issues are described.

DOMESTIC FUNDS

- Total amount granted to Arctic research from all national funds in the years 2009-2019 was 1,493,200,788 ISK.
- The Icelandic Research Fund was by far the biggest domestic fund, contributing 1,180,897,000 ISK, which is 79.1% of all Arctic research grants.
- The financial contribution to Arctic research from the Icelandic Research Fund was 6.93% of its total allocations.
- Arctic research projects within the University of Iceland received 70.1% of the total allocation to Arctic research from the Icelandic Research Fund.
- A significant majority, or 94.3% of Arctic research projects funded by the Icelandic Research Fund, were in the field of science and technology - 71.9% being in natural and environmental science and 22.3% in engineering, technical sciences and sciences. Only 5.7% were allocated to humanities and social sciences.

INTERNATIONAL FUNDS

- In this report the focus on international funding is the EU Horizon 2020 programme. The total sum granted by Horizon 2020 to Icelandic participants for Arctic research was €7,322,932 (992,914,422 ISK) out of a total of €120,398,311 during the period 2014-2020.
- The percentage of funding to Arctic research projects out of the total funding from Horizon 2020 to Icelandic participants was 6.08%.
- The distribution of total Arctic research funding to Icelandic participants from Horizon 2020 is more evenly distributed between companies and institutes, compared to the national competitive funds. ICEWIND and the Stefansson Arctic Institute have each received over 20% of the grant allocation to Arctic research from the Horizon 2020 programme.
- The participants with most participation instances in Horizon 2020 Arctic projects are Arctic Portal (six instances), the Agricultural University of Iceland (four instances) and the University of Iceland (three instances).
- The biggest Horizon 2020 Arctic projects with Icelandic participants are the NJORD, JUSTNORTH and INTERACT projects, which received over 10% of the funding.
- For FP7 the total allocation to Icelandic participants, for Arctic research projects was €2,038,363 (328,244,676 ISK) out of a total of €67,591,003, which resulted in 3.02%. For FP6 there were no Arctic research projects funded. These results showcase an increased activity in Icelandic participation in Arctic research projects funded by the EU Framework Programme on research and innovation. Combined, FP7 and Horizon 2020 have granted €9,361,295 (1,321,159,098 ISK) to Arctic research in Iceland.

KEY TAKEAWAYS

- The total amount of funding for Arctic research projects during the last decade from the domestic funds (2009-2019), and the past two EU Framework Programmes on research and innovation (2009-2020), amounts to 2,814,359,886 ISK.
- When comparing the largest sources of Arctic research funding, the EU Framework Programme has contributed the highest amount for Arctic research projects in Iceland. The average annual allocation of the largest domestic source of funding for Arctic research projects, the Icelandic Research Fund in the years 2009-2019, was 118,089,700 ISK, while the yearly average allocation from the international EU Framework Programmes on research and innovation (FP7 and Horizon 2020) in the years 2009-2020 was 120,105,373 ISK.
- When comparing the Icelandic Research Fund and Horizon 2020, the proportion allotted to Arctic research projects has been at a similar level for the two most significant funding schemes, 7% for the Icelandic Research Fund and 6% for Horizon 2020. The funding pattern of the Horizon 2020 is however more diverse than the Icelandic Research Fund. Together these two main funding schemes create a wide-range research platform for Icelandic research entities with both consistent and various partners.
- Grants from domestic funds to Arctic research are mostly distributed to universities and institutes located in and near the capital area, in contrast to grants from international funds that are mainly extended to institutes in the northern part of Iceland, such as Akureyri municipality.
- Access to strong competitive research funds is highly important and necessary for Arctic scientists but it is not sufficient. For Arctic research seeking knowledge on rapid natural and societal changes comprehensive and consistent monitoring and observing is also needed to create a time-series of events and observations. Research institutes and their infrastructure have an essential role in observation and monitoring and they cannot rely on short-term research funding for this kind of long-term mission. A targeted policy addressing this challenge is needed.

Samantekt

Norðurslóðarannsóknir hafa aukist talsvert á Íslandi undanfarinn áratug og hefur rannsóknastyrkjum til norðurslóðaverkefna einnig fjölgað. Í skýrslunni er að finna yfirlit um norðurslóðastefnu íslenskra stjórnvalda og lýsingu á íslenskum aðilum sem stunda norðurslóðarannsóknir, en þeirra á meðal eru háskólar, stofnanir, fyrirtæki og fleiri. Meginefni skýrslunnar er greining sem gerð var á innlendum og erlendum sjóðum sem hafa veitt styrki til íslenskra aðila til norðurslóðarannsókna. Megináhersla er lögð á að greina styrki Rannsóknasjóðs sem úthlutað hefur verið til norðurslóðarannsókna, svo og styrki sem hafa fengist til málaflokksins úr rannsóknaáætlunum Evrópusambandsins, einkum Horizon 2020. Þá er gerð grein fyrirvöldum rannsóknaverkefnum með íslenskum þátttakendum auk alþjóðlegra vettvanga sem þjóna málefnum norðurslóða.
Meginniðurstöður skýrslunnar eru eftirfarandi:

INNLENDIR SJÓÐIR

- Heildarfjármagn veitt til norðurslóðarannsókna úr öllum innlendum sjóðum árin 2009-2019 var 1.493.200.788 krónur.
- Rannsóknasjóður er stærstur innlendra sjóða og veitti samtals 1.180.897.000 krónum til norðurslóðarannsókna, sem er 79,1% af öllu fjármagni veitt til málaflokksins.
- Úthlutað fjármagn til norðurslóðarannsókna úr Rannsóknarsjóði á umræddu tímabili nam 6,93% af heildarúthlutun sjóðsins.
- Háskóli Íslands fékk í sinn hlut 70,1% fjármagnsins sem veitt var til norðurslóðarannsókna úr Rannsóknarsjóði á tímabilinu.
- Afgerandi meirihluti, eða 94,3% af verkefnum á sviði norðurslóðarannsókna sem styrkt voru úr Rannsóknarsjóði voru á raunvísindasviði. Þar af voru 71,9% á sviði náttúru- og umhverfisvísinda og 22,3% á sviði verkfræði og tækni. Einungis 5,7% var úthlutað til verkefna á sviði hug- og félagsvísinda.

ALÞJÓÐLEGAR SAMSTARFSÁÆTLANIR

- Áhersla var lögð á að skoða Horizon 2020, rannsókna- og nýsköpunaráætlun Evrópusambandsins. Íslenskir aðilar fengu alls 120.398.311 evrur úr Horizon 2020 á tímabilinu 2014-2020 og þar af var 7.322.932 evrum (992.914.422 krónum) veitt til íslenskra þátttakenda í norðurslóðarverkefnum.
- Hlutfall fjármagns til norðurslóðarannsókna var 6,08% af heildarfjármagni úr Horizon 2020 til íslenskra aðila á umræddu tímabili.
- Dreifing heildarfjármagns til íslenskra þátttakenda í norðurslóðarannsóknum sem styrktar voru af Horizon 2020 reyndist vera jafnari meðal stofnana og fyrirtækja samanborið við innlenda samkeppnissjóði. ICEWIND og Stofnun Vilhjálms Stefánssonar fengu rúmlega 20% fjármagns hvor í sinn hlut fyrir norðurslóðarannsóknir í Horizon 2020.
- Íslenskir þátttakendur sem hafa flest þátttökutilvik í norðurslóðarannsóknum í Horizon 2020 eru Norðurslóðagáttin (sex tilvik), Landbúnaðarháskóli Íslands (fjögur tilvik) og Háskóli Íslands (þrjú tilvik).
- Umfangsmestu norðurslóðaverkefnin innan Horizon 2020 með íslenskum þátttakendum eru NJORD, JUSTNORTH og INTERACT, sem öll fengu yfir 10% fjármagns verkefnanna í sinn hlut.
- Í sjöundu rannsóknaráætlun Evrópusambandsins 2007-2013 (FP7) var heildarúthlutun til íslenskra þátttakenda í norðurslóðarannsóknum 2.038.363 evrur (328.244.676 krónur) sem reyndist vera 3,02% af heildarfjármagni til íslenskra aðila úr áætluninni, sem var 67.591.003 evrur. Í sjöttu rannsóknaráætlun Evrópusambandsins (FP6) var ekkert norðurslóðaverkefni með íslenskri þátttöku fjármagnað. Þessar niðurstöður sýna að þátttaka íslenskra aðila í norðurslóðarannsóknum hefur aukist umtalsvert í síðustu samstarfsáætlunum Evrópusambandsins. Samanlagt heildarfjármagn til norðurslóðarannsókna á Íslandi úr FP7 og Horizon 2020 nam 9.361.295 evrur (1.321.159.098 krónur).

LYKILATRIÐI

- Samanlagt heildarfjármagn til norðurslóðaverkefna 2009-2019 úr innlendum sjóðum og rannsóknaráætlunum ESB (FP7 og Horizon 2020) var 2.814.359.886 krónur. ISK.
- Stærstur hluti styrkja til norðurslóðarannsókna á Íslandi hefur komið úr síðustu tveimur rannsóknaáætlunum ESB (FP7 og Horizon 2020). Meðalársúthlutun úr stærsta innlenda sjóðnum, Rannsóknarsjóði 2009-2019, var 118.089.700 krónur, samanborið við meðalársúthlutun úr FP7 og Horizon 2020 á árunum 2009-2020 sem var 120.105.373 krónur.
- Hlutfall veittra styrkja til norðurslóðarannsókna er sambærilegt fyrir tvo helstu sjóðina, 7% úr Rannsóknasjóði og 6% úr Horizon 2020. Þá er úthlutun fjármagns úr Horizon 2020 dreifðara samanborið við Rannsóknasjóð. Saman mynda þessir tveir sjóðir breiðan vettvang fyrir íslenskar rannsóknarstofnanir og fjölbreyttan hóp rannsakenda.
- Styrkir úr innlendum sjóðum fara að mestu leyti til háskóla og stofnana sem staðsett eru á höfuðborgarsvæðinu, á meðan stofnanir á landsbyggðinni, oft á Akureyri, fá fleiri styrki úr alþjóðlegum samstarfsáætlunum.
- Aðgengi að öflugum samkeppnissjóðum er bæði mikilvægt og nauðsynlegt fyrir vísindamenn á norðurslóðum en er ekki fullnægjandi. Markmiðið með norðurslóðarannsóknum er að leita þekkingar á örum samfélagslegum- og náttúrulegum breytingum, þannig er einnig þörf á stöðugu eftirliti, mælingum og athugunum svo hægt sé að skapa heildstæða og samfellda tímaröð athugana. Rannsóknastofnanir og innviðir þeirra gegna mikilvægu hlutverki í langtímavöktun og því geta þau ekki reitt sig einungis á fjárveitingar til skamms tíma. Þörf er á sértækri stefnu í þeim efnum.

Introduction and Methods

Arctic Research in Iceland

Arctic research in Iceland has grown significantly over the last decade and today takes place within various institutions in Iceland. Although a substantial part of research by Icelandic scientists deals directly with Arctic natural science phenomena, Icelandic social scientists have increasingly focused on Arctic communities. In recent years increased participation by Icelandic scientists in international Arctic research has been witnessed, such as through Horizon 2020.

Icelandic scientists are actively engaged in various disciplines of Arctic research including: Climate change, Glacier research, Hydrology, Marine science, Plant and animal ecology, International politics and law, Security, History and culture, Economic and social development, Gender equality, Health care issues and more. Arctic affairs have for the last decade been moving up on the political agenda in Iceland. Although there is considerable activity in Arctic research in Iceland, the Arctic research environment is fragmented. There is only one research institute wholly devoted to the Arctic in Iceland, the Stefansson Arctic Institute, which has focused primarily on social and human aspects of the Arctic. There is no strategic Arctic research programme in Iceland and an Arctic research policy, such as can be found in neighbouring countries, has not yet been developed. The objective of this report is to begin to map the institutional and funding landscape for Arctic research in Iceland in the hope that this overview will prove useful to scientists, policymakers and the general public interested in Arctic research.

In broad strokes, four major Arctic research efforts have currently been identified in Iceland:[1]

Glaciers and Climate. Extensive collaborative efforts take place involving the Icelandic Met Office, the University of Iceland, the National Power Company of Iceland and other agencies to understand the ongoing and future changes of the glaciers in Iceland. The programme involves regular monitoring of annual mass balance and changes of glacier terminus positions, mapping of glacier surfaces based on remote sensing from aircraft and satellites, as well as projecting future changes with physical models. Since1930, a large group of lay people, including local people, long-term volunteers and school groups, have been involved in the regular monitoring of the glaciers.[2] The ice cap Hofsjökull and the neighbouring central Icelandic highland is one of the sites in the international GCW/CryoNet surface station network for global cryosphere monitoring. As part of Iceland's chairmanship of the Arctic Council, Iceland has initiated a collaboration between international research institutes, universities and the Arctic Spatial Data Infrastructure (SDI) to study surface elevation changes of glaciers in the Arctic based on the ArcticDEM.

Responses to climate change. Research focuses on increased hazards due to climate change such as rock avalanches caused by retreating glaciers, changing periodicity of floods/droughts and impacts of sea level rise, but also the adaptation of a strategy needed for future infrastructure development in a changing climate. An official climate change scenario has been derived for Iceland through a series of national and international research projects and government initiatives. The scenario, which is updated regularly, is used to facilitate long-term planning and design of infrastructure such as harbours, hydro-electric power plants and flood control measures.

The Ocean around Iceland. The Marine and Freshwater Research Institute, in collaboration with national and international universities and research institutes, both monitors and researches the marine environment

1 Iceland Ocean Cluster. About Us. Retrieved 17.9.2020:
2 Spordamælingar. Jöklarannsóknarfélag Íslands. Retrieved 9.10.2020: https://jorfi.is/rannsoknir/spor%c3%b0am%c3%a6lingar/

and the marine ecosystem. This includes long-term monitoring of oceanographic conditions, primary and secondary production, and diversity and abundance of invertebrates, fish and marine mammals. Emphasis is on understanding how climate change impacts oceanographic condition and the marine biota.

Social Impacts of Climate Change. Awareness of the social impacts of climate and environmental changes has increased, and in the last decade related research and projects have gradually become more prominent. This is not least evident in the work of the Stefansson Arctic Institute, which collaborates with numerous research institutes, nationally and internationally, in projects addressing adaptation, resilience and the impact of climate change on Arctic societies. In addition, the University of Iceland has participated in social science and humanities research, including projects placing an emphasis on security concerns and Nordic and West-Nordic regional cooperation. The Coast Guard has participated in projects relating to emergency prevention, risk assessment and response. The University of Akureyri has focused on important themes such as health and well-being and law and governance in the region through its Polar Law Programme. Also noteworthy is the project on gender equality in the Arctic, which is led by the Icelandic Arctic Cooperation Network. Greater emphasis on and support for social science research and interdisciplinary approaches is required.[3]

Why do we need Arctic Research?

Due to a rapidly warming climate, the Arctic region is witnessing significant environmental and societal changes. These include increased melting of glaciers, sea ice and permafrost as well as sea level changes. This shift already affects the life of Arctic inhabitants and will continue to increasingly impact quality of life in the Arctic. The livelihoods of Arctic inhabitants are closely linked with environmental changes, not least in terms of the marine environment. Indigenous and other resource dependent communities are more exposed than others to these changes and therefore special consideration and effort is required to foster community empowerment. Furthermore, research on the impact of climate and environmental change on social, cultural and economic aspects, including consideration of rights and gender vulnerable populations, is urgently needed. The scale, dynamics and complexity of the emerging situation in the region requires concerted international scientific cooperation to effectively address these issues.

In Iceland, in particular, there is a need for research which provides a foundation to community adaption to climate change, especially with regard to the rapid changes occurring in the Arctic. In order to estimate the need for adaptive response, an accurate prediction of climate change is necessary, as is an impact assessment of changes to natural systems and in turn the impact on social systems, including quality of life for Arctic inhabitants. In addition, it is necessary to predict the potential for Arctic communities to cope with these adaptations. Scientific knowledge and understanding of the interaction of natural and social systems is essential for sustainable policy efforts in the future.

Mapping Arctic Research in Iceland

This report is the first attempt to map the landscape of Arctic research in Iceland with a focus on institutional aspects and domestic and international funding schemes. The goal is to measure the overall funding dedicated to Arctic research projects and how it is distributed between the available funding schemes (both domestic and international sources). The report examines the context of the Arctic research environment in Iceland, including its international dimension and is divided into five parts:

1) Firstly, the report first looks at national policy and coordination on Arctic research and international cooperation, highlighting the governance structure of Arctic research in Iceland.
2) Secondly, an overview is provided of the role of universities, research institutes, agencies, companies and infrastructure that makes it possible to carry out Arctic research in Iceland.
3) Thirdly, domestic and international funding mechanisms are presented with an analysis of the scope of Icelandic Arctic research.
4) Fourthly, platforms with a high relevance to Arctic research in Iceland are described.
5) Lastly, selected international Arctic research projects with Icelandic participation are highlighted.

3 Tome. Arctic Cooperation Network. Retrieved 15.10.2020: https://www.arcticiceland.is/en/

The aim of the report is to provide indicators of Arctic research activity in Iceland and the funding sources for the research projects. In order to achieve that goal, the available data of relevant funding mechanisms was obtained and categorized by the Arctic relevance of each funded project.

Methodology

Based on geographic location, one might say that most research taking place in Iceland is Arctic-related. However, this kind of understanding is not useful for the purpose of this study. Therefore, this report used the following working definition, originally developed within the Icelandic Joint Committee on Arctic Affairs, to assess the Arctic-relevance of research projects:

> *"Icelandic Arctic issues involve research, monitoring, education and public discourse that relate to both **distinctive and common** denominators of nature, culture, economy and history of the Arctic region i**n an international context.**"*[4]

This definition resonates with the International Arctic Science Committee´s (IASC) State of Arctic Research Reports[5] and is in accordance with the contributions from the Icelandic science community to the Arctic Science Ministerial (ASM3) meeting co-hosted by Iceland and Japan. For geographic defintion of the Arctic see the map below (Figure 1) which is a part of the Agreement on Enhancing International Arctic Scientific Cooperation.[6] The concept of Arctic research is elusive and is perhaps better illustrated in shades rather than categories.

Figure 1: Map of the Arctic region

Arctic research in Iceland is funded by various sources, the Icelandic Research Fund (IRF) and Horizon 2020 being the largest sources of funding. The report identifies 20 relevant funds supporting Arctic research, 11 domestic and nine international. These funds serve different objectives and clientele and range from large competitive funds and university funds to niche funds regarding climate, regional aspects and bilateral cooperation. The largest domestic fund, the IRF, is bottom-up driven without socio-economic targets. However, Horizon 2020, the largest international fund, is top-down driven with specific targets for socio-economic impacts. The smaller funds are of various categories, targeting research linked to specific sectors in society, e.g. energy and transport. The university funds are only open to faculties of the respective universities. Some of the international funds, such as Northern Periphery and NORA, also support activities other than research. What is common for these funds is that they all maintain a review process and that they have supported Arctic research.

The selected funds furthermore have different levels of information made publicly available. For the purpose of this study the report benefits from having a complete dataset of the national funds managed by Rannís and Horizon 2020, where a full list of Icelandic participants in projects can be extracted from the eCorda database. The two largest funding sources for Arctic research in Iceland, the IRF and Horizon 2020, are highlighted throughout the report in terms of participation of Icelandic entities in Arctic research.

4 Niels Einarsson. Heimsskautasvæðin í alþjóðlegri samræðu. 2011. Retrieved 19.11.2020. https://www.visir.is/g/20111142660d
5 The International Arctic Science Committee's IASC 2020 State of Arctic Report. Retrieved 12.10.2020: https://iasc.info/images/media/print/SAS2020_web.pdf
6 Arctic Region. United States Department of State. Retrieved 13.10.2020: https://www.state.gov/key-topics-office-of-ocean-and-polar-affairs/arctic/

When examining the funds, projects from each fund were reviewed and colour-coded on the scale of AR1 to AR5, ranging from:

AR1	Unquestionably Arctic Research
AR2	Likely Arctic Research-related
AR3	Possibly Arctic Research-related
AR4	Unlikely to be Arctic Research-related
AR5	Not Arctic Research-related

Figure 2: Counted and categorized research projects of domestic and international funds.

Count of participation instances of Icelandic entities / number of granted projects with participation of Icelandic entities (shown in brackets).

Funds	**AR1**	**AR2**	**AR3**	**AR4**	**AR5**	**Total**
Domestic	Instances (Projects)	Instances (Projects)	Instances (Projects)	Instances (Projects)	Instances (Projects)	Instances (Projects)
*Icelandic Research Fund (2009-2019)	128 (50)	189 (76)	86 (39)	112 (47)	1118 (476)	1633 (688)
*Technology and Development Fund (2009-2019)	4 (2)	49 (30)	320 (146)	85 (53)	647 (417)	1105 (648)
*Student Innovation Fund (2009-2019)	17 (6)	101 (20)	276 (36)	41 (12)	713 (126)	1148 (200)
*Strategic Research and Development Programme 2020-2023 (Societal challenges)[I]	N/A	N/A	N/A	N/A	N/A	N/A
*Arctic Research and Studies[II] (2012-2020)	202	0	0	0	0	202 (202)
*Climate Fund[III]	N/A	N/A	N/A	N/A	N/A	N/A
University of Akureyri's Research Fund (2009-2019)	23	9	3	0	0	35 (35)
University of Iceland's Doctoral Fund (2009-2019)	7	8	1	1	0	17 (17)
University of Iceland's Research Fund (2009-2019)	85	72	41	2	2	202 (202)
The Icelandic Road and Coastal Administration's Research Fund (2009-2019)	19 (15)	59 (35)	31 (23)	5 (3)	801 (556)	915 (632)
Landsvirkjun Energy Research Fund	20 (16)	29 (27)	23 (20)	3 (3)	0	75 (66)
Total domestic	**505 (406)**	**516 (277)**	**781 (318)**	**249 (121)**	**3281 (1577)**	**5332 (2699)**
International	**AR1**	**AR2**	**AR3**	**AR4**	**AR5**	**Total**
*Horizon 2020 (2014-2020)	31 (18)	15 (8)	57 (26)	64 (49)	175 (152)	342 (253)
*FP6	0 (0)	0 (0)	19 (15)	21 (14)	97 (75)	137 (104)
*FP7	8 (8)	7 (3)	54 (35)	12 (9)	200 (169)	281 (224)
*Horizon Europe[IV] (2021-2027)	N/A	N/A	N/A	N/A	N/A	N/A
*Erasmus+	1	1	7	4	692	705 (705)
Northern Periphery and Arctic Programme[V]	101 (85)	0	0	0	0	101 (85)
*EEA Grants	N/A	N/A	N/A	N/A	N/A	N/A
NORA	82 (48)	150 (88)	16 (11)	4 (3)	N/A	252(150)
*NordForsk[VI]	7 (3)	N/A	N/A	N/A	N/A	7 (3)
*Nordregio[VII]	42 (33)	N/A	N/A	N/A	N/A	42 (33)
*Nordplus	N/A	N/A	N/A	N/A	N/A	N/A
The Greenland Fund[VIII]	N/A	N/A	N/A	N/A	N/A	N/A
Total international	**272 (196)**	**173 (100)**	**153 (94)**	**105 (79)**	**1164 (1025)**	**1867 (1557)**
Total domestic and international	**777 (602)**	**689 (377)**	**934 (412)**	**354 (200)**	**4445 (2665)**	**7199 (4256)**

** Fund serviced by Rannís*
I Grants have not been allocated from the programme
II Bilateral fund jointly funded by the Icelandic and Norwegian Ministries for Foreign Affairs, administered by the Icelandic Centre for Research (Rannís) in cooperation with the Norwegian Agency for International Cooperation and Quality Enhancement in Higher Education (Diku)
III The Climate Fund was established in 2019 and had its first allocation of grants in 2020
IV Horizon Europe has not started
V All projects funded by the programme are required to have Arctic relevance
VI Database with a full overview of funding from NordForsk is not available
VII Administrator of the Nordic Council of Ministers' Arctic Cooperation Programme
VIII Allocations not relevant to Arctic research

A total of 4256 projects with 7199 participation instances were reviewed by the report authors in the above-mentioned funding schemes. In the case of the two largest Arctic research funding schemes with the most complete datasets available, the Icelandic Research Fund and Horizon 2020, the following three phases of evaluation were employed. In the first round, the projects were assessed by three summer interns and the project supervisor. The second review process was conducted by three expert reviewers on behalf of Rannís, the Stefansson Arctic Institute (in collaboration with the Northern Research Forum) and the Icelandic Arctic Cooperation Network. A final round of reviews was conducted jointly by all seven parties where a final assessment of each project was drawn up. For the university funds expert opinions were sought from the respective universities.

For compilation of information concerning Arctic research in Iceland, an inquiry on research activities was sent to institutes and universities performing Arctic research.

The allocated sums for all grants, both domestic and international, presented in this report are at current value (at the time they were granted). When analysing amounts granted to Icelandic entities from international funds, e.g. Horizon 2020 etc., then the amount in foreign currencies (such as EUR) was converted to Icelandic krona (ISK) in accordance with the currency transfer rate the day the project contract was established. This mapping project is to be viewed as an attempt to provide indications of the landscape of Arctic research in Iceland. Yet, there are several limitations to this study that are important to keep in mind:

- The availability of data on funding schemes is neither exhaustive nor standardized. As one example, no attempt is made to assess the extent of block funding from the government that might go to individual research performers.
- The definition of Arctic research is not always clear-cut and is perhaps better illustrated in shades than categories.
- The funds under review are of various types and some are more focused on education and regional development than research per se.
- The funds not serviced by Rannís were pre-screened when in search for Arctic projects, prior to the categorization of Arctic relevance, therefore the total number of projects and participation instances reviewed in this report are not exhaustive.
- In some cases, the grant amounts are only available for the total project (which can include an Icelandic participant with one or more partners) and therefore the exact amount received by the Icelandic research performers for their project involvement is not available. Projects in such programmes (including the Northern Periphery and Arctic Programme, NordForsk, Nordregio and Arctic Research and Studies) are not included in the statistics of the total amount granted to Icelandic entities.
- The grant amounts presented in the report are in current prices at the time of being awarded. Evidently the currency rate between ISK and foreign currencies fluctuates over the period examined.
- The focus in the report is heavily tilted towards funding of Arctic research, yet there are other means to examine Arctic research through bibliographic metrics and qualitative methods.
- This report is not exhaustive, neither regarding Arctic research, nor studies and innovation.

Icelandic Policy and Coordination on Arctic Research and International Cooperation

Governance

This section will describe the main role of the branches of government which are responsible for policy and coordination in Arctic affairs and research. This includes Parliament and several ministries and their participation in international cooperation in this field. Also, the role of selected agencies with coordinating functions in close cooperation with the respective ministries will be outlined.

Parliament

Legislative power is vested in both the government and the parliament, Alþingi. In 1997 Alþingi adopted Act No. 81 establishing the Stefansson Arctic Institute, which is the only research institute in Iceland with a mandate to conduct Arctic research.

Conference of Parliamentarians of the Arctic Region

The Conference of Parliamentarians of the Arctic Region is a biennial conference for parliamentarians representing eight Arctic countries and the European Parliament. The Standing Committee of the Parliamentarians of the Arctic Region (SCPAR) was established in 1994 by the decision of the International Conference of Parliamentarians of the Nordic Council for Development and Protection of the Arctic Region held in 1993 in Reykjavík, Iceland. The committee is a working body of the Conference of Parliamentarians of the Arctic Region. Membership of the Standing Committee corresponds to the membership of states in the Arctic Council. Members of the Committee are Denmark, Iceland, Canada, Norway, Russia, the US, Finland, Sweden, and the European Parliament. Observer status in the Standing Committee and in the Conference of Parliamentarians of the Arctic Region is given to the Saami Council, the Inuit Circumpolar Conference, and the Russian Association of Indigenous Peoples of the North. The Standing Committee itself has observer status in the Arctic Council and as a guest takes part in meetings of the Euro-Arctic Region Council.[7]

A Parliamentary Resolution on Iceland's Arctic Policy (2011)

Iceland's policy in Arctic issues is anchored in a parliamentary resolution adopted unanimously by Alþingi in the spring of 2011 which outlines 12 priority areas: 1) Promoting and strengthening the Arctic Council; 2) securing Iceland as a coastal State within the Arctic region; 3) promoting understanding of the Arctic region as an extensive area when it comes to ecological, economic, political and security matters; 4) using UNCLOS for dispute resolution; 5) strengthening and increasing cooperation with the Faroe Islands and Greenland; 6) supporting the right of Indigenous Peoples in the Arctic; 7) building on agreements and promoting cooperation; 8) preventing human-induced climate change; 9) safeguarding broadly-defined security interests in States in the Arctic region; 10) developing further trade relations between States in the Arctic; 11) advancing Icelanders' knowledge of Arctic issues and promoting Iceland abroad; and 12) increasing consultations and cooperation at the domestic level.[8] Currently a Parliamentary Committee is working on reviewing Iceland's policy in the Arctic.

7 Conference of Arctic Parliamentarians (CPAR)-About. Retrieved 15.9.2020: http://www.arcticparl.org/about.aspx
8 A Parliamentary Resolution on Iceland's Arctic Policy. Approved by the Althingi at the 139th legislative session March 28, 2011. Retrieved 13.10.2020: https://www.government.is/media/utanrikisraduneyti-media/media/nordurlandaskrifstofa/A-Parliamentary-Resolution-on-ICE-Arctic-Policy-approved-by-Althingi.pdf

The Role of the Ministries

Executive power is exercised by the government, which is divided into several ministries. Some of them participate in the interministerial Science and Technology Policy Council (STPC), chaired by the Prime Minister. Beyond STPC, there are at least three ministries having an important role in relation to Arctic research and coordination, i.e. the Ministry of Education, Science and Culture, the Ministry for Foreign Affairs and the Ministry for the Environment and Natural Resources.

Science and Technology Policy Council

The Science and Technology Policy Council (STPC) is responsible for setting public policy in matters of science and technology in Iceland. Its role is to support scientific research, science education and technological development in Iceland to strengthen the foundations of Icelandic culture and increase the competitiveness of the economy. The Council is chaired by the Prime Minister and its members include the Minister of Finance and Economic Affairs, the Minister of Education, Science and Culture, the Minister of Tourism, Industry and Innovation, as well as 16 representatives nominated by different ministries and higher education institutions and by the social partners. In addition, the chair may appoint up to four other ministers to the Council. The Council sets the official science and technology policy for a three-year period. The Council's deliberations in each of the two fields are prepared by its working committees, the Science Board and the Technology Board. The Science and Technology Policy Council is convened 2-3 times a year, and in general terms, the Council prepares and sets the agenda for the Strategic Research and Development Programmes.[9]

The Science and Technology Policy 2020-2022

A new policy on Science and technology policy was signed early September 2020 and the measures aim to increase the contribution to a competitive fund in science and innovation in the coming years through a temporary three-year effort. The funds will increase 50% in the year 2021 compared to the budget for the year 2020. Other measures include improving the quality of university work and university funding, increasing access to public data, strengthening the dissemination of science and strengthening skills in the labour market so that people are better equipped to cope with rapid technological changes. The policy also emphasizes the importance of science and innovation in tackling societal challenges such as climate change, health and well-being and the fourth industrial revolution. Although Arctic research is not mentioned in this context, these topics might have a strong Arctic relevance.[10]

Ministry of Education, Science and Culture

The main areas of responsibility of the Ministry of Education, Science and Culture are education, science, culture, media, sports and youth. The Ministry is responsible for the implementation of legislation pertaining to all school levels from pre-primary and compulsory education through the upper secondary and higher education levels, as well as continuing and adult education.

The Ministry grants accreditation to higher education institutions that fulfil the criteria laid down in national legislation as well as international accepted criteria. Science is the responsibility of the Ministry of Education, Science and Culture, in particular basic research, as is public support or scientific activities and international scientific cooperation.[11]

The Arctic Science Ministerial

The Arctic Science Ministerial (ASM) was developed to shape the course of future international Arctic science research. The first Ministerial was hosted by the United States in 2016 and held in Washington, DC. The second Ministerial was co-hosted by the European Commission, Finland and Germany in 2018 and held in Berlin. Japan and Iceland offered to co-host the Third Arctic Science Ministerial (ASM3) in Tokyo, which will be the first Ministerial meeting regarding Arctic issues held in Asia.

9 Government of Iceland. Science and Technology Council. Retrieved 7.9.2020: https://www.government.is/default.aspx?pageid=fd3aa1f5-c399-11e7-9420-005056bc530c
10 Stjórnarráð Íslands. Forsætisráðuneytið. Visinda- og tæknistefna 2020-2022. Retrieved 17.9.2020: https://www.stjornarradid.is/library/03-Verkefni/Visindi/Visinda-%20og%20tæknistefna%202020-2022.pdf
11 Government of Iceland. Areas of responsibilities. Retrieved 19.9.2020: https://www.government.is/ministries/ministry-of-education-science-and-culture/areas-of-responsibility/

The ASM3 aims to use the well-established foundation of the Ministerial as a means to act on coordinated Arctic observations and research in an open and transparent format which includes all Arctic stakeholders. The involvement of states, Indigenous participants, and international organisations for Arctic research shows a broad recognition at government level of the urgent response and action needed.

The main tasks of the ASM3 is the development of education and capacity building for future generations, with an emphasis both on scientific and local knowledge in Arctic and non-Arctic states. On Iceland´s behalf, organisation of the ASM3 is the responsibility of the Ministry of Education, Science and Culture. The Ministry has participated on behalf of the country in ASM events from its foundation.

Arctic Funders Forum

The organisers of ASM2 established a working group to explore the possibility of setting up a Forum of Arctic Science Funders, which could further strengthen cooperation between national and transnational science funding programmes. The recommendations of this working group will be brought to the attention of the participants in the ASM3. Currently, this working group is chaired by Iceland.

Arctic Scientific Cooperation Agreement

In May 2017, the eight Arctic States signed the Agreement on Enhancing International Arctic Scientific Cooperation during the 10th Arctic Council Ministerial in Fairbanks, Alaska. This is the third legally binding agreement negotiated under the auspices of the Arctic Council. The agreement facilitates access by scientists of the eight Arctic states to Arctic areas that each state has identified, including entry and exit of persons, equipment, and materials; access to research infrastructure and facilities; and access to research areas. The agreement also calls for the parties to promote education and training of scientists working on Arctic matters. National points of contact for the Arctic Science Cooperation Agreement are the Ministry of Education, Science and Culture and the Icelandic Centre for Research.[12/13]

The Icelandic Centre for Research

The Icelandic Centre for Research (Rannís) supports research, innovation, education and culture in Iceland. Rannís cooperates closely with the Icelandic Science and Technology Policy Council and provides professional assistance in the preparation and implementation of the national science and technology policy. Rannís administers the national competitive funds in the fields of research, innovation, education and culture, as well as strategic national research programmes. With Arctic research in mind, the most appropriate funds are listed below. European funding programmes, such as Horizon 2020, are however listed separately within the international section. Those programmes are serviced and promoted by Rannís. Rannís monitors resources and performance in R&D and promotes public awareness of research and innovation, education and culture in Iceland.[14]

The Science and Technology Policy Council (STPC) is the main body responsible for developing and adopting the general policy on science, technological development and innovation. The STPC is chaired by the Prime Minister while the council´s secretariat is located at Rannís.

Domestic funds administered by Rannís are: The Icelandic Research Fund; The Student Innovation Fund; The Technology Development Fund; The Climate Fund; Strategic Research and Development Programme (2020-2023) Societal Challenges; and Arctic Research and Studies, which is jointly funded by the Ministries for Foreign Affairs of Iceland and Norway.

International research, innovation and education programmes managed by Rannís include the EU Research Framework Programme, Erasmus+, EEA grants, NordForsk, Nordplus and the Belmont Forum.

Rannís represents the Icelandic science community in various international Arctic Science platforms and bilateral cooperation with other countries. Since 2017, Rannís has hosted the Secretariat of the International Arctic Science Committee (IASC) in Akureyri.[15]

12 Arctic Science Agreement - International Arctic Science Agreement. Retrieved 16.9.2020: https://iasc.info/ASA
13 Agreement on Enhancing International Arctic Science Cooperation. Retrieved 17.9.2020: https://www.rannis.is/media/arctic-studies/Arctic-Science-Agreement-.pdf
14 About Rannis. Activities. The Icelandic Centre for Research. Retrieved 17.9.2020: https://en.rannis.is/activities/
15 Rannís hosts the IASC Secretariat in Akureyri until 2026. News. The Icelandic Centre for Research. Retrieved 13.10.2020: https://en.rannis.is/news/rannis-hosts-the-iasc-secretariat-in-akureyri-until-2026

Rannís was granted a total of €101,250,00 (16,420,725,00 ISK) from Horizon 2020 for participation in the Arctic-related project EU-PolarNet2.

International Arctic Science Committee

The International Arctic Science Committee (IASC) is a non-governmental organisation made up of international scientific groups involved in Arctic research. IASC's main goals are to initiate, develop and coordinate impactful scientific activities in the Arctic and the role of the Arctic in the Earth's social-ecological system. IASC activities will support both basic and applied research that answers societal-relevant questions relating to the Arctic. The IASC strategy is built on three central pillars: 1) Facilitating Arctic research cooperation in the interdisciplinary areas and optimizing the data and information management and sharing; 2) Promoting the engagement by developing opportunities with the Association of Polar Early Career Scientists (APECS) and UArctic, supporting the participation of Indigenous Peoples and locals in different Arctic matters, and nurturing and expanding IASC partnerships; 3) Ensuring knowledge exchange through the promotion of high-quality scientific input and the increment of scientific education, outreach and communication.[16]

The IASC is an Arctic Council Observer and advises other associations on scientific issues affecting the Arctic. The geographical scope of the IASC covers the Arctic Ocean and the surrounding landmass and can also include sub-Arctic areas.[17]

The IASC convenes five international scientific working groups (WGs), each working in interdisciplinary research areas. The Icelandic representatives in IASC working groups are from the following institutions: the University of Iceland in Cryosphere WG, the Icelandic Met Office in Atmosphere WG, the Marine and Freshwater Research Institute in Marine WG and Terrestrial WG and the University Centre of the Westfjords/Stefansson Arctic Institute in the Social Human WG.[18] The IASC Working Groups are open to proposals from the Arctic science community to fund small activities (up to 15,000 EUR) which help bring together international and/or interdisciplinary Arctic science teams.

Ministry for Foreign Affairs

The Ministry for Foreign Affairs safeguards the interests of Icelandic citizens, companies and consumers by facilitating access to international markets and strengthening free trade. The Ministry supports Icelandic firms abroad and promotes Icelandic arts and culture. The Foreign Ministry conducts Iceland's political relations with other states and international organisations, covering a wide range of issues ranging from human rights to security and defence and trade. Iceland's international development cooperation aims to deliver measurable results in the areas of poverty eradication, improved living conditions, gender equality and freedom and prosperity in the world. The Ministry represents Iceland in the Arctic Council and is responsible for the 2019-2021 Arctic Council Chairmanship. The overall theme of the Icelandic Arctic Council Chairmanship is „Together Towards a Sustainable Arctic", highlighting four priorities: 1) The Arctic Marine Environment, 2) Climate and Green Energy Solutions, 3) People and Communities of the Arctic, and 4) A Stronger Arctic Council.[19]

The Ministry has initiated several reports on Arctic Affairs including the following which are most relevant to Arctic research:

Iceland's Position in the Arctic - Report by the Ministry for Foreign Affairs in Iceland on Sustainable Development in the Arctic (2009)

The priorities from Iceland's Position in the Arctic 2009 are implied based on the different section headings including: International cooperation, security, resource development and environmental protection, transportation, people and culture, and science and monitoring.

The report highlights that Iceland's consultation in the field of security and defence takes place within the North Atlantic Treaty Organisation along with the Nordic Cooperation in the field of security and defence

16 International Science Committee. 2020 State of Arctic Science Report. 2020. Retrieved 13.10.2020: https://iasc.info/images/media/print/SAS2020_web.pdf
17 International Science Committee. Strategic Plan 2018-2023. Enhancing the Knowledge and Understanding the Arctic. 2018. Retrieved 13.10.2020: https://iasc.info/images/about/organization/StrategicPlan2018_layout_web.pdf
18 Fulltrúar vinnuhópa IASC. Rannsóknarmiðstöð Íslands. Retrieved 17.9.2020: https://www.rannis.is/starfsemi/nordurslodir/um-iasc/fulltruar-vinnuhopa-iasc/
19 Arctic Council. 2019. Together Towards a Sustainable Arctic. Iceland's Arctic Council Chairmanship 2019-2021. Retrieved 13.10.2020: https://www.government.is/library/01-Ministries/Ministry-for-Foreign-Affairs/PDF-skjol/Arctic%20Council%20-%20Iceland's%20Chairmanship%202019-2021.pdf

(NORDEFCO). In addition, bilateral meetings are held regularly with neighbouring countries, with the emphasis being on security and defence. According to the report, Iceland's contribution to Arctic research covers not only natural and environmental sciences but also the fields of humanities and social science. The section on research highlights the fact that it is important to keep in mind that an interdisciplinary approach to Arctic research needs to be expanded and take into consideration Iceland's position when it comes to participation and work related to research in the Arctic.[20]

Iceland's Interests in the Arctic (2016)

Initiated by the Foreign Ministry, this report was commissioned for an Interministerial Committee on Arctic Affairs and published by the Prime Minister´s Office. The main findings of the report regarding Arctic research is as follows: Research on the ecosystem, environment and communities in the Arctic has been one of the most important aspects of international cooperation between the Arctic states. Scientific research and monitoring of changes in the Arctic are the basis for further policy-making both within the states themselves, as well as in international cooperation. Targeted participation in as many areas as possible related to Arctic research indicated the importance of the issue for Iceland. The contribution extends not only to the natural and environmental sciences but also to the humanities and social sciences. Looking to the coming years, it is important to keep in mind that an interdisciplinary approach to Arctic research needs to be expanded. This contribution is of great value and strengthens Iceland's position in international cooperation, and national educational and administrative institutions.[21]

The Arctic Council

Iceland is one of the eight member states of the Arctic Council and the chair of the Council from 2019 to 2021. The Council is the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic States, Arctic indigenous communities and other Arctic inhabitants on common Arctic issues, in particular the issues of sustainable development and environmental protection in the Arctic. It was formally established in 1996 with the signing of the Ottawa Declaration. The importance of science and research is recognized in the Declaration as a contributor to the collective understanding of the circumpolar Arctic.[22]

The Arctic Council regularly produces comprehensive, cutting-edge environmental, ecological and social assessments through its Working Groups (WGs). The six WGs are: the Arctic Contaminants Action Programme (ACAP), the Arctic Monitoring and Assessment Programme (AMAP), the Conservation of Arctic Flora and Fauna (CAFF), Emergency Prevention, Preparedness and Response (EPPR), Protection of the Arctic Marine Environment (PAME), and the Sustainable Development Working Group (SDWG). Iceland has been hosting the secretariat for CAFF (since 1996) and PAME (since 1999) in Akureyri.[23]

CAFF

CAFF (Conservation of Arctic Flora and Fauna) is a biodiversity working group of the Arctic. It provides a mechanism to develop common responses on issues of importance for the Arctic ecosystem such as development and economic pressures, conservation opportunities and political commitments.

CAFF's mandate is to address the conservation of Arctic biodiversity, and to communicate its findings to the governments and residents of the Arctic, helping to promote practices which ensure the sustainability of the Arctic's living resources. It does so through various monitoring, assessment and expert group activities. CAFF's projects provide data for informed decision-making to resolve challenges arising from trying to conserve the natural environment and permit regional growth. This work is based upon cooperation between all Arctic countries, indigenous organisations, international conventions and organisations.[24]

CAFF was granted a total of €157,795 (12,489,050 ISK) from Horizon 2020 for participation in the Arctic-related project INTERACT.

20 Ministry for Foreign Affairs. 2009. Ísland á Norðurslóðum. https://www.stjornarradid.is/media/utanrikisraduneyti-media/media/skyrslur/skyrslan_island_a_nordurslodum.pdf
21 Forsætisráðuneytið. Hagsmunir Íslands á norðurslóðum. Tækifæri og áskoranir. 2016. Retrieved 13.10.2020: https://www.stjornarradid.is/media/forsaetisraduneyti-media/media/Skyrslur/HAGsmunamat_Skyrsla-LR-.pdf
22 Arctic Council. Declaration on the Establishment of the Arctic Council. 1996. Retrieved 18.9.2020: https://oaarchive.arctic-council.org/bitstream/handle/11374/85/ED-OCS-1752-v2-ACMMCA00_Ottawa_1996_Founding_Declaration.PDF?sequence=5&isAllowed=y
23 Arctic Council-About. 2020. Retrieved 17.9.2020:https://arctic-council.org/en/about/
24 CAFF-About. 2020. Retrieved 17.9.2020: https://www.caff.is/about-caff

PAME

PAME's (Protection of the Arctic Marine Environment) mandate is to address marine policy measures and other measures related to the conservation and sustainable use of the Arctic marine and coastal environment in response to environmental change and from both land and sea-based activities, including non-emergency pollution prevention control measures such as coordinated strategic plans. It is also responsible for developing programmes, assessments and guidelines which aim to complement or supplement efforts and existing arrangements for the protection and sustainable development of the Arctic environment.[25]

SDWG

Iceland is chairing the Sustainable Development Working Group (SDWG) and its Social, Economic and Cultural Expert Group (SEC) as well as the Arctic Human Health Expert Group. This Expert Group supports work to advance social, economic and cultural research in the development of sustainable and integrated approaches emerging in the circumpolar region. The Icelandic Arctic Cooperation Network leads the Arctic Council SDWG project on Gender Equality in the Arctic (GEA).[26/27]

During the Arctic Council Ministerial Meeting in Rovaniemi, May 2019, the Arctic Council signed a Memorandum of Understanding (MoU) with the Arctic Economic Council. The aim of the Memorandum of Understanding is to provide a framework for cooperation and to facilitate collaboration between the Arctic Council and the Arctic Economic Council.[28] The first joint meeting of the Arctic Council and Arctic Economic Council took place in Iceland on 9th October 2019 during the Icelandic business community's chairmanship of the Arctic Economic Council (2019-2021).[29]

Ministry for the Environment and Natural Resources

The Icelandic Ministry for the Environment and Natural Resources formulates and enforces the Icelandic government's policy for environmental affairs. The ministry supervises affairs pertaining to nature in Iceland, conservation and outdoor recreation, the national parks of Iceland, climate change, the protection of animals, wild-life management, pollution prevention, planning and building matters, fire prevention, weather forecasting and avalanche-protection, surveying and cartography, forestry and soil conservation, and environmental monitoring and surveillance.

Iceland has commitments to mitigate climate change under the Kyoto Protocol and the Paris Agreement by limiting emissions of greenhouse gases and sequestering carbon from the atmosphere by afforestation and revegetation. A second version of the Climate Action Plan was launched by the Icelandic government in June 2020 setting out targets for 2030, as well as the government's aim to be carbon neutral by 2040. This will be achieved by cuts in greenhouse gas emissions and increased carbon uptake by soil and vegetation though actions in lzand use.[30]

The Icelandic Joint Committee on Arctic Affairs

The Minister for the Environment and Natural Resources appoints a Cooperation Committee on Arctic Affairs for four-year period. The role of the committee is to strengthen cooperation between the parties concerned through monitoring and research in the Arctic. The committee has organised Arctic Science Days and submitted a proposal for an Arctic Research Programme to the SCTP. The following institutions have a representative on the committee: The Agricultural University of Iceland, the Environmental Agency of Iceland, the Icelandic Centre for Research, the Icelandic Institute of Natural History, the Marine and Freshwater Research Institute, the Met Office, the Stefansson Arctic Institute, the University of Akureyri and the University of Iceland.[31]

25 About PAME. 2020. Retrieved 17.9.2020: https://www.pame.is/shortcode/about-us
26 SDWG. About us. Retrieved 16.10.2020: https://sdwg.org/about/
27 Home – Icelandic Arctic Cooperation Network. Retrieved 15.10.2020 https://www.arcticiceland.is/en/
28 https://arcticeconomiccouncil.com/news/press-release-the-aec-welcomes-new-chair-signs-mou-with-arctic-council/
29 Government of Iceland. First joint meeting between the Arctic Council and the Arctic Economic Council. Retrieved 4.11.2020: https://www.government.is/diplomatic-missions/embassy-article/2019/10/09/First-joint-meeting-between-the-Arctic-Council-and-the-Arctic-Economic-Council/
30 Government of Iceland. Climate Change. Retrieved 17.9.2020:https://www.government.is/topics/environment-climate-and-nature-protection/climate-change/
31 81/1997: Lög um Stofnun Vilhjálms Stefánssonar og samvinnunefnd um málefni norðurslóða. Lög. Alþingi. 1997. Retrieved17.9.2020: https://www.althingi.is/lagas/150b/1997081.html

Icelandic Arctic Cooperation Network

The Icelandic Arctic Cooperation Network (IACN) was founded in 2013 and is a result of cooperation between the Ministry for Foreign Affairs, the Ministry of Education, Science and Culture, the Ministry for the Environment and Natural Resources, Eything, and the numerous parties involved with Arctic issues in Akureyri. Its role is to facilitate cooperation amongst the Icelandic public and private organisations, institutions, businesses and bodies involved in the region, among other things in research, education, innovation and monitoring, or other activity relevant to the Arctic region. Currently members of the IACN are approximately thirty, including universities and university centres; large research and public institutions, such as the Icelandic Meteorological Office, the Marine and Freshwater Research Institute and the Icelandic Coast Guard; and municipalities and other important stakeholders involved with the Arctic region. Cooperating partners are a combination of public and private institutions, organisations, businesses and initiatives in Iceland.[32]

The Network works closely with the Icelandic Chairmanship of the Arctic Council (2019-2021) including chairing the Social, Economic and Cultural Expert Group (SEC), which is under the auspices of the Sustainable Development Working Group (SDWG). The Network is Iceland´s representative at the Arctic Science Ministerial Meeting (ASM3) of the Science Advisory Board.[33]

IACN activities range from leading and participating in domestic and international projects and events; consultation, facilitation and coordination; and information dissemination. The Network has received funding from the Arctic Research and Studies Programme, the EU Northern Periphery and Arctic Programme, the Nordic Council of Ministers and the Icelandic Gender Equality Fund.

32 About - Icelandic Arctic Cooperation Network. Retrieved 6.10.2020: https://arcticiceland.is/en/
33 Partners - Icelandic Arctic Cooperation Network. Retrieved 6.10.2020: https://www.arcticiceland.is/en/partners

Arctic Research in Iceland

Icelandic Universities

There is a total of seven universities in Iceland. All of them engage in Arctic research in some manner, whether it be an occasional research project, or an entire programme and institute dedicated to an aspect of Arctic research. The universities are instrumental in educating the next generation of Arctic scientists in Iceland. In this section these universities and their connection to Arctic research will be explored. All universities in Iceland participate in the University of the Arctic (UArctic) network, either by providing board members, hosting positions and organising the UArctic Congress and other related events.

University of Iceland

The University of Iceland is the country's largest university by any metric and a leading research institute in Iceland. Academics from diverse disciplines within the University of Iceland focus on Arctic and Arctic-related research and teaching. Examples of Arctic-related teaching are the interdisciplinary programme of Environment and Natural Resources (ENR), attracting a number of students from all over the world, and the Arctic Circle course offered to all graduate students at the University in connection with the Arctic Circle Assembly. The University actively participates in the UArctic network by providing a board member and hosting the position of philanthropic officer for UArctic and Arctic Circle.[34]

The University of Iceland is a large and far-reaching institution. Seven study centres connected to the University are operated in rural areas; many of them attend to research based on localised knowledge. The University considers itself responsible for strengthening academia and research everywhere in the country. Consequently, this aspect of the University's operations is growing rapidly. The University operates dozens of research institutions and centres, which are the venue for diverse research in various fields. Among the most Arctic-related research centres and institutes are the following centre and institutes:

The Centre for Arctic Studies, founded in 2013, is run under the auspices of the Institute of International Affairs. The Centre leads interdisciplinary collaboration in the field of Arctic research within the University of Iceland. The main goal of the Centre is to support and conduct research both on a national and international level and to increase cooperation between academia and the public and private sector. The Centre works with numerous international networks and academics in the field of Arctic research and represents the University of Iceland in several UArctic programmes.

The Institute of Earth Science was established in 2004 when the Nordic Volcanological Institute and the geology and geophysics sections of the Science Institute, University of Iceland, merged. The Institute runs the Nordic Volcanological Centre, funded jointly by the Icelandic state and the Nordic Council of Ministers. The Institute of Earth Sciences is an independent part of the University's Science Institute and the main site of academic research in earth sciences in Iceland. Research within the Institute is organised into three broadly defined themes: Understanding volcanoes, Environment and climate and Crustal process.

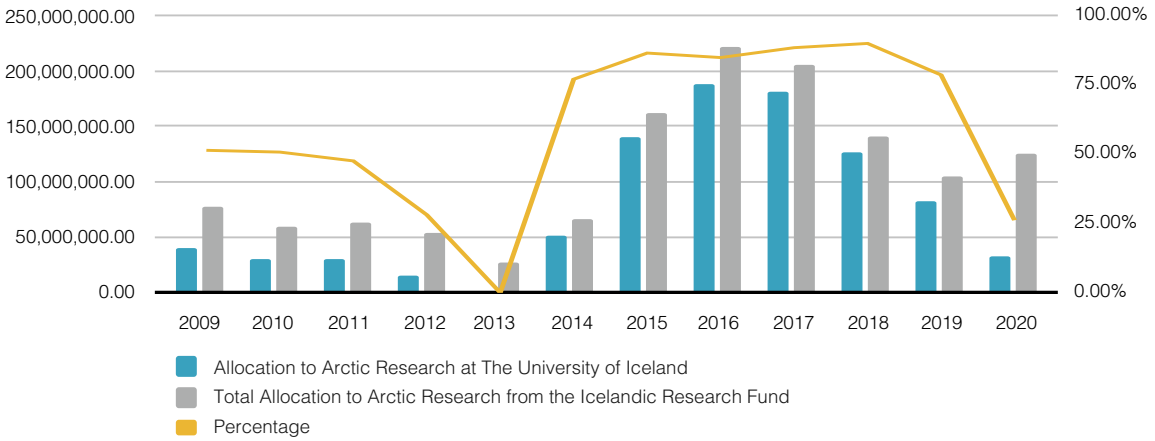
The Institute of Life and Environmental Sciences was founded in 2011 to support research undertaken by members of the University's Faculty of Life and Environmental Sciences in the fields of biology, geography and tourism studies, in addition to research conducted by non-academic staff and graduate students.

The University of Iceland manages a research fund with the purpose of strengthening research activities at the University. The fund is divided into a project fund and a doctoral fund. Furthermore, the University of Iceland has been leading when it comes to Arctic research with grants from the Icelandic Research Fund.

34 Congress – Congress Portal. Retrieved 15.10.2020: https://congress.uarctic.org/

As illustrated in figure 3, the University of Iceland was granted a total of 916,008,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 70.13% of the total amount from the fund that went into Arctic research.

Figure 3: Percentage of total allocation to the University of Iceland from the Icelandic Research Fund for Arctic research.



The University of Iceland was granted a total of €514,703 (74,133,630 ISK) from Horizon 2020 for participation in the Arctic-related projects ArcticHubs, ESPSI and IceAq, which is 7.03% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

University of Akureyri

Established in 1987, the University of Akureyri (UNAK) is a young university located in a municipality in the northeast of the country known as the "Capital of the North". The university offers courses on an undergraduate and graduate level within its three schools: The School of Health Sciences, the School of Humanities and Social Sciences, and the School of Business and Science. Its most notable Arctic connections are the Polar Law Master's Programme, the associated Polar Law Institute, and the Nansen guest professorship at the University. During the Icelandic Chairmanship of the Arctic Council, the University of Akureyri provides the chair for the expert group on Arctic Human Health within the Sustainable Development Working Group. In May 2020, UNAK and the Ministry for Foreign Affairs signed a two-year contract which includes a 50 million ISK grant to the university in collaboration with the Northern Research Forum.[35] The University of Akureyri is one of the founding members of the University of the Arctic, and the faculty of UNAK have participated in IASC Working Groups, and UArctic thematic networks.

The University of Akureyri was granted a total of 13,565,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 1.04% of the total amount from the fund that went into Arctic research.

The University of Akureyri was granted a total of €269,145 (39,887,289 ISK) from Horizon 2020 for participation in the Arctic-related project MicroArctic, which is 3.68% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Polar Law Programme

The Polar Law Programme is an interdisciplinary programme which offers MA and LLM degrees, and a diploma qualification in Polar Law. The programme was launched in 2008 with a rising international and domestic interest in the Arctic and draws together governance issues that pertain not only to the Arctic but to both poles.[36] The Yearbook of Polar Law, based at the Faculty of Social Sciences and Law at the University of Akureyri, covers a wide variety of topics relating to the Arctic and the Antarctic.[37]

35 HA hefur gert samning við utanríkisráðuneytið um eflingu norðurslóðastarf. Háskólinn á Akureyri. Retrieved 17.9.2020: https://www.unak.is/is/samfelagid/frettasafn/frett/ha-hefur-gert-samning-vid-utanrikiraduneytid-um-eflingu-nordurslodastarfs
36 Polar Law Programme. Polar Law Institute. Retrieved 17.9.2020: https://www.polarlaw.is/en/polar-law-program
37 The Yearbook of Polar Law. 2020. Retrieved 6.10.2020: https://brill.com/view/serial/POLA

Accreditation of Master's Programme of Arctic relevance

UNAK accredits two international master's programmes that are operated by the University Centre of the Westfjords: Coastal and Marine Management, and Coastal Communities and Regional Development.

Polar Law Institute

The Polar Law Institute is a non-profit research and education institution and operates in cooperation with the University of Akureyri. It was established together and in cooperation with the Polar Law Programme at the University. The institution was established in 2009 and it primarily focuses on organising the annual Polar Law Symposiums held in September. It also provides the Polar Law Programme with support in a variety of manner, as well as aiming to generally enhance cooperation within the field, publishing material, and organising other events.[38]

Nansen Professorship

The Nansen Professorship is a guest professorship in Arctic studies at the University of Akureyri. It was established through a Memorandum of Understanding signed by the Ministers for Foreign Affairs in Iceland and Norway on 29 September 2011 concerning cooperation in the field of Arctic scientific research. Scientists within the legal, economic, social or natural fields linked to the Arctic contribute to teaching and researching for a twelve-month period each. The position has been filled with high-level scholars in their respective fields.[39]

The Northern Research Forum

The Northern Research Forum (NRF) provides an international platform for an effective dialogue between members of the research community and stakeholders, including researchers, educators, politicians, business leaders, civil servants and community leaders. From 2012-2015 the NRF organised a biennial open meeting where members of the research community and representatives of a wide range of other northern stakeholders could meet and exchange ideas. This forum also aims to oversee and implement the NRF Fellows Programme, administer UNAK's bilateral or multilateral Arctic cooperation activities, including the Nansen professorship, aid NRF Fellows in supporting the work of the Arctic Council working groups, and facilitate and promote UNAK's participation in the UArctic network. NRF is in charge of projects provided for by the agreement between UNAK and the Ministry for Foreign Affairs.[40]

The publication of the Arctic Yearbook is the outcome of the NRF and the University of the Arctic Thematic Network on Geopolitics and Security. The yearbook is a critical analysis of the Arctic region, with a mandate to inform about Arctic geopolitics and security.[41]

Agricultural University of Iceland

Scientists at the Agricultural University of Iceland (AUI) conduct multi-disciplinary research pertaining to the Arctic region. This includes research in many aspects of cultivation and food production under Arctic conditions, and research aimed at understanding how human land use affects fragile Arctic ecosystems, and how disturbance and degradation of these systems can be prevented through restoration and planning. For instance, the main focus of the Faculty of Agricultural Sciences is applied research for Arctic livestock farming on vulnerable volcanic soils in a sustainable manner. In light of the accelerated changes at higher latitudes and the increasing demand for sustainable development, where a balance is maintained between ecology, equity and economy, the Faculty of Planning and Design at AUI focuses on future planning in the Arctic area and on identifying possible conflicts related to land use changes that need to be addressed in the planning process. In the field of environmental sciences in Iceland, the Faculty of Environmental and Forest Sciences at AUI is at the forefront of research aimed at understanding the effects and feedbacks of climate change on terrestrial ecosystem composition and functioning, Arctic ecosystem restoration and soil science. AUI is also internationally recognized in the field of atmospheric sciences, particularly concerning research of dust sources at high latitudes.

38 Polar Law Institute. Retrieved 17.9.2020: https://www.polarlaw.is/
39 Nansen professor. University of Akureyri. Retrieved 17.9.2020: https://www.unak.is/english/research/nansen-professor
40 HA hefur gert samning við utanríkisráðuneytið um eflingu norðurslóðastarf. Háskólinn á Akureyri. Retrieved 17.9.2020: https://www.unak.is/is/samfelagid/frettasafn/frett/ha-hefur-gert-samning-vid-utanrikiraduneytid-um-eflingu-nordurslodastarfs
41 UArctic-UArctic Institute: The Northern Research Forum. 2020. Retrieved 17.9.2020:https://www.uarctic.org/organization/thematic-networks/northern-research-forum/

The Agricultural University of Iceland was granted a total of 105,063,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 8.04% of the total amount from the fund that went into Arctic research.

The Agricultural University of Iceland was granted a total of €423,290 (57,716,716 ISK) from Horizon 2020 for participation in the Arctic related project Charter, INTERACT and FutureArctic, which is 5.78% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Environmental Changes at Higher Latitudes (EnCHiL Nordic Master)

The Nordic Master in Environmental Changes at Higher Latitudes (EnCHiL) offers international and Nordic students hands-on experience while addressing the important issues in a multi-disciplinary environment and gives them opportunities to work with relevant Arctic topics, as well as practical experience in Greenland, Iceland and other countries within the Arctic region.[42]

Bifröst University

Bifröst has engaged in various research projects run by individual faculty members. Bifröst University has offered a course on Arctic Politics with a focus on how globalization and climate change are transforming the geopolitical status of the region and influencing the positions of the Arctic states within the international political economy.[43] Bifröst University has one instance of participation in a Northern Periphery and Arctic Programme project named ERNACT, with the title Involving the Community to co-Produce Public Services.

Hólar University

Hólar University´s activity is mainly divided into three academic departments; aquaculture and fish biology, equine studies, and rural tourism. Hólar University engages in Arctic research in all its academic departments. The Department of Aquaculture and Fish Biology is an international centre for research, instruction, and continuing education in aquatic biology, aquaculture and fish biology.[44]

Hólar University was granted a total of 43,144,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 3.30% of the total amount from the fund that went into Arctic research.

Hólar University was granted a total of €197,601 (31,003,597 ISK) from Horizon 2020 for participation in the Arctic-related project ArcticHubs, which is 2.70% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Iceland University of the Arts

The Iceland University of the Arts (IUA) is the only higher education institute in the field of arts in Iceland. Diverse research is conducted at the IUA, through the use of various materials, forms and media, and entailing both artistic research practice and academic research. In the last two decades research in the arts has established itself as a professional method of practice. Artistic research challenges general definitions of research methodologies, recognizing the values of contemporary cultural practices as an important contributor to new knowledge and advanced approaches, often in collaborative effort with other fields of expertise. With the aim of enhanced understanding of what research in the arts can contribute to societies and advancement of sustainable co-living in the north, the IUA is engaged in mutually inclusive collaboration and contribution to research on human-environment relations in the Circumpolar Arctic.[45]

The Icelandic University of the Arts was granted a total of 7,513,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 0.58% of the total amount from the fund that went into Arctic research.

42 Environmental Changes at Higher Latitudes (EnCHiL Nordic Master). Landbúnaðarháskóli Íslands. Retrieved 17.9.2020: http://www.lbhi.is/environmental_changes_higher_latitudes_enchil_nordic_master
43 Arctic Politics. Retrieved 17.9.2020: https://www.bifrost.is/english/erasmus/exchange-program-courses-in-english/arctic-politics/
44 Department of Aquaculture and Fish Biology. Retrieved 17.9.2020: https://www.holaraquatic.is/
45 Listaháskóli Íslands. Retrieved 17.9.2020 https://www.lhi.is/en

Reykjavík University
Reykjavík University is an academic institution responsible for advanced education, research and scientific projects. Its subjects in teaching and research are science and engineering, computer science, business and law. The University has a modern, interdisciplinary approach and programmes, e.g. crossing business with computer science and computer science with engineering. In its focus area, the University is at the forefront of research in Iceland. Amongst main research areas at the Department of Law at the University of Reykjavík are Maritime Law, Law of the Sea and Energy Law.[46]

Reykjavik University was granted a total of 15,013,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 1.15% of the total amount from the fund that went into Arctic research.

University Research Centres

University Centre of the Westfjords
The University Centre of the Westfjords is a rural higher educational institution that operates two international master's programmes that are accredited through the University of Akureyri: Coastal and Marine Management and Coastal Communities and Regional Development. Courses in the programmes cover Arctic issues such as shipping and offshore activities, ocean governance, future scenario workshops, and communicating climate change. Students also choose their own thesis research topics which often have an Arctic focus and can be completed in collaboration with other Arctic institutions. The University Centre is a member of the University of the Arctic and a faculty member is the vice chair of the UArctic Thematic Network for Arctic Ocean Food Systems. Faculty members conduct Arctic and sub-Arctic interdisciplinary research in the social and natural sciences and are involved in Arctic organisations such as the SDWG of the Arctic Council and the IASC Social Human Working group.

Icelandic Tourism Research Centre
The Icelandic Tourism Research Centre (ITRC) is a cooperative project between the University of Iceland, the University of Akureyri, Hólar University, the Icelandic Tourist Board and the Icelandic Travel Industry Association. The aims of the ITRC are to boost research and thus understanding better the impact tourism has on the Icelandic economy, society and environment. Among the Arctic research projects conducted by the Centre are projects on: "Sustainable Arctic Cruise Communities: From Practice to Governance", as well as various projects on the impact and role of tourism in Iceland.[47]

Institutes Conducting Arctic Research

Icelandic Institute of Natural History
The Icelandic Institute of Natural History (IINH) is an agency of the Ministry for the Environment and Natural Resources. The institute conducts basic and applied research on the natural environment in Iceland, with a focus on botany, ecology, taxonomy, geology and zoology, and participates in environmental consultant work on sustainable use of natural resources and land development in Iceland. It also assesses the conservation status of species, geological formations, habitats, and ecosystems. The IINH also participated in several projects involving cooperation with international organisations operating in the North Atlantic and the Arctic. Individual employees at the IINH take an active part in a wide range of cooperative projects and international collaborations in the field of science. The institute has a representative on the CAFF Management Board and participates in expert groups on circumpolar seabirds (CBird), flora (CFG), protected areas (CPAN), and biodiversity monitoring (CBMP). The institute participated in the Arctic-related project Microorganisms in Warming Arctic Environment, which received funding from Horizon 2020.[48]

The Icelandic Institute of Natural History was granted a total of 27,950,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 2.14% of the total amount from the fund that went into Arctic research.

The Icelandic Institute of Natural History participated in the EU project MicroArctic, which is considered to have Arctic relevance, but the institute did not receive funding from Horizon 2020.

46 Reykjavík University. Retrieved 17.9.2020: https://en.ru.is/
47 About Us. Icelandic Tourism Research Centre. Retrieved 17.9.2020: http://www.rmf.is/en
48 ABOUT. Náttúrufræðistofnun Íslands. Retrieved 17.9.2020: https://en.ni.is/about

Stefansson Arctic Institute

The Stefansson Arctic Institute (SAI) was established in 1998 and is located at Borgir in Akureyri. The institute is an independent governmental research institute within the Icelandic Ministry for the Environment and Natural Resources. The SAI takes an inter-disciplinary approach to understanding human environment relations in the Circumpolar Arctic. Particular emphasis is placed on research and scientific assessments concerning economic systems and human development, marine-resource governance, political ecology of agricultural systems, and the impacts of and adaptation to past and present climate change.[49] The Stefansson Arctic Institute participates in two EU Horizon 2020 Arctic-related projects: NUNATARYUK and JUSTNORTH.[50]

The Stefansson Arctic Institute was granted a total of €1,506,373 (218,451,094 ISK) from Horizon 2020 for participation in the Arctic-related projects JUSTNORTH and NUNATARYUK, which is 20.57% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Icelandic Meteorological Office

The Icelandic Meteorological Office (IMO) is a governmental institution under the Ministry for the Environment and Natural Resources. The main purpose of the IMO is to contribute towards increased safety and efficiency in society. This it does by monitoring, analysing, interpreting, informing, giving advice and counsel, providing warnings and forecasts and, where possible, predicting natural processes and natural hazards; issuing public and aviation alerts about impending natural hazards, such as volcanic ash, extreme weather and flooding; conducting research on the physics of air, land and sea, specifically in the fields of meteorology, hydrology, glaciology, climatology, seismology and volcanology; maintaining high-quality service and efficiency in providing information in the interest of economy, of safety affairs, of sustainable usage of natural resources and with regard to other needs of the public; ensuring the accumulation and preservation of data and knowledge regarding the long-term development of natural processes such as climate, glacier changes, crustal movements and other environmental matters that fall under the IMO's responsibility, e.g. undertaking of risk assessments for natural hazards as requested by the government.

The research focus of the IMO is on weather and climate, atmospheric processes, glacier and avalanche studies, hydrological systems, earthquake and volcanic processes and geohazards. The IMO also focuses on research in multi-parameter geophysical monitoring to develop more accurate forecasts of hazardous events. The IMO cooperates with many agencies in related fields, both within and outside Iceland, and with international organisations, including the WMO (World Meteorological Organisation), which in many cases relates to Arctic issues. Examples of which include active participation in EC-PORS (Panel of Experts on Polar Observations, Research and Services); Arctic-HYDRA (The Arctic Hydrological Cycle Monitoring and Assessment Programme); and GCW (Global Cryosphere Watch). Furthermore, IMO experts take part in various work groups of the IASC (International Arctic Science Committee) and the board of SAON (Sustaining Arctic Observing Networks) on behalf of Iceland, as well as participating in other Arctic committees/working groups.[51/52]

The Icelandic Meteorological Office was granted a total of 24,079,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 1.84% of the total amount from the fund that went into Arctic research.

The Icelandic Scientific Committee's Report on Climate Change (2018)

The report of the Scientific Committee on Climate Change was published May 3rd, 2018 by the Icelandic Meteorological Office. The report adds much to the previous reports of the Scientific Committee on the same subject, which were published in 2000 and 2008. This report contains e.g. in-detail discussion on ocean acidification, sea level rise, the effect of climate change on natural hazards, social infrastructure and the necessary adaptations due to this. Information is also updated from previous reports on global warming in recent decades and its impact on the natural environment on land and the ocean around it.[53]

49 About us. Stefansson Arctic Institute. 2013. Retrieved 17.9.2020: http://www.svs.is/en/about-us
50 New research projects: JUSTNORTH. Stefansson Arctic Institute. 2013. Retrieved 17.9.2020: http://www.svs.is/en/news/new-research-project-justnorth
51 Mission. Icelandic Meteorological Office. Retrieved 17.9.2020: https://en.vedur.is/about-imo/mission/
52 Arctic cooperation. Icelandic Meteorological Office. Retrieved 17.9.2020:https://en.vedur.is/about-imo/arctic/
53 Björnsson, H., Sigurðsson, B. D., Davíðsdóttir, B., Ólafsson, J. S., Ástþórsson, O. S., Ólafsdóttir, S., ... & Jónsson, J. (2018). Loftslagsbreytingar og Áhrif Þeirra á Íslandi: Skýrsla Vísindanefndar Um Loftslagsbreytingar 2018. Tech. Rep., Veðurstofa Íslands, Reykjavík, 238 pp. Retrieved: https://www.vedur.is/media/loftslag/Skyrsla-loftslagsbreytingar-2018-Vefur.pdf

Marine and Freshwater Research Institute

The Marine and Freshwater Research Institute (MFRI) is a government institute under the auspices of the Ministry of Industries and Innovation. It is a major contributor to Arctic research in Iceland and conducts various marine and freshwater research within the Icelandic and Arctic territories and provides the Ministry with scientific advice based on its research on marine and freshwater resources and the environment. The main research priorities are research on marine and freshwater ecosystems, sustainable exploitation of main fish stocks, ecosystem approach to fisheries management, research on fishing technology and seafloor and habitat mapping. The MFRI is highly regarded in the scientific community and is therefore a valuable research partner, active at an international level and with a strong infrastructure and high-quality equipment. MFRI experts take part in various working groups of the IASC and other Arctic oriented committees.[54]

The Marine and Freshwater Research Institute was granted a total of 13,800,000 ISK from the Icelandic Research Fund for Arctic research in the years 2009 to 2019, which is 1.06% of the total amount from the fund that went into Arctic research.

The Marine and Freshwater Research Institute was granted a total of €334,163 (51,081,371 ISK) from Horizon 2020 for participation in the Arctic-related projects ECOTIP and Blue-Action, which is 4.56% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Agencies

Several government agencies provide support, logistics, infrastructure and expertise to Arctic research.

Environment Agency of Iceland

The Environment Agency of Iceland operates under the direction of the Ministry for the Environment and Natural Resources. Its role is to promote the protection and sustainable use of Iceland's natural resources, as well as public welfare by helping to ensure a healthy environment and safe consumer goods. The Agency is responsible for monitoring environmental quality, evaluation of environmental impact assessments and development plans, assessment of conservation effects and registration of unique nature sites, risk analysis, wildlife management, collaboration in international projects, among other tasks.[55]

The Environment Agency is not a research institute and has therefore not formulated an Arctic research policy as such, but the monitoring carried out or supported by the agency contributes to obtaining a comprehensive overview of the state of the environment and the source of pollution in the area. Iceland and the ocean around the country are within the Arctic region and an emphasis has been placed on making the results of monitoring and research in Iceland accessible for us in research projects concerning the Arctic. The policy of the Environment Agency includes that the results of monitoring and research is accessible so that the relevant data can be used as widely as possible. The data from monitoring is often submitted to international databases and thus made accessible to scientists.

Icelandic Coast Guard

The Icelandic Coast Guard (ICG) was founded in 1926 and is a law enforcement agency that is responsible for search and rescue, maritime safety and security surveillance, and law enforcement in the seas surrounding Iceland. The ICG's operations are based on gathering, analysing and distributing information in close cooperation with neighbouring countries in order to create a surface picture as accurate as possible at any given moment to ensure maritime safety and security. The Icelandic Coast Guard has been observing developments in the Arctic and participated in forming policy and spearheading work regarding Arctic maritime safety in cooperation with other coastal states in the North Atlantic and Arctic. The goal has mainly been to coordinate and standardize their procedures and gather information on best practices, expertise, equipment and manpower available for rescue. Iceland (represented by ICG) is chair of the Arctic Coast Guard Forum 2019-2021 in concert with the Icelandic Chairmanship of the Arctic Council.[56]

54 MFRI. Marine and Freshwater Research Institute. Retrieved 17.9.2020: https://www.hafogvatn.is/en/about/mfri
55 Umhverfisstofnun. Forsíða. 2020. Retrieved 17.9.2020: https://www.ust.is/
56 About the ACGF :: ACGF. Retrieved 4.11.2020: https://www.arcticcoastguardforum.com/about-acgf

Currently the ICG is a participant and work package leader in the EU Horizon 2020 project "Arctic and North Atlantic Security and Emergency Preparedness Network" (ARCSAR).

The Icelandic Coast Guard was granted a total of €226,750 (31,314,175 ISK) from Horizon 2020 for participation in the Arctic-related project ARCSAR, which is 3.10% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Icelandic Road and Coastal Administration

The Icelandic Road and Coastal Administration has been working on research in collaboration with its sister institutions in the Nordic countries on research under the so-called NordFoU hat. In December 2004 an agreement was signed between the Road Administration in Iceland, Sweden, Denmark, Norway and Finland. Research and development works have always been a part of the Icelandic Road and Coastal Administration's operation. Grants are awarded annually for research projects, which are financed mostly by so-called experimental funds, which according to the Road Act should be about 1,5% of the agency's market revenue.[57]

Icelandic Regional Development Institute

The Icelandic Regional Development Institute is an independent state-owned agency and comes under the ultimate authority of the Minister of Transport and Local Government. The function of the institute is to promote rural settlement and economic activity, with a special emphasis on the creation of equal opportunities for all inhabitants to employment and habitation. In accordance with its function, the institute prepares, organises and funds projects and provides loans with the aim of bolstering regional settlement, boosting employment and encouraging innovation in business and industry. The Icelandic Regional Development Institute monitors regional settlement trends in Iceland, through among other means research and the collection of data. It may draw up or have drawn up plans for regional development and economic activity with the aim of supporting settlement and employment in the country's non-metropolitan areas.[58] The Icelandic Regional Development Institute administrates the Northern Periphery and Arctic Programme and the NORA cooperation for Iceland.

Research Infrastructures

High Performance Computing in Meteorological Research

Building upon 100 years of meteorological cooperation, the Icelandic and Danish Meteorological Offices signed a partnership agreement in 2014 regarding extensive research collaboration and the operation of a supercomputer in Iceland running numerical weather prediction models. This cooperation provides a basis for expanded weather and climate services on which integrated research on past and future climate change can build upon. This collaboration will be expanded in 2023 when the Netherlands and Ireland join the cooperation under the name of United Weather Centre – West.[59]

Field stations

Arctic Observatory at Kárhóll

The land of Kárhóll is owned by a non-profit organisation named Arctic Observatory, which provides necessary land, facilities and operational services for the Arctic Observatory. The Polar Research Institute of China (PRIC) leases the land on behalf of the observatory. The aim of the cooperation at Kárhóll is to further scientific understanding on solar-terrestrial interaction and space weather by conducting polar upper atmosphere observation, such as auroras, geomagnetic and other related phenomena, and outreach to the public. The PRIC has made agreements with several Icelandic research institutes regarding Arctic research cooperation at Kárhóll. Overall, Rannís represents the Icelandic research community in this cooperation. The observatory is a part of the EU INTERACT Project.[60]

57 About us. The Icelandic Road and Coastal Administration. Retrieved 17.9.2020: http://www.road.is/about-us/
58 English. Byggðastofnun. 2019. Retrieved 17.9.2020: https://www.byggdastofnun.is/en
59 Supercomputer in Iceland. New. Icelandic Meteorological Office. Retrieved 28.9.2020: https://en.vedur.is/about-imo/news/nr/3309.
60 China Arctic Research Observatory - INTERACT. 2017. Retrieved 17.9.2020: https://eu-interact.org/field-sites/karholl-research-station/

Grímsfjall Field Station

This field station of the Iceland Glaciological Society is located in the centre of the 7700 km2 Vatnajökull glacier. It hosts a variety of geophysical equipment that monitors the active volcanoes beneath the glacier, as well as isostatic rebound due to glacier thinning. It also serves as a base for mass balance and other glaciological research on Vatnajökull.

Litla-Skarð

Litla-Skarð is a bio-monitoring site. The site is operated jointly by the Agricultural University of Iceland, the Icelandic Institute of Natural History, the Icelandic Meteorological Office, the Environmental and Food Agency of Iceland, and the Iceland Forest Service. Litla-Skarð is a national site for the International Co-operative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICPIM). The main research emphasis till now has been on the chemistry of precipitation, climate, and hydrology. Litla-Skarð is a part of the EU INTERACT Project.[61]

Rif Research Station

Rif Research Station (RRS) provides access to a research area in Melrakkaslétta, which includes Iceland's northernmost point on the mainland. The area allows research and monitoring within the field of natural science, e.g. related to vegetation and bird life, freshwater biology, coastal ecosystems, geology and geo-morphology. The RRS is an INTERACT station and is being developed as one of three monitoring stations for the Circumpolar Biodiversity Monitoring Programme (CBMP) under the Arctic Council Working Group, Conservation of Arctic Flora and Fauna (CAFF).[62]

Rif Research Station was granted a total of €207,140 (26,339,472 ISK) from Horizon 2020 for participation in the Arctic-related project INTERACT, which is 2.83% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Skálanes Nature and Heritage Centre

Skálanes Nature and Heritage Centre is an independent research station. The area is a habitat of a rich wildlife including reindeer, the Arctic fox and 74 different bird species such as a large Arctic tern colony, puffins and an eider colony. The research includes human activities such as eider farming, a vegetable garden and a small holding of animals in the summer season. Skálanes is a part of the EU INTERACT Project.[63]

Suðurnes Science and Learning Center

The Suðurnes Science and Learning Center is a non-profit organisation, partly financed and accredited by the Ministry of Education, Science and Culture in Iceland. The Center focuses on bird studies, marine invertebrates and seashore ecology. Southwest Iceland Nature Research Institute and the University of Iceland´s Research Center in Suðurnes are part of the centre and their main focus has been on research and teaching using the clean water (e.g. ecotoxicology), organisms from the wild (e.g. new species for aquaculture or fisheries) and prevention and cure of diseases in aquaculture or in the wild. The Center is a partner in the Reykjanes UNESCO Global Geopark, as well as being part of INTERACT, the International Network for Terrestrial Research and Monitoring in the Arctic.[64]

Suðurnes Science and Learning Center was granted a total of €233,867 (29,536,915 ISK) from Horizon 2020 for participation in the Arctic-related project INTERACT, which is 3.19% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

61 Litla-Skard - INTERACT. 2017. Retrieved 17.9.2020: https://eu-interact.org/field-sites/litla-skard/
62 RIF - Field Station - INTERACT. 2017. Retrieved 17.9.2020: https://eu-interact.org/field-sites/rif-field-station/
63 Skálanes - INTERACT. 2017. Retrieved 17.9.2020: https://eu-interact.org/field-sites/skalanes/
64 Sudurnes Science and Learning Center. Þekkingarsetur Suðurnesja. 2020. Retrieved 17.9.2020: https://thekkingarsetur.is/english/

Vessels
Iceland operates three ice-strengthened multi-purpose ocean vessels suitable for a wide range of marine biological and oceanographic research as well as marine geophysical surveying. These vessels are capable of supporting a range of activities in the northern oceans.

R/V Árni Friðriksson & Bjarni Sæmundsson
The two research vessels are operated by the Marine Research Institute and used for marine biological, fisheries, oceanographic and marine geology research.

ICGV Þór
Þór is a multi-purpose vessel of the Icelandic Coast Guard well equipped for a wide range of duties including hydrographic surveying and serves as a platform for a variety of research activities.

Aircraft
Iceland operates two airplanes that are partly used for marine and glacier monitoring.

TF-FMS
A Beechcraft 200 aircraft operated by the Icelandic Aviation Services, equipped with surface profiling C-band radar.

TF-SIF
A Dash 8 aircraft of the Icelandic Coast Guard equipped with a wide range of surveillance sensors and a SAR radar, used for pack ice mapping, marine monitoring and glacier surface monitoring.

Companies
In recent years there is growing interest among companies in Iceland to participate in Arctic research.

Arctic Portal
The Arctic Portal is a comprehensive gateway to Arctic information and data on the internet, increasing information sharing and co-operation among Arctic stakeholders and granting exposure to Arctic-related information and data. Arctic Portal has operated in consultation and cooperation with members of the Arctic Council and its working groups, permanent participants, observers and other stakeholders. The Arctic Portal is a network of information and data sharing and serves as host to many websites in a circumpolar context, supporting cooperation and outreach in science, education and policy making. The portal is managed as a non-profit organisation, located in Akureyri, Iceland, under an international board of directors. The Arctic Portal provides web presence to over 50 scientific institutions, associations and projects of international importance.[65] Arctic Portal has participated in six EU Horizon 2020 projects: EDU-ARCTIC, APPLICATE, ADMS, NUNATARYUK, ARICE, & INTERACT.

Arctic Portal was granted a total of €1,086,264 from Horizon 2020 for participation in Arctic-related projects, which is 14.83% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

ICEWIND
Icewind was founded in 2012 but its development goes back to 2008. The company designs and manufactures small vertical axis wind turbines for telecom towers and residential applications such as homes, cabins and farms. The design demonstrates that turbines can be elegant, quiet, durable, cost effective and nearly maintenance-free solutions for energy production. ICEWIND has two instances in participation in Horizon 2020 in the NJORD project. The NJORD project works towards making wind turbines that are capable of working over a wide production range with minimum maintenance. The turbines are designed for countries who suffer extreme weather conditions, such as Iceland and the other four Nordic countries, Northern US, Canada's Prairies, the UK and Nigeria.[66]

ICEWIND was granted a total of €1,790,260 (221,240,162 ISK) from Horizon 2020 for participation in the Arctic-related project NJORD, which is 24.45% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

65 About Us - Arctic Portal - The Arctic Gateway. Retrieved 17.9.2020: https://arcticportal.org/about-us
66 ICEWIND. Extreme Energy Solutions - Extreme Energy Solutions. 2019. Retrieved 17.9.2020: https://icewind.is/

Landsvirkjun – National Power Company of Iceland
Landsvirkun or the National Power Company of Iceland operates 18 power stations across Iceland and is among the largest producers of renewable energy in Europe. The company supports and takes part in research in a variety of fields, including research on the ecosystem of the country, climate, hydrology, glaciers and geology, among others. The research is conducted in collaboration with a number of universities, educational institutions and businesses, as well as individual researchers, based in Iceland and abroad.[67] Furthermore, Landsvirkjun operates the Icelandic Energy Research Fund, with the goal of strengthening research in the fields of environmental and energy affairs and to award grants to students, university research projects, institutions, companies and individuals researching these areas. In 2016, Landsvirkjun, the Icelandic Met Office, the University of Iceland and Reykjavik University signed an agreement with various institutes in Canada in the field of research and training with the aim of exploring sustainable energy potential in the Arctic.[68]

MATÍS
Matís is an independent, governmentally-owned research and development company headquartered in Reykjavík, Iceland, with a role of supporting food safety and increasing public health and value creation from sustainably-harvested bioresources.[69] This is done through research, innovation, services and dissemination of knowledge. Matís puts emphasis on value creation within the bioeconomy through valorisation of side streams and underutilized resources from land and sea, improved handling, efficient value chains and product development. Matís collaborates with a wide net of national and international partners. Sustainable food manufacturing and food security is in line with the Sustainable Development Goals of the United Nations (SDG17) that have contributed to strengthen MATÍS's relevance.

MATÍS was granted a total of 7,496,000 ISK from the Icelandic Research Fund into Arctic research in the years 2009 to 2019, which is 0.57% of the total amount from the fund that went into Arctic research.

Svarmi
Svarmi is a company specialized in mapping with drones. The focus has shifted from selling custom-made drones to data service. Svarmi is now a leading expert in Iceland in remote sensing data for scientific and industrial purposes. Svarmi has one instance of participation in Horizon 2020 in the FutureArctic project, A Glimpse into the Arctic Future: Equipping a Unique Experiment for Next-generation Ecosystem Research.[70]

Svarmi was granted a total of €274,331 (35,084,192 ISK) from Horizon 2020 for participation in the Arctic-related project FutureArctic, which is 3.75% of the total amount granted for Icelandic participation in EU Horizon 2020 Arctic projects.

Icelandic Arctic Chamber of Commerce
The objective of the Chamber is to promote and maintain commercial links between Iceland and other Arctic States. In accordance with the Chamber's objective it shall guard the commercial interest of its members in respect of the Arctic, organize meetings and conferences concerning common matters on commercial opportunities in the Arctic, organize visits by parties within the business community in the Arctic States and other interested parties, work with governments, universities and other relevant parties in Iceland and abroad, e.g. to co-ordinate commercial related matters with regards to the Arctic and finally render direct services as decided by the Board, i.e. providing information about business contacts, assisting in establishing links between companies and distributing information relating to commerce in the Arctic States.[71]

Arctic Services
Arctic Services is an association between a number of companies and institutions in the Eyjafjörður area, central North Iceland. The association's participants possess expertise and experience relevant to construction projects in the Arctic, such as companies that conduct industrial and technical services, research, engineering and aviation, as well as public utilities in the area.[72]

67 Projects - The National Power Company of Iceland. Retrieved 17.9.2020: https://www.landsvirkjun.com/researchdevelopment
68 Samið um rannsóknir á sjálfbærri orku á Norðurslóðum. Fréttir. Veðurstofa Íslands. Retrieved 18.9.2020: https://www.vedur.is/um-vi/frettir/samid-um-rannsoknir-a-sjalfbaerri-orku-a-nordurslodum
69 GRÓ-FTP signs new partnership agreement with Matís. Fisheries Training Programme under the auspice of UNESCO. Retrieved 13.10.2020: https://www.grocentre.is/ftp/media-ftp/news-ftp/gro-ftp-signs-new-partnership-agreement-with-matis
70 Drone Mapping & Survey. Data Service - Svarmi Iceland. 2020. Retrieved 17.9.2020: https://svarmi.is/
71 Arctic Chambers of Commerce. Retrieved 4.11.2020: http://iacc.is/en/about_us/
72 Arctic Services: Industrial & technical service providers in Akureyri, North Iceland. Retrieved 17.9.2020: http://www.arcticservices.is/en

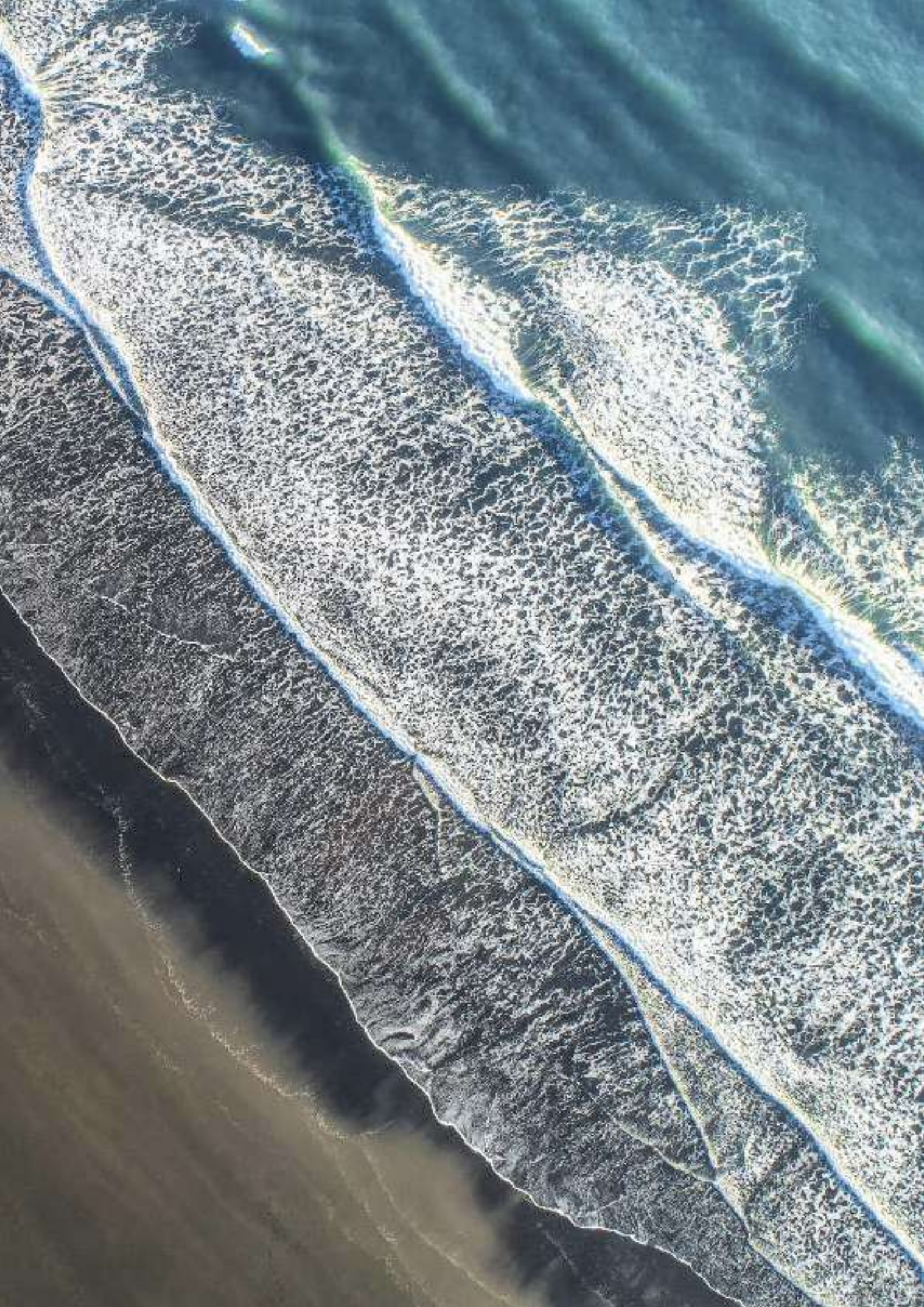
Auðna - Technology Transfer Office Iceland

The Technology- and Knowledge Transfer Office is for all universities and foremost public research organisations in Iceland and is a non-profit organisation with the mission to transform inventions into solutions with societal- and economic impact. The office supports the scientific community in Iceland with advice on intellectual property protection, analyses market- and patent landscapes, connects inventions and innovative research projects with investors and the industry, and enables science and technology to benefit society by commercialisation, both nationally and internationally.[73] Auðna has proposed to the ASM3 organisers to initiate a Nordic Collaboration network among knowledge- and technology transfer offices in the Nordic countries to synergistically provide scientific solutions and technology that respond to climate change and marine environment in the Arctic.

Iceland Ocean Cluster

The Iceland Ocean Cluster delivers a range of services for the marine industries through its mission of increasing value by connecting entrepreneurs, businesses and knowledge. Its research focus is on seafood, by-product utilization, marine biotech and other marine industries. The Cluster operates a cooperation platform with selected businesses. Membership provides businesses with opportunities to interact closely with the industry, partake in events, global projects, new projects and spin-off business development.[74] The Icelandic Ocean Cluster has participated in one Arctic research project, DisruptAqua, with grants from the Northern Periphery and Arctic Programme.[75]

73 Technology Transfer Office Iceland. 2020. Retrieved 17.9.2020: https://ttoiceland.is/
74 Iceland Ocean Cluster. About Us. Retrieved 17.9.2020: http://www.sjavarklasinn.is/en/
75 Funded Projects. Retrieved 17.9.2020: http://www.interreg-npa.eu/projects/funded-projects/project/241/



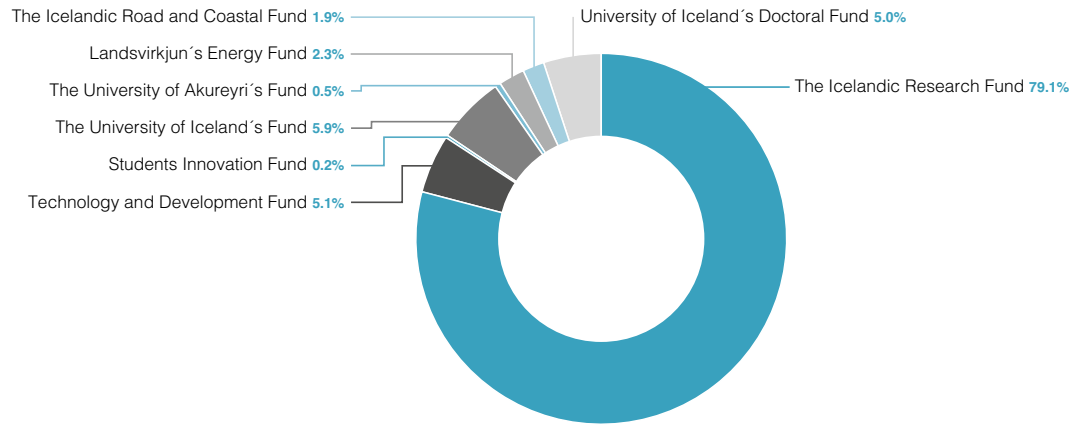
Funds

A number of funds support research studies, research, technology development and innovation in Iceland. Many of them are located within institutions and are only open for applicants within these respective institutions (for example, at HEIs, the university hospital etc.). Other funds are open to all, although they all make formal demands of their applicants regarding education, experience and more. No fund specifically targets Arctic research; however an attempt will be made to estimate what proportion of research grants goes to Arctic research.

National Funds

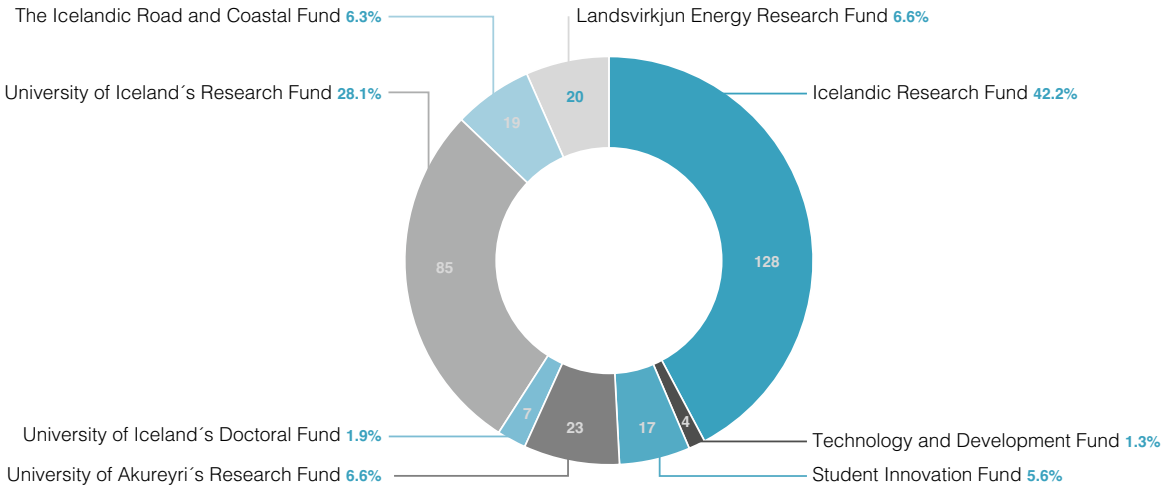
In figure 4 the amount of grants from domestic funds to Arctic research projects is illustrated. The total amount of funding from the national funds for Arctic research projects in the years 2009-2019 is 1,493,200,788 ISK. The total amount granted from the Icelandic Research Fund in the years 2009-2019 was 1,180,897,000 ISK, which is 79,1% of the total amount granted from domestic funds.

Figure 4: Amount of grants from domestic funds to Arctic research projects in percentages



The percentage of participation instances in Arctic research projects with grants from the funds in the years 2009-2019, and its distribution is shown in figure 5. The total number of Arctic research projects that received grants from domestic funds is 204, with 303 participation instances of Icelandic partners.

Figure 5: Percentage of participation instances in Arctic research by funds



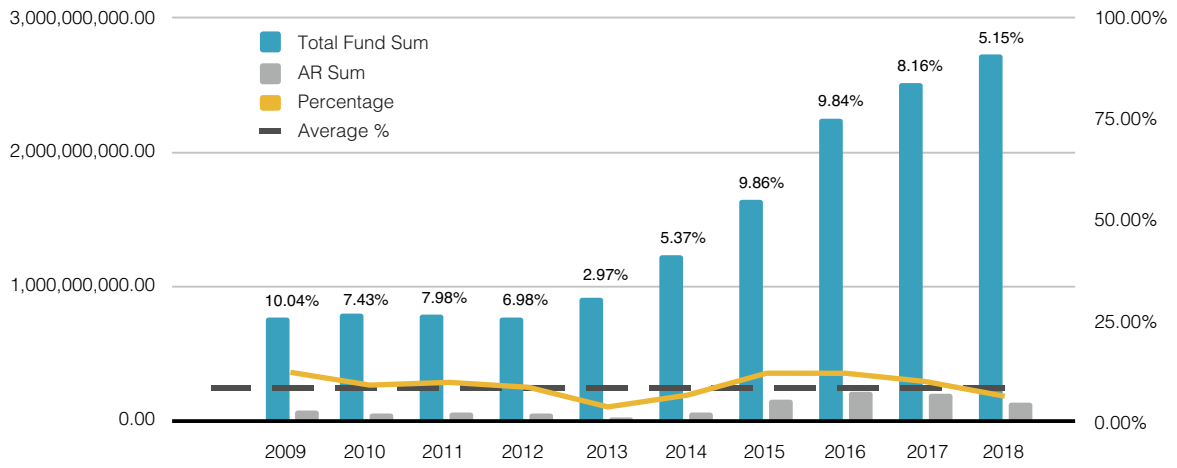
The Icelandic Research Fund

The Icelandic Research Fund is an open competitive fund that provides grants according to the general emphasis of the Science and Technology Council and the professional evaluation of the quality of the research project. The role of the fund is to encourage and strengthen scientific research and research-related postgraduate studies and defined research projects for individuals, research groups, universities, research institutes and companies.

The Icelandic Research Fund granted 1,180,897,000 ISK to Arctic research out of the total fund of 17,038,000,000 ISK, which was distributed in the years 2009 to 2019 and counted for 6.93% of the total available funding over the period. Of national funds, the amount of grants from the Icelandic Research Fund accounts for 79.08% of the total research funding in Iceland that goes into Arctic research.

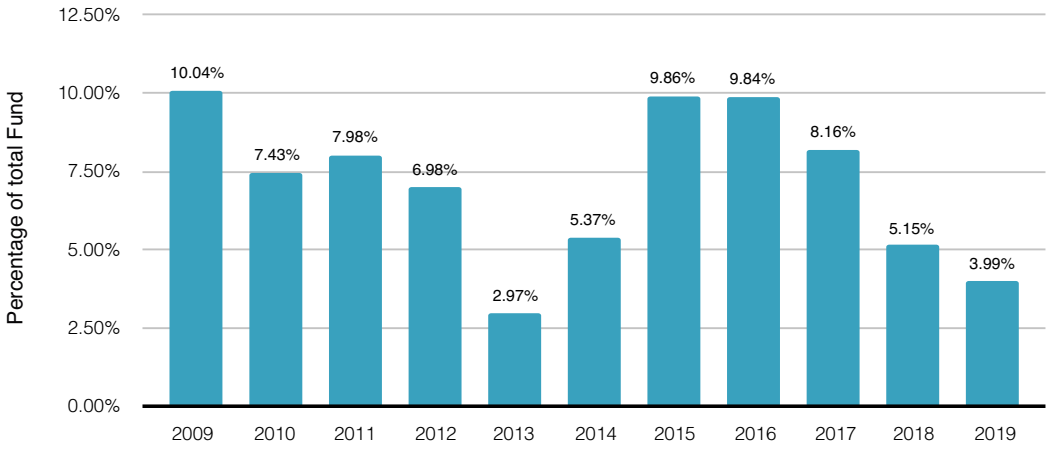
In figure 6 the total sum granted to Arctic research from the Icelandic Research Fund is illustrated and compared to the total amount granted from the Icelandic Research Fund to the overall research projects in Iceland.

Figure 6: The Icelandic Research Fund - Proportion of Arctic research and total amounts



The percentage of granted amount to Arctic research from the Icelandic Research Fund is illustrated in figure 7.

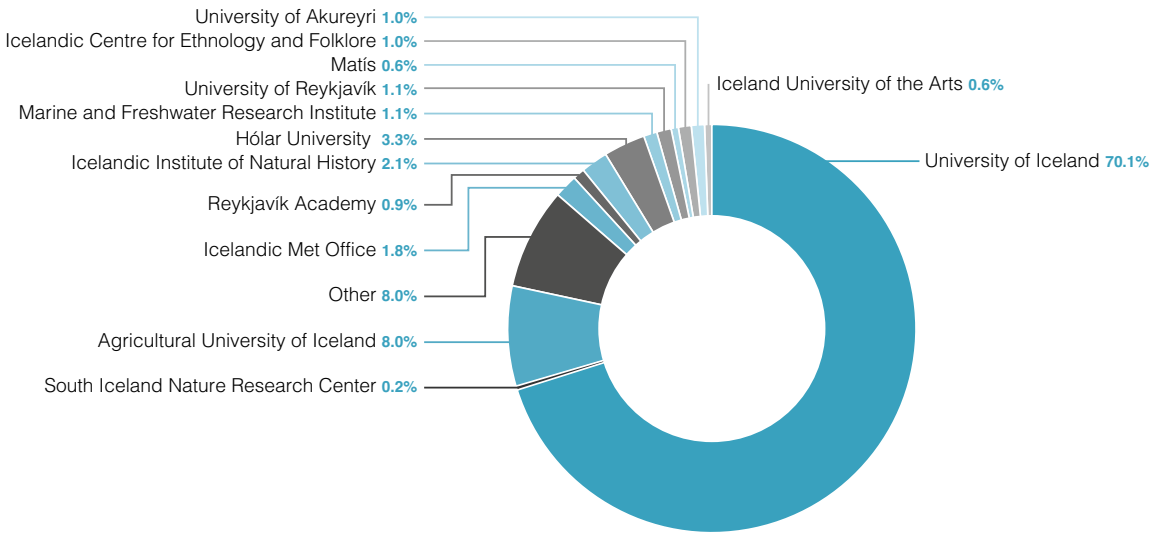
Figure 7: Percentage of total budget granted to Arctic research by the Icelandic Research Fund



The budget distribution to Arctic research performers from the Icelandic Research Fund is illustrated in figure

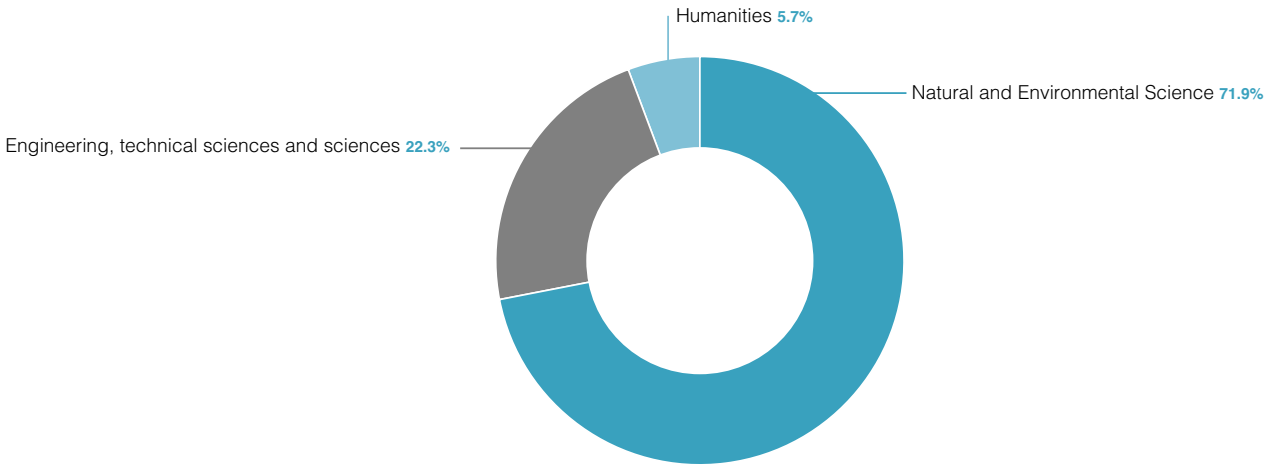
8. The largest part goes to the University of Iceland, which is the oldest and largest university in the country and covering the most scientific fields.

Figure 8: Allocation of grants to Arctic research performers from the Icelandic Research Fund in percentages.



In figure 9 the division of disciplines in Arctic research with funding from the Icelandic Research Fund is shown. It is interesting to note the large share of the fund that goes to Natural Science and Environment projects, while no part of the funding goes to Social Science projects.

Figure 9: Division of scientific fields in Arctic research with funding from the Icelandic Research Fund 2009-2019



The Technology Development Fund

The fund offers five different grants depending on the stage of development of each project. The grants are: Fræ, Sproti, Vöxtur, Sprettur and Markaðssprettur, as well as practical research projects. The role of this open competitive fund is to support research and development activities and so encourage innovation in Icelandic industry.

The Technology Development Fund granted 76,175,000 ISK, which was distributed in the years 2009-2019 and that went into Arctic research. Of national funds, the amount of grants from the Technology Development Fund is 5.10% of the total research funding that goes into Arctic research.

The Student Innovation Fund
Grants are paid to students in monthly payments while the supervisor is responsible for facilities and material costs. In addition to the grant, companies are allowed to pay extra salaries to students. A number of students have applied for, and been granted, funding from the Student Innovation Fund to conduct Arctic research.

The Student Innovation Fund granted 3,495,000 ISK, which was distributed in the years 2009-2019 and that went into Arctic research. Of national funds, the amount of grants from the Student Innovation Fund is 0.23% of the total research funding in Iceland that goes into Arctic research.

The Climate Fund
The Climate Fund supports innovation projects in the field of climate and projects dealing with presentation and education of the effects of climate change and which might be relevant to the Arctic. Grants are also meant to support research and development dealing with adaptation of new climate-friendly technological solutions and design. The Climate Fund was established in 2019 and had its first allocation of grants in 2020 and is thus not included in the statistics of research funding.[76]

Strategic Research and Development Programme 2020-2023 (Societal Challenges)
The programme is divided into three categories in line with the emphasis of the Science and Technology Council: Environmental issues and sustainability; health and welfare; and life and work in a changing world. The aim of the grant allocations is to accelerate development within these three categories, some of which might be relevant for Arctic research. Interdisciplinary collaboration and promoting research and innovation is also encouraged. This fund had its first call for proposals in 2020 and has not yet allocated any grants to applicants.[77]

Targeted and Institutional Funds

The Arctic Research and Studies Programme
The Arctic Research and Studies Programme is based on a Memorandum of Understanding between Iceland and Norway in the field of Arctic research. The programme is intended to encourage scientific cooperation between higher education institutions and research organisations in the two countries and is open to applications from Icelandic and Norwegian institutions.[78] This programme is jointly funded by Norway and Iceland.

The amount of grants awarded from the fund in the years 2012-2020 was €1,002,337.4 (137,687,249 ISK).

The University of Iceland's Research Fund
The aim of the University of Iceland's Research Fund is to strengthen research within the University by providing financial support for research projects. All members of the teaching and research staff are entitled to apply (i.e. professors, associate professors, assistant professors, experts, scholars and specialists).[79] The fund is divided into a project fund and a doctoral fund. When assessing the project, their scientific value is primarily assessed.

The University of Iceland's Research Fund granted 88,193,000 ISK, which was distributed in the years 2009-2019 and that went into Arctic research. Of domestic funds, the amount of grants from the University of Iceland's Research Fund is 5.91% of the total funding that goes into Arctic research.[80]

The University of Iceland's Doctoral Fund granted 75,218,788 ISK, which was distributed in the years 2009-2019 and that went into Arctic research. Of domestic funds, the amount of grants from the University of Iceland's Research Fund is 5.04% of the total funding that goes into Arctic research.

76 Loftslagssjóður. Rannsóknamiðstöð Íslands. Retrieved 17.9.2020: https://www.rannis.is/sjodir/rannsoknir/loftslagssjodur/
77 Rannsóknamiðstöð Íslands. Handbook for the Strategic Research and Development Programme 2020-2023. Societal Challenges. Rules for Applicants and Expert Panels. 2020. Retrieved: https://www.rannis.is/media/markaaetlun-samfelgagslegar-askoranir/SRDP_SC-Handbook-2020-2023.pdf
*78 Arctic Research and Studies. Arctic Studies. The Icelandic Centre for Research. Retrieved 17.9.2020: https://en.rannis.is/funding/research/arctic-studies/ * The grants from Arctic Research and Studies Programme are not included in the statistics of allocation of grants to Icelandic entities under domestic funds since the recipients of the grants include both Icelandic and Norwegian*
79 The University of Iceland Research Fund. Sjóðir og styrkir Háskóla Íslands. Retrieved 17.9.2020: https://sjodir.hi.is/node/16131
80 The University of Iceland Research Fund. Sjóðir og styrkir Háskóla Íslands. Retrieved 17.9.2020: https://sjodir.hi.is/node/16131

The University of Akureyri Research Fund
The University of Akureyri Research Fund aims to strengthen research and support scientific activities within the university. The fund is not confined to the teaching and research staff, but extends to institutes and companies that are in active partnership with the University of Akureyri, so as to support scientific operations and innovations in industry within the Eyjafjörður region. The inclusion of early career researchers is highly encouraged, and a special weight is further given to projects involving international scientific cooperation.[81]

The University of Akureyri Research Fund granted 7,272,000 ISK, which was distributed in the years 2009-2019 and that went into Arctic research. Of domestic funds, the amount of grants from the University of Akureyri research Fund is 0,49% of the total research funding in Iceland that goes into Arctic research.

Landsvirkjun's Energy Research Fund
The goal of Landvirkun´s Energy Research Fund is to support research in the fields of environmental and energy affairs, including research on renewable energy, and to award grants to students, university research projects, institutions, companies and individuals researching these areas.

Landsvirkun's Energy Research Fund granted 33,850,000 ISK in the years 2009-2019 that went into Arctic research. Of domestic funds, the amount of grants from Landsvirkjun's Energy Research Fund is 2.27% of the total research funding in Iceland that goes into Arctic research.

The Icelandic Road and Coastal Administration's Research Fund
Research and development work have always been a part of the Icelandic Road and Coastal Administration's activities. Grants are awarded annually for research projects and are financed mostly by so-called experimental funds, which according to the Road Act should be 1.5% of the institute's market revenue.

The Icelandic Road and Coastal Administration's research and development work aims to acquire new knowledge in the field of road and transport, for instance by participating in foreign research collaboration and by putting domestic and foreign knowledge to practical use. It also promotes the findings of research and development regarding methods and material use and regarding the environment and good coexistence between society and road and transport.[82]

The Icelandic Road and Coastal Administration's Research Fund granted 28,100,000 ISK in the years 2009-2019 that went into Arctic research. Of domestic funds, the amount of grants from the Icelandic Road and Coastal Administration's Research Fund is 1.88% of the total research funding in Iceland that goes into Arctic research.

The Greenland Fund
The role of the Greenland Fund is to strengthen relations between Greenland and Iceland. The Central Bank of Iceland is custodian of the fund and provides three million ISK for grants annually. The fund offers grants for study trips, art exhibitions, sporting events and other issues in the field of culture, education, and science that can contribute to increased communication between Greenlanders and Icelanders.[83]

International Funds

European Cooperation Programmes
The European Union (EU) consists of 27 member states that are located primarily in Europe. The EU has developed an internal single market through a standardized system of laws that apply in all member states. The European Council notes that many of the issues affecting the region are of a global nature and more effectively addressed through regional or multilateral cooperation. The EU´s Arctic Policy notes that the EU should continue to make a significant contribution both regionally and multilaterally when it comes to Arctic matters.[84] Rannís services Icelandic participation in the Framework Programmes and follows European funding mechanisms.

81 University of Akureyri Research Fund. University of Akureyri Research Centre. Retrieved 17.9.2020:https://www.rha.is/en/research-administration/funds/university-of-akureyri-research-fund
82 Rannsóknir og þróun. Vegagerðin. Retrieved 17.9.2020: http://www.vegagerdin.is/um-vegagerdina/rannsoknir-og-throun/
83 Stjórnarráðið. Grænlandssjóður. Retrieved 17.9.2020: https://www.stjornarradid.is/verkefni/menningarmal/styrkir-og-sjodir/graenlandssjodur/
84 EU Arctic Policy: Council adopts conclusions - Consilium. 2019. Retrieved 17.9.2020: https://www.consilium.europa.eu/en/press/press-releases/2019/12/09/eu-arctic-policy-council-adopts-conclusions/

EU Framework Programmes on Research and Innovation 1-7

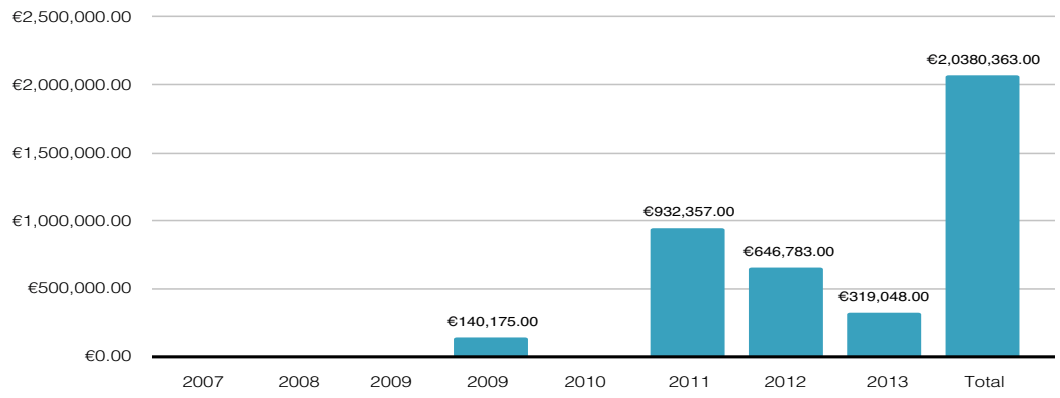
The Framework Programme on research and innovation has had seven periods before Horizon 2020. The programmes were scheduled to support research and innovation in the fields of science and education to enhance Europe's competitiveness and contribute to increased research. The Framework Programmes (FP) have been the main financial tools through which the European Union supports research and development activities covering almost all scientific disciplines. FPs are proposed by the European Commission and adopted by its Council and the European Parliament following a co-decision procedure.

Since 1984, European Community research and technological development activities have been defined and implemented by a series of multi-annual Framework Programmes. Iceland has participated in the EU Framework Programmes from FP4, or from the onset of the EEA-Agreement, with growing participation and success. There has also been a rise in Arctic research projects in the FPs. For the case of this study, the first Arctic research project was funded in FP7, while there were no Arctic research projects with Icelandic participation in FP6.

EU Framework Programme on Research and Innovation 7

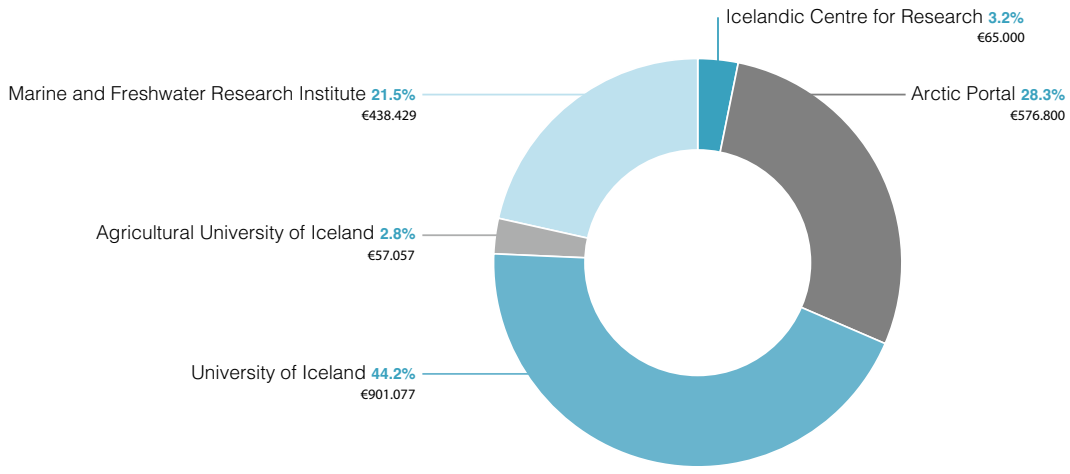
The total grants from FP7 to Icelandic participants for Arctic research was €2,038,363 (328,244,676 ISK) out of the €67,591,003, which resulted in 3.02%. In figure 10 the total sum granted to Icelandic participants for Arctic projects from FP7 is illustrated.

Figure 10: Grants to Icelandic participants in EU FP7 Arctic projects



In figure 11 the grant allocation to Icelandic participants from FP7 is illustrated in amount and percentages.

Figure 11: Grant allocation to Icelandic participants in EU FP7 funded Arctic projects in percentages



In figure 12 the count of participation of Icelandic partners in EU FP7 Arctic research projects is shown.

Figure 12: Count of participation of Icelandic partners in Arctic research projects.

Participant	Instance
University of Iceland	4
Arctic Portal	1
Icelandic Centre for Research	1
Agricultural University of Iceland	1
Marine and Freshwater Research Institute	1
Total	**8**

Horizon 2020

Horizon 2020 is the largest EU research programme to date and is in force for 2014-2020. The total funding of the programme amounted to 80 billion euros. The programme aims to support research and innovation in all fields of science and education to enhance Europe's competitiveness, as well as creating jobs and ensuring that a greater number of good ideas reach the market. The plan reflects the fundamental objectives of the EU's support for sustainable economic growth in Europe.

The percentage of Arctic research projects out of the total funding from Horizon 2020 to Icelandic participants is 6.08% and accounted for about €7,322,932 (992,914,422 ISK) to Arctic research projects. The total amount of grants from Horizon 2020 to Icelandic participants is €120,398,311.

The amount of funding from Horizon 2020 that went to Icelandic participants in Arctic research each year is illustrated in figure 13.

Figure 13: Grants to Icelandic participants for EU Horizon 2020 Arctic projects

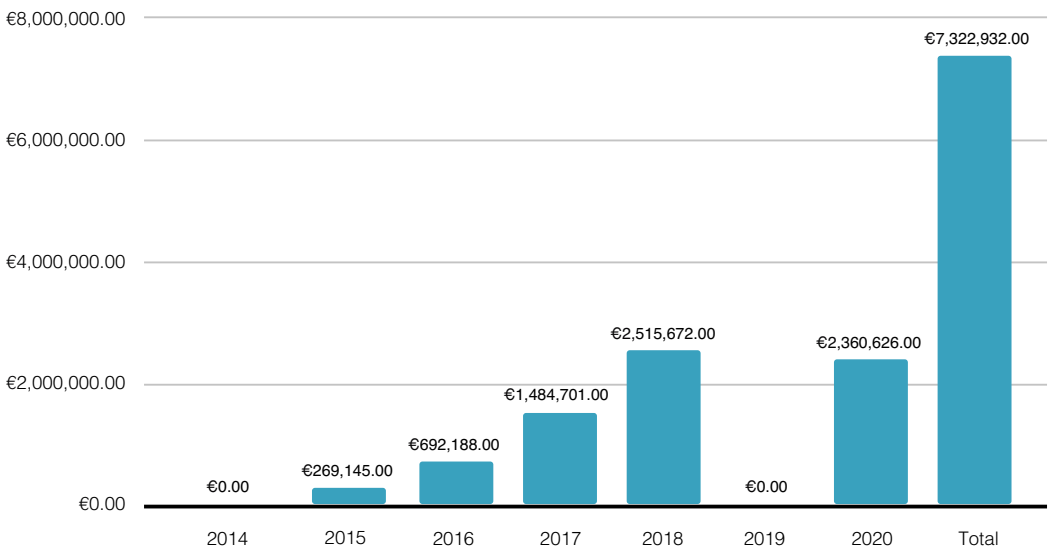
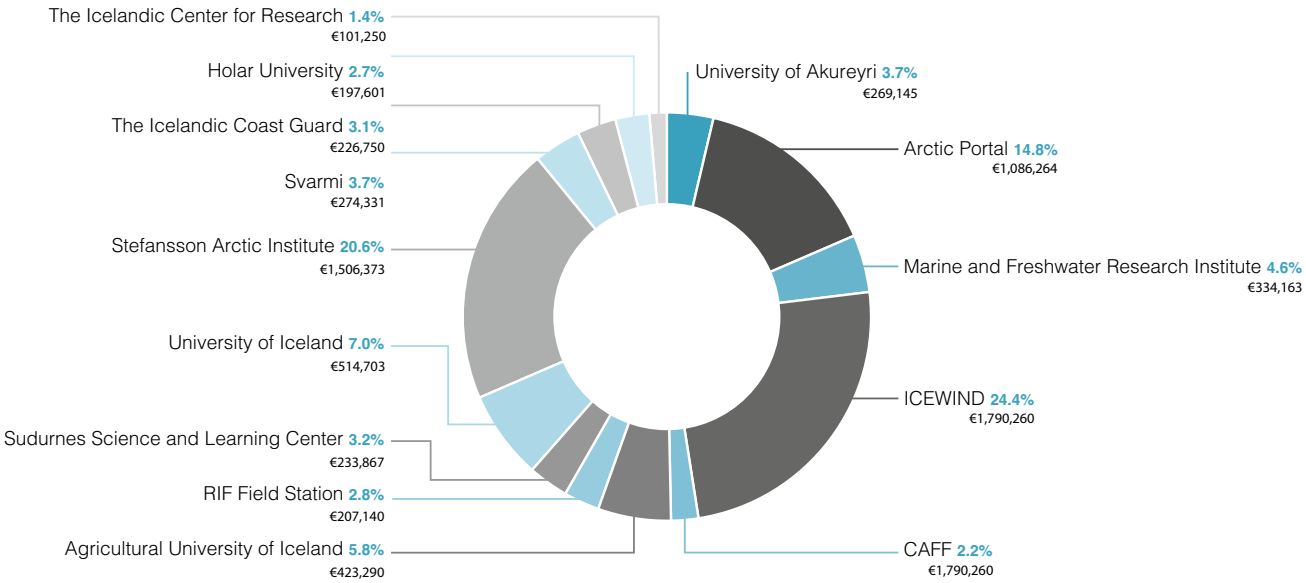


Figure 14 illustrates allocation of grants to Icelandic participants in EU Horizon 2020 funded projects for Arctic research.

Figure 14: Grant allocation to Icelandic participants in Horizon 2020 funded projects in percentages



The three research performers who have the most participation instances in EU Horizon 2020 projects are Arctic Portal, the University of Iceland and the Agricultural University of Iceland. Of the Icelandic participation in EU Horizon 2020 projects, ICEWIND, the Stefansson Arctic Institute and Arctic Portal received the biggest portion of the budget. That considered, certain partners do have frequent participation in Arctic research projects but receive smaller grants. Therefore, both the participation instances and the amount of funding received need to be considered when analysing participation of Icelandic research performers in Arctic research.

The count of participation of Icelandic partners in Arctic research projects with funding from EU Horizon 2020 are shown in the following table.

Figure 15: Count of participation of Icelandic partners in Arctic research projects.

Participant	Instance
Arctic Portal	6
Agricultural University of Iceland	4
University of Iceland	3
Suðurnes Science and Learning Center	2
Stefansson Arctic Institute	2
Rif Field Station	2
Marine and Freshwater Research Institute	2
CAFF	2
ICEWIND	2
Icelandic Centre for Research	1
University of Akureyri	1
Svarmi	1
Icelandic Institute of Natural History	1
Icelandic Coast Guard	1
Holar University	1
Total	**31**

Horizon Europe
Horizon Europe is a continuation of Horizon 2020, and part of the EU's research programme covering the years 2021-2027. According to numbers from April 2019, it is estimated that the capital to be invested in the project will be EUR 94,1 billion - in contrast to EUR 77 billion in Horizon 2020.[85]

Erasmus Programmes
Erasmus+ is the EU's programme to support education, training, youth and sport in Europe. Its budget of €14.7 billion will provide opportunities for over 4 million Europeans to study, train, gain experience, and volunteer abroad. Set to last until 2020, Erasmus+ does not just have opportunities for students. By merging seven prior programmes, it has opportunities for a wide variety of individuals and organisations.[86]

Iceland started participating in the EU's Erasmus programmes in 1991 and since then over 30 thousand individuals have participated.

EEA grants
The European Economic Area is an international agreement which permits the extension of the European Union's single market to member states of the European Free Trade Association. The EEA links the EU member states and three EFTA states, Iceland, Liechtenstein and Norway, into an internal market governed by the same basic rules. The agreement aims to enable free movement of persons, goods, services, and capital within the European single market, including the freedom to choose residency in any country within this area.

The EEA and Norway Grants are funded by Iceland, Liechtenstein and Norway. The Grants have two goals – to contribute to a more equal Europe, both socially and economically – and to strengthen relations between Iceland, Liechtenstein and Norway and the 15 beneficiary countries in Europe. The total budget in the years 2014-2021 for EEA Grants is €1,5 billion and for Norway Grants €1,3 billion.[87]

Legal entities in the beneficiary countries apply for EEA Grants in open calls (which account for 98% of the EEA Grants funding) and in accordance with the fund's policy. The condition for granting the projects (with a few exceptions) is that there is at least one project partner from Iceland, Liechtenstein and Norway involved in the project.

Institutions, universities, companies, municipalities, organisations, students and teachers can all apply for grants from the programme, which is intended for collaboration in research, innovation, education and culture within the funds receiving states. Several Arctic-focused projects and events have been sponsored by the EEA and Norway Grants to date, including in Poland, Estonia and the Czech Republic.

Northern Periphery and Arctic Programme & the Northern Periphery Programme
The Northern Periphery and Arctic Programme (NPA) 2014-2020 is a cooperation between nine programme partner countries which encompass the Euro-Arctic zone, parts of the Atlantic zone and parts of the Barents region. It was established in 2014 and built upon its predecessor, the Northern Periphery Programme, which ended in 2013. The Programme is part of the EU initiative Interreg and its aims are divided into four priorities: Using innovation for the benefit of communities, promoting entrepreneurship to realize the area's potential, fostering energy-secure communities, and protecting, promoting and developing cultural and natural heritage. Approximately EUR 56 million was allocated on bi-annual calls through the programme, of which €43,414,205 went to projects where Icelandic institutes were partners during the NPA 2014-2020. NPA 2021-2027 will replace NPA 2014-2020.[88]

Nordic Cooperation

Nordic Council of Ministers
The Nordic Council of Ministers is the official body for intergovernmental cooperation in the Nordic Region. Set up in 1971, the Council consists of Denmark, Finland, Iceland, Norway, and Sweden. However, the Faroe

85 Horizon Europe - the next research and innovation framework programme. European Commission. Retrieved 13.10.2020: https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en#implementing-horizon-europe-strategic-planning
86 Erasmus+ Education and training. The Icelandic Centre for Research. Retrieved 17.9.2020: https://en.rannis.is/funding/education/erasmus-education-and-training/
87 About Us. EEA Grants. Retrieved 19.9.2020: https://eeagrants.org/about-us
88 Northern Periphery and Arctic Programme 2014-2020. Retrieved 17.9.2020: http://www.interreg-npa.eu/

Islands, Greenland and Åland practically enjoy the same representation as the other members. As all Nordic countries belong, at least partly, to the Arctic region, some Nordic funding might be linked to the Arctic. The Prime Ministers' vision is that the Nordic region will become the most sustainable and integrated region in the world by 2030. Cooperation within the Nordic Council of Ministers must strive towards this purpose.[89]

NordForsk

NordForsk is a Nordic institution operating under the auspices of the Nordic Council of Ministers for Education and Research and was established in 2005. Its role is to supervise cooperation in the field of research and research education in the Nordic countries. The work considers integration, funding and advice related to the project. NordForsk subsidizes projects in many areas, including the Arctic with a capital of NOK 116 million. NordForsk funds Nordic infrastructure cooperation through open calls for proposals. NordForsk decided in December 2015 to establish four Nordic Centres of Excellence in Arctic research, however Arctic research is also funded through other thematic areas of NordForsk funds.[90]

Nordplus

The Nordplus Programme offers financial support to a variety of educational cooperation projects between partners in the area of lifelong learning from the eight participating countries and three autonomous regions in the Baltic and Nordic area. More than 10,000 people from the Baltic and Nordic region benefit from it.[91]

NORDREGIO

Nordregio is a leading Nordic and European research centre for regional development and planning, including the Nordic Arctic, established by the Nordic Council of Ministers. Nordregio works on commissioned projects that help policymakers and practitioners tackle economic and social challenges, and more general planning of governance.[92] One of those projects is the Arctic Cooperation Programme, detailed below, which Nordregio operates for the Nordic Council of Ministers.

Arctic Cooperation Programme 2015-2017

The Arctic Cooperation Programme supplements other Nordic Council of Ministers' programmes, strategies and initiatives that address issues relevant to the Arctic. The programme is designed to ensure coherence between the work done on Arctic issues by the various councils of Nordic ministers. It provides a proportion of the funding for the Nordic Council of Ministers' activities in the Arctic and is administered by the ministers for the Cooperation. Nordregio administered a yearly budget of approximately 6 million DKK for the programme.[93]

Arctic Cooperation Programme 2018-2021

The purpose of the Arctic Cooperation Programme 2018-2021 is to create sustainable and constructive development in the Arctic and for its people, based on the planet, people, prosperity, peace and partnerships. The strength of the programme is its wide range and the ability to reach out to smaller stakeholders in the Arctic. The programme aims at contributing to policy-making with its projects and findings. As a rule, three Nordic countries must be involved in a cooperation project. A partnership between three Nordic countries can be supplemented with one or more non-Nordic country, as long as they meet application criteria. The programme has an annual budget of app. 10 million DKK.[94]

North Atlantic Cooperation (NORA)

The Nordic Atlantic Cooperation (NORA) is an intergovernmental organisation under the regional cooperation programme of the Nordic Council of Ministers bringing together Greenland, Iceland, Faroe Islands and Coastal Norway. The organisation is funded by the Nordic Council of Ministers with supplementary contri-

89 About the Nordic Council of Ministries. Nordic cooperation. Retrieved 17.9.2020: https://www.norden.org/en/information/about-nordic-council-ministers
90 About NordForsk. NordForsk. 2020. Retrieved 17.9.2020: https://www.nordforsk.org/about
91 Home - Nordplus. 2019. Retrieved 17.9.2020: https://www.nordplusonline.org/
92 About. Nordregio. Retrieved 17.9.2020: https://nordregio.org/about/
93 Norden. Arctic Co-operation Programme 2015-2017. 2014. Retrieved 15.10.2020: http://norden.diva-portal.org/smash/get/diva2:768633/FULLTEXT02.pdf
94 Nordic Council of Ministers. Nordic Partnerships for the Arctic. The Nordic Council of Ministers' Arctic Programme 2018-2021. 2017. Retrieved 15.10.2020: http://norden.diva-portal.org/smash/get/diva2:1153655/FULLTEXT01.pdf

butions from the four participating countries. NORA offers funding opportunities to concrete cooperation projects involving partners from at least two NORA countries.[95] Iceland has participated in 137 Arctic-related projects out of a total of 184 NORA research projects.

Other International Cooperation

Belmont Forum

Established in 2009, the Belmont Forum is a partnership of funding organisations, international science councils, and regional consortia committed to the advancement of transdisciplinary science. Forum operations are guided by the Belmont Challenge, a vision document that encourages: "International transdisciplinary research providing knowledge for understanding, mitigating and adapting to global environmental change." Forum members and partner organisations work collaboratively to meet this challenge by issuing international calls for proposals, committing to best practices for open data access, and providing transdisciplinary training. Iceland participates in three Belmont Forum funded Arctic projects: Arctic Wetlands Ecosystem - Resilience through Restoration & Stewardship (AWERRS); From Nunavik to Iceland: Climate, Human and Culture through time across the coastal (sub) Arctic North Atlantic (NICH-Arctic); Scenario of freshwater biodiversity and ecosystem services in a changing Arctic (ARCTIC-BIODIVER) where CAFF is a partner. The Icelandic participation in these projects is based on in-kind contributions from the respective institutes.[96]

Fulbright Arctic Initiative

Fulbright's mission is to foster collaboration between Icelandic and U.S. scholars, scientists, students and artists. Fulbright Iceland has a partnership with the National Science Foundation in the U.S. with grant programmes focused on two areas that are currently prioritized by both countries: Fulbright-NSF Arctic research grants and the Fulbright-NSF grant in cyber-security and critical infrastructure.[97]

Fulbright Arctic Initiative brings together a network of scholars, professional and applied researchers from eight Arctic countries for a series of three seminar meetings and a Fulbright exchange experience to address key research and policy questions related to creating a sustainable and secure Arctic. It offers interdisciplinary collaboration where issues are examined in a holistic way and anyone working on Arctic-related projects is encouraged to apply.[98] Icelandic participants in the Fulbright Arctic Initiative have come from the University of Iceland and Reykjavík University.

95 NORA. Retrieved 17.9.2020: https://nora.fo/hvad-er-nora?_l=no
96 Projects. 2017. Retrieved 17.9.2020: https://www.belmontforum.org/projects/?fwp_project_countries=iceland%22%20\h
97 US Scholars & Specialists. Fulbright. Retrieved 17.9.2020: https://fulbright.is/grants-to-iceland/us-scholars/
98 Fulbright Arctic Initiative. Fulbright Scholar Program. Retrieved 17.9.2020: https://www.cies.org/program/fulbright-arctic-initiative

Photo accreditation: Arctic Circle

Platforms

This section describes selected international platforms which are relevant for Arctic research cooperation and collaboration.

Arctic Circle

The Arctic Circle is the largest network of international dialogue and cooperation on the future of the Arctic. The organisation holds an annual Assembly which attracts more than 2000 participants from more than 60 countries to Reykjavik, Iceland. The Assembly is open to all and attended by heads of states, government officials, scientists, entrepreneurs, students, and more.

The Arctic Circle also organises forums on specific areas of Arctic cooperation in collaboration with various countries and institutions. Forums have been held in China, Alaska, the Faroe Islands, Québec and elsewhere. Future forums are scheduled to be held in Berlin, Tokyo and Abu Dhabi. Both the Arctic Circle Assemblies and Forums have been extremely useful and important for dialogue between scientists and policy makers on the rapid changes occurring in the Arctic. The Arctic Circle has raised the profile of Iceland in international Arctic cooperation in various sectors, not least in Arctic Science.[99] The 2020 October assembly in Reykjavík was postponed due to the COVID-19 pandemic.

Resilience Forum

The Arctic Resilience Forum is hosted by the Icelandic Chairmanship of the Arctic Council and co-organized by the Council's Sustainable Development Working Group and the Arctic Initiative at Harvard Kennedy School's Belfer Center. It is the second forum organized since the Council's Arctic Resilience Action Framework (ARAF) was endorsed at the 10th Arctic Council Ministerial meeting in Fairbanks, USA in May 2017.

The forum seeks to actively engage participants in discussion about how to build the resilience of Arctic communities and ecosystems. It offers the opportunity to discuss concrete best practices and experiences from the Council and the broader community of circumpolar experts and knowledge holders. The Arctic Resilience Forum aims to continue to strengthen cooperation of resilience work.[100]

Arctic Science Summit Week (ASSW)

The Arctic Science Summit Week (ASSW) was initiated by the International Arctic Science Committee (IASC) in 1999 to provide opportunities for coordination, cooperation and collaboration between the various scientific organisations involved in Arctic research and to economize on travel and time. Since its inception it has evolved into the most important annual gathering of the Arctic research organisations. The 2020 ASSW was to be held in Akureyri, Iceland, but moved online due to COVID-19. ASSW 2021 is to be held in Lisbon, Portugal.[101]

International Conference on Arctic Research Planning (ICARP)

ICARP is an Arctic Science Conference, convened decennially by IASC and its partners to identify key scientific questions and issues relating to the Arctic.

First held in Hanover NH, US, in 1995, ICARP I reviewed the state of Arctic research and resulted in a series of IASC-supported research projects. The second ICARP was then held in Copenhagen in 2005 at which several plans were developed and resulted in international projects and programmes. Finally, ICARP III was held across ASSW 2014 and 2015 with the aim of identifying Arctic science priorities for the next decade, coordinating Arctic research, informing policymakers, both Arctic and non-Arctic people, and building relationships.[102] ICARP IV is to be held in 2025 and preparations will get underway at ICASS X.[103]

99 About - Arctic Circle. Retrieved 17.9.2020: http://www.arcticcircle.org/about/about
100 Arctic Council. Virtual Arctic Resilience Forum launches in October. 2020. Retrieved 15.10.2020: https://arctic-council.org/en/news/virtual-arctic-resilience-forum-launches-in-october/
101 About ASSW - International Arctic Science Committee. Retrieved 17.9.2020: https://iasc.info/assw/about-assw
102 IASC. ICARP III. Integrating Arctic Research - Roadmap for the Future. 3rd International Conference on Arctic Research Planning. Retrieved 17.9.2020: https://icarp.iasc.info/images/articles/downloads/ICARPIII_Final_Report.pdf
103 Program. ICASS X. 2020. Retrieved 17.9.2020: https://icass.uni.edu/program

Arctic Encounter Symposium

The Arctic Encounter Symposium (AES) is the largest annual Arctic policy event in the United States. The event is held in Seattle, WA, USA, and attracts roughly 300 participants to address the most pressing challenges and innovative ideas in the Arctic region.[104]

Arctic Frontiers

Arctic Frontiers is an annual conference held in Tromsø, Norway. The main premise behind Arctic Frontiers is to couple academia with decision makers from government and business, linking policy, business and science for responsible and sustainable development of the Arctic.[105]

Arctic Futures Symposium

Arctic Futures Symposium is an annual event bringing together Arctic stakeholders, the EU community and the public to discuss challenges facing the Arctic. The conference is held in Brussels for the benefit of European institutions and is free of charge to increase accessibility.[106]

The Arctic: Territory of Dialogue International Arctic Forum

The International Arctic Forum is an annual conference held in Russia and was first held in 2010. In 2019 the Forum attracted more than 3600 participants from 51 countries, mainly from Russia. The Forum brings together government bodies, international organisations, and the scientific and business communities of Russia and other countries for a focused discussion and comprehensive exchange of views on current issues impacting sustainable growth in the Arctic region.[107]

The China-Nordic Arctic Research Center

The China-Nordic Research Center (CNARC) was established in December 2013 by 10 Member Institutes, four Chinese and six Nordic, all of which have the capacity to influence and coordinate Arctic research. CNARC's research themes include: Arctic climate change and its impacts, Arctic resources, shipping and economic cooperation, and Arctic policymaking and legislation. Its purpose is to provide a platform for academic cooperation to increase awareness, understanding and knowledge of the Arctic and its global impacts, as well as to promote cooperation for sustainable development of the Nordic Arctic and coherent development of China in a global context. CNARC has hosted seven China-Nordic Arctic Cooperation Symposia on a predetermined topic with regards to Arctic research, rotating annually between Chinese and Nordic member institutes. The second CNARC symposia was hosted in Akureyri, Iceland, in June 2014 by Rannís, the University of Akureyri and the Icelandic Arctic Cooperation Network. Rannís is a founding member of CNARC and the University of Akureyri joined as a member of CNARC in 2017.[108]

The European Polar Board

The European Polar Board (EPB) is an independent organisation established in 1995 and an independent entity since 2015 with its Secretariat hosted by the Dutch Research Council (NWO) in The Hague. The EPB focuses on major strategic priorities in the Arctic and Antarctic. EPB members include research institutes, logistic operators, funding agencies, scientific academies and government ministries from across Europe. The EPB promotes multilateral collaborative activities between their members and provides a single contact point for the European Polar Research community as a whole for international partners. Rannís represents the Icelandic scientific community within the EPB.[109]

High North Dialogue

Hosted by the High North Center for Business and Governance at Nord University Business School in Bodø, Norway, the High North Dialogue focuses on business in the Arctic. The annual conference aims to create a platform for discussion and elaboration of ideas for the future of the Arctic region, with an emphasis on innovation and economic growth.[110]

104 About AES - Arctic Encounter Symposium. 2020. Retrieved 17.9.2020: https://www.arcticencounter.com/the-aes-story
105 About us - Arctic Frontiers. Retrieved 17.9.2020: https://www.arcticfrontiers.com/
106 Arctic Future Symposium - about the conference - Arctic Future Symposium. 2020. Retrieved 17.9.2020: https://www.arcticencounter.com/the-aes-story
107 About the Forum. Retrieved 17.9.2020: https://forumarctica.ru/en/the-forum/about/
108 Home - China-Nordic Arctic Research Center - CNARC. Retrieved 17.9.2020: https://www.cnarc.info/
109 Home. European Polar Board. 2018. Retrieved 13.10.2020: http://www.europeanpolarboard.org/
110 www.highnorthdialougue.no. Retrieved 17.9.2020: http://www.highnorthdialogue.no/

International Congress of Arctic Social Sciences

Every three years, a General Assembly is organised by the International Arctic Social Sciences Association (ICASS) where social scientists and researchers on the humanities are welcomed to present their findings on all facets of the Arctic and Sub-Arctic. ICASS IX, the last Congress, was held in Umeå, Sweden, in 2017 and attracted 800 participants from 25 countries. ICASS X was scheduled to be held in Arkhangelsk in June 2020 but was postponed until 2021 due to COVID-19.[111]

Polar Law Symposium

Polar Law describes legal regimes, rules and processes applicable to the Arctic and the Antarctic. The programme was launched by the University of Akureyri (UNAK) and is a novel and innovative field of research.[112]

The Polar Law Institute is a non-profit research and education institution and operates within the University of Akureyri. It was established in June 2009, following the graduation of the first Polar Law students from the University of Akureyri. The Polar Law Institute has primarily focused on organising the annual Polar Law Symposia that are held in September. The 13th Polar Law Symposium will be held online and be hosted by Kobe University, Japan in November 2020.[113]

University of the Arctic

The University of the Arctic (UArctic) is a cooperative network of universities, colleges, research institutes and other organisations concerned with education and research in and about the North.

UArctic builds and strengthens collective resources and collaborative infrastructure that enables member institutions to better serve their constituents and their regions. Through cooperation in education, research and outreach, UArctic enhances human capacity in the North, promotes viable communities and sustainable economies, and forges global partnerships. The aim of UArctic is to empower the people of the Circumpolar North by providing unique educational and research opportunities through collaboration within a powerful network of members.[114] All the Icelandic universities are members of UArctic.[115]

The University of Iceland has a member on the board of UArctic and has a designated staff member from UArctic stationed at the University of Iceland.

UArctic North2North Mobility Programme

The UArctic North2North is a small-scale mobility programme for students, staff and faculty members which provides opportunities to experience different Arctic regions first-hand, and to share experiences face-to-face by allowing study, research and cooperation at other UArctic institutions. Currently all the Arctic countries, except Iceland, either fund North2North exchanges or provide waivers for inbound North-2North students or scholarships for outbound students.

UArctic Congress

The Congress brings together institutional leaders, Indigenous representatives, academics, scientists and students from around the Circumpolar North and beyond. It is an excellent platform for all UArctic members to engage with each other and promote cooperation in circumpolar science and higher education. Together with partners, policy makers and other actors, the UArctic Congress strives to take the Arctic agenda forward by creating and strengthening collaborations that produce new findings and solutions for the future of the Arctic.

111 About IASSA. Retrieved 17.9.2020: https://iassa.org/about-iassa
112 Polar Law Institute. Retrieved 17.9.2020: https://www.polarlaw.is/en
113 HOME. Special Online Session of 13th Polar Law Symposium. 2020. Retrieved 17.9.2020: https://2020polarlawsymposium.org/
114 UArctic - About the UArctic. 2020. Retrieved 17.9.2020: https://www.uarctic.org/about-uarctic/
115 UArctic - Member List. 2020. Retrieved 17.9.2020: https://www.uarctic.org/about-uarctic/members-list/

Projects

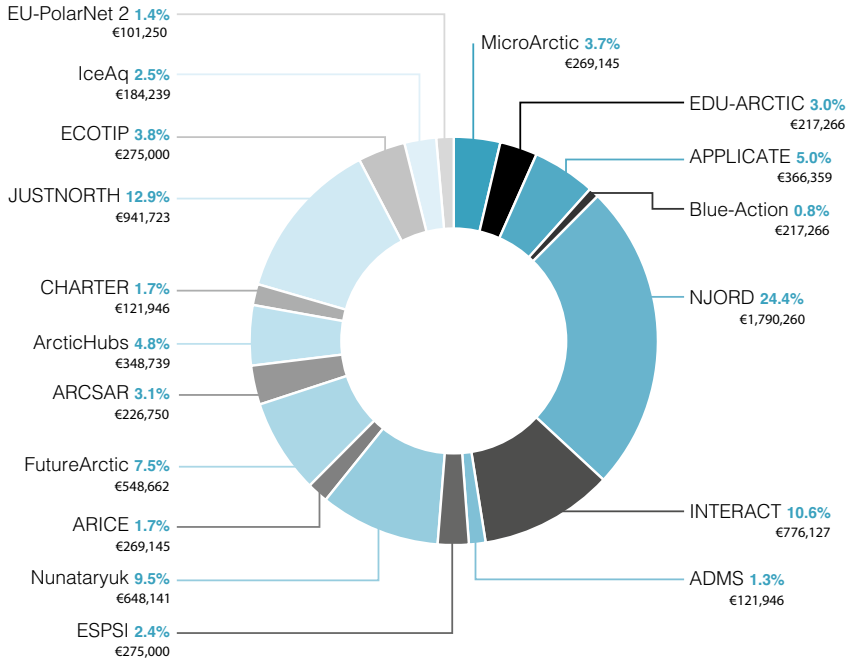
This section outlines selected large transnational projects with Icelandic participation which are mainly supported by the European Union, NordForsk and the Arctic Council.

EU Arctic Cluster Projects

The EU Arctic Cluster is a network of Horizon 2020 and 7th Framework Programme funded Arctic projects and fosters the necessity of providing answers for a changing Arctic. It currently involves 11 projects (described below). With a strong emphasis on climate change and global warming, these projects address a broad spectrum of research and coordination activities: The most up-to-date findings on permafrost and sea ice, enhancing observation to improve predictions, networking of research stations, coordinating access to icebreakers, building scenarios to help local communities adapting to the changing Arctic and more. The Cluster´s activities include merging up-to-date findings on Arctic change and its global implications, providing guidance and policy-relevant information to support the EU in advancing international cooperation, responding to the impacts of climate change and finally promoting sustainable development. The Cluster also provides one entry point to the EU-funded Arctic research.[116]

The distribution of the Horizon 2020 budget within Arctic research projects with Icelandic participation for each project is shown in figure 16.

Figure 16: Budget distribution to EU Arctic projects with Icelandic participation from Horizon 2020 in EUR



Projects with Icelandic Partners

EU Arctic Cluster projects with Icelandic partners are listed and described below.

APPLICATE

APPLICATE (Advanced prediction in Polar regions and beyond: modelling, observing system design and linkages associated with a changing Arctic climate). A focus on the Arctic is important for improved pre-

116 EU Arctic-cluster. The EU Arctic Cluster. Implementing the European Arctic Policy and fostering international cooperation. Retrieved 17.9.2020: http://www.europeanpolarboard.org/fileadmin/user_upload/EU-Arctic-Cluster_Webinar.pdf

dictions of weather and climate in the mid-latitudes because the changes taking place in the Arctic due to climate change - the retreat of sea ice, warming seas and a warming atmosphere - have the potential to influence weather and climate in the mid-latitudes. The impact of severe weather on commerce and infrastructure can be significant, so having adequate tools to predict when and how severe weather systems will affect Europe, Asia and North America is vital to inhabitants of these regions. The APPLICATE project is bringing together an international team of experts in weather and climate prediction to improve climate and weather forecasting models and to work on improving prediction tools while expanding and improving observational capabilities in the Arctic. Arctic Portal is an Icelandic partner in the APPLICATE project.[117]

Arctic Portal was granted 46,234,506 ISK (€366,359) for its participation in the project.

ARCSAR

ARCSAR (Arctic and North Atlantic Security and Emergency Preparedness Network) addresses the Arctic and North-Atlantic (ANA) region, preparing to cope with the security and safety threats that will result from increased commercial activity in the region, including traffic through the Northern passages, cruise traffic and offshore oil and gas activity. It created a social idea management platform to support the improvement of Arctic and North Atlantic search and rescue and oil spill response capabilities. The Icelandic Coast Guard is a participant in ARCSAR.[118]

The Icelandic Coast Guard was granted 31,314,175 ISK (€226,750) for its participation in the project.

ARICE

The Arctic Research Icebreaker Consortium (ARICE) is an international cooperation strategy aiming at improving Europe's Arctic capacities by better coordinating the existing polar research fleet, by offering transnational access to a set of international High Arctic research icebreakers and by collaborating with the maritime industry in a „programme of ships and platforms of opportunity". The Icelandic company Arctic Portal was a participant in the ARICE project.[119]

Arctic Portal was granted 15,056,110 ISK (€122,507) for its participation in the project.

Blue-Action

Blue-Action seeks to understand the linkages between the Arctic and the global climate systems to improve weather and climate modelling and prediction, to improve forecasting of hazardous conditions and climate extremes, and to co-design targeted climate services with relevant stakeholders.

Blue-Action involves over 120 experts from 40 organisations in 17 countries, pooling expertise to improve how we model and predict the impact of warming in the Arctic region. Through a combination of empirical scientific research, advanced statistical techniques and enhanced climate modelling, it aims to improve understanding of the impact of Arctic warming on regional and global atmospheric and oceanic circulation. This project will increase the capacity to predict climate and weather extremes in the Northern Hemisphere. The Marine and Freshwater Research Institute is a participant in the Blue-Action project.[120]

The Marine and Freshwater Research Institute was granted 7,466,371 ISK (€59,163) for its participation in the project.

INTERACT

INTERACT is an infrastructure project under the auspices of SCANNET, a circumarctic network of currently 88 terrestrial field bases in northern Europe, Russia, the US, Canada, Greenland, Iceland, the Faroe Islands and Scotland, as well as stations in northern alpine areas. INTERACT specifically seeks to build capacity for research and monitoring all over the Arctic and is offering access to numerous research stations through the Transnational Access Programme.

117 About - Applicate. Retrieved 17.9.2020. https://applicate.eu/about-the-project
118 Front Page. Retrieved 17.9.2020: https://arcsar.eu/#about-3
119 About - Arctic Research Icebreaker Cons. Retrieved 17.9.2020: https://www.arice.eu/about
120 Blue-Action. Retrieved 17.9.2020: http://blue-action.eu/

This EU interdisciplinary project, which embraces the fields of glaciology, permafrost, climate, ecology, biodiversity and biogeochemical cycling, has a main objective to build capacity for identifying, understanding, predicting and responding to diverse environmental changes throughout the wide environmental and land-use envelopes of the Arctic.[121] This is necessary because the Arctic is so vast and so sparsely populated that environmental observing capacity is limited compared to most other latitudes. The Icelandic partners in the INTERACT projects are the Suðurnes Science and Learning Center, Arctic Portal, the Rif Field Station, the Agricultural University of Iceland and CAFF. The project did receive a second funding in 2020, the same Icelandic partners were participants.

Icelandic participants were granted a total of 99,846,210 ISK (€776,127) for their participation in the project.

NUNATARYUK

NUNATARYUK, an ongoing project 2017-2022, will determine the impact of thawing coastal and subsea permafrost on the global climate and will develop targeted and co-designed adaptation and mitigation strategies for the Arctic coastal population.

The project will be guided by a Stakeholders' Forum of representatives from Arctic coastal communities and Indigenous societies, creating a legacy of collaborative community involvement and a mechanism for developing and applying innovative evidence-based interventions to enable the sustainable development of the Arctic.[122] The Icelandic partners in the project were the Stefansson Arctic Institute, and Arctic Portal.[123]

Icelandic participants were granted a total of 86,360,042 ISK (€698,141) for their participation in the project.

CHARTER

The CHARTER project, with the title Drivers and Feedbacks of Changes in the Arctic Terrestrial Biodiversity, involves 21 research institutions across nine countries. The project is an ambitious effort to advance the adaptive capacity of Arctic communities to climatic and biodiversity changes through state-of-the-art synthesis based on thorough data collection, analysis and modelling of Arctic change with major socio-economic implications and feedbacks. The Icelandic partner participating in the CHARTER project is the Agricultural University of Iceland. The CHARTER project is a new EU Horizon 2020 funded project and is therefore not yet considered an EU Arctic Cluster project.[124]

The Agricultural University of Iceland was granted 19,243,079 ISK (€121,946) for its participation in the project.

JUSTNORTH

The project brings together 15 partners from seven disciplines to evaluate the viability of Arctic economic activities. The project started in June 2020 and runs for 3.5 years. The project will merge justice theories with sustainable development goals to enable EU policy coherence towards just transitions. The project will offer policy, legal and regulatory pathway recommendations, by developing a framework from the reconciliation of the various ethics and value systems present in the Arctic. JUSTNORTH will bring insights from Indigenous, local, business, State and NGO perspectives of the social, economic and environmental complexities of the Arctic into the realm of policymaking for just sustainable development.[125] The Icelandic partner in the JUSTNORTH project is the Stefansson Arctic Institute. The JUSTNORTH project is a new EU Horizon 2020 funded project and is therefore not yet considered an EU Arctic Cluster project.

The Stefansson Arctic Institute was granted 148,603,889 ISK (€941,723) for its participation in the project.

FutureArctic

FutureArctic embeds the overarching question of how much carbon will potentially escape the Arctic in the future climate and how will it affect climate change? The ForHot website in Iceland offers a geothermally con-

121 Home - INTERACT. 2017. Retrieved 17.9.2020: https://eu-interact.org/
122 About - Nunataryuk. Retrieved 17.9.2020: https://nunataryuk.org/about
123 Nunataryuk. Stefansson Arctic Institute. 2013. Retrieved 17.9.2020: http://www.svs.is/en/projects/nunataryuk
124 CHARTER - Drivers and Feedbacks of Changes in Arctic Terrestrial Biodiversity. 2020. Retrieved 21.9.2020: http://www.charter-arctic.org/2020/05/01/eu-funded-charter-project-starts-up/
125 Toward, Just, Ethical and Sustainable Arctic Economies, Environment and Societies. JUSTNORTH Project. H2020. CORDIC. European Commission. 2020. Retrieved 17.9.2020: https://cordis.europa.eu/project/id/869327

trolled soil temperature warming gradient, where Arctic ecosystem processes are affected by temperature increases as expected through climate change. Given the strong urgency of tackling the climate challenge and the particularly important role herein of Arctic ecosystems, a rapid assessment of the ecosystem and ambient processes at the ForHot site will provide potentially crucial insight in future carbon cycling. The project directly engages this research challenge in an inter-sectoral training initiative for early stage researchers, that aims to form "ecosystem-of-things" scientists and engineers at the ForHot site. FutureArctic aims to pave the way for generalized permanently connected data acquisition systems for key environmental variables and processes. FutureArctic will initiate a new machine-learning approach to analyse large high-throughput environmental data-streams, through installing a pioneer „"ecosystem-of-things"" at the ForHot site. FutureArctic will thus channel, building on a timely project in the ForHot area, an important evolution to machine-assisted environmental fundamental research. This is achieved through the dedicated training of researchers with profiles at the inter-sectoral edge of computer science, artificial intelligence, environmental science (both experimental and modelling), scoial sciences and sensor engineering and communication. Icelandic partners in the FutureArctic projects are the Agricultural University of Iceland and Svarmi.[126]

Icelandic participants were granted a total of 71,295,798 ISK (€564,622) for their participation in the project.

EU-PolarNet 2

EU-PolarNet 2 will provide a coordination platform to co-develop strategies to advance the European Polar Research action and its contribution to the policy-making processes. It will operate as such a platform for the four years of the project´s lifetime. Once EU-PolarNet 2 ends, the gained experience, the established network and the developed tools to facilitate better coordination and co-design of Polar research actions will be transferred to the European Polar Coordination Office to be sustained. The EU-PolarNet 2 consortium consists of 25 partners representing all European and associated countries with Polar research programmes and activities. This allows EU-PolarNet 2 to significantly improve the coordination and co-design of European Polar research actions, but also to provide evidence-based advice on behalf of the whole European Polar community.[127] Rannís is the partner from Iceland, mainly contributing to the Research optimization work package.

Rannís was granted 16,420,725 ISK (€101,250) from Horizon 2020 for its participation in the project.

Projects in the EU Arctic Cluster with no Icelandic partner

EU Arctic Cluster projects with no Icelandic partners are the following: INTAROS, iCupe, KEPLER, ICE-ARC and EU-PolarNet, however Iceland is participating in EU-PolarNet2.

Other EU funded projects with an Icelandic partner

HERA

HERA (Humanities in the European Research Area) is a partnership between 26 humanities research councils across Europe and the European Commission. The mission of HERA is to promote and support European arts and humanities research through research funding, collaboration and advocacy.[128]

Arctic Encounters: Contemporary Travel/Writing in the European High North (ENCARC)

Arctic Encounters is an international collaborative research project that looks at the increasingly important role of cultural tourism in fashioning twenty-first century understandings of the European Arctic. The project's general objective is to account for the social and environmental complexities of the High North – an area which incorporates some of Europe's most geographically extreme regions – as these are inflected in the mutual relationship between a wide range of recent travel practices and equally diverse representations of those practices framed in both verbal and visual terms (e.g. travel writing and documentary film).[129]

126 A Glimpse into the Arctic Future: equipping a unique natural experiment for next-generation ecosystem research. 2020. Retrieved 18.11.2020: https://cordis.europa.eu/project/id/813114
127 EU-PolarNet: About EU-PolarNet. 2016. Retrieved 17.9.2020: https://www.eu-polarnet.eu/about-eu-polarnet/
128 Who we are. About us. Humanities in the European Research Area. Retrieved 22.10.2020: heranet.info/about-us/
129 Humanities in the European Research Area. Retrieved 20.11.2020: http://heranet.info/

The project received funding from the European Union's Horizon 2020 research and innovation programme, the Seventh Framework Programme for research, technological development and demonstration and the Sixth Framework Programme for research and technological development.The University of Iceland participated in the project.[130]

NordForsk Projects

The NordForsk research programme, Responsible Development of the Arctic: Opportunities and Challenges - Pathways to Action, was established in 2016 to create new knowledge on the possibilities and challenges that the Arctic Region is facing. The programme is a cross-disciplinary initiative and funds four Nordic Centres of Excellence in Arctic Research. Icelandic partners participate in two of these centres: ARCPATH and REXSAC.[131]

Arctic Climate Predictions: Pathways to Resilient, Sustainable Societies (ARCPATH)

The ARCPATH project seeks to combine improved regional climate predictions with enhanced understanding of environmental, societal, and economic interactions in order to supply new knowledge on Arctic „pathways to action". This will be achieved through extensive cross-disciplinary collaboration including: climatology (regional and global modelling; dynamic downscaling; and historical climatology); environmental science and environmental economics; oceanography and cryosphere research; marine and fisheries biology; fisheries management; anthropology; governance systems; human eco-dynamics; and traditional ecological knowledge (TEK). The project is co-lead by the Nansen Environmental and Remote Sensing Centre (NERSC) at the University of Bergen and the Stefansson Arctic Institute in Akureyri.[132]

Resource Extraction and Sustainable Arctic Communities (REXSAC)

REXSAC focuses on the study of extractive resource industries in the Arctic as cultural, social, economic, and ecological phenomena from analysis of why resource extraction commences, what consequences it has for communities in the Arctic and beyond, and what opportunities exist for transitioning towards post-extractive futures. The cultural footprint of a mine is just as real as its environmental and economic footprint, and both must be considered as related (often inseparable) parts of a single whole. No programme or centre with this mission currently exists anywhere in the world. The Stefansson Arctic Institute is the Icelandic participant in REXSAC.

Nordic Volcanological Center (NordVulk)

NordVulk is a Nordic research center specializing in volcanology and related fields. NordVulk is co-financed by the Nordic Council of Ministers and the Icelandic government. It is located in downtown Reykjavík, at the Institute of Earth Sciences, University of Iceland. The Institute of Earth Sciences is leading within the Nordic countries in disciplines such as volcanology and plate tectonics, and furthermore holds special expertise in climatology, glaciology, sustainable environments and geothermal processes.[133]

Swedish Riksbankens Jubileumsfond

ICECHANGE

The Stefansson Arctic Institute participates in the ICECHANGE project which is funded funded by the Swedish Riksbankens Jubileumsfond and undertakes systematic analysis of descriptions of the environmental information in Icelandic literature and the history of Iceland for the period ca. AD 800-1800. Environmental and social observation are described meticulously and make these sources a treasury of information concerning perceptions and knowledge of changing environments over the course of many human generations.[134]

Arctic Council Projects

Iceland leads in the following Arctic Council projects. However, Iceland participates in a number of other projects that are not noted in this report.[135]

130 Arctic Encounters: Contemporary Travel /Writing in the European High North. Projects. Humanities in the European Research Area. Retrieved 22.10.2020: http://heranet.info/projects/hera-2012-cultural-encounters/arctic-encounters-contemporary-travelwriting-in-the-european-high-north/
131 Joint Nordic Initiative on Arctic Research, fact sheet. NordForsk. 2017. Retrieved 24.9.2020: https://www.nordforsk.org/2017/joint-nordic-initiative-arctic-research-fact-sheet
132 Arcpath. Stefansson Arctic Institute. 2013. Retrieved 17.9.2020: http://www.svs.is/en/projects/arcpath 139 About. Nordvulk. 2012. Retrieved 10.11.2020: http://nordvulk.hi.is/node/5
133 About. Nordvulk. 2012. Retrieved 10.11.2020: http://nordvulk.hi.is/node/5
134 Icechange. Stefansson Arctic Institute. 2013. Retrieved 17.9.2020: http://www.svs.is/en/projects/icechange
135 Arctic Council. Projects. 2020. Retrieved 17.9.2020: https://arctic-council.org/en/projects/

Gender Equality in the Arctic - Phase III

The purpose of this project is to promote an extensive, policy-relevant dialogue on issues of gender equality in the Arctic region in the context of current realities in terms of economic and social development as well as current and future challenges, inter alia relating to climatic and environmental changes.[136] This project has been ongoing since 2013, it is now in its 3rd phase to be finished in fall 2021. The GEA project is an Arctic Council SDWG project and an Icelandic chairmanship project. A report will be published before the end of the chairmanship in May 2021. The project will likely continue beyond the Icelandic chairmanship. The project is led by the Icelandic Arctic Cooperation Network with cooperation from the Directorate for Equality, the Ministry for Foreign Affairs and the Stefansson Arctic Institute, in addition to its international partners. It has received funding from the NCM, the Icelandic Gender Equality Fund, in addition to national funds from Finland, the Faroe Islands, Sweden, Norway, Canada and the US National Science Foundation.[137]

Sustaining Arctic Observing Networks

Sustaining Arctic Observing Network (SAON) is a joint activity of IASC and the Arctic Council with the purpose of supporting and strengthening the development of multinational engagement for sustained and coordinated pan-Arctic observing and data sharing systems. SAON promotes the vision of well-defined observing networks that enable users to have access to free, open and high-quality data that will realize pan-Arctic and global value-added services and provide societal benefits. The activities of SAON are supported by the AMAP Secretariat.[138]

Regional Action Plan on Marine Litter

The Regional Action Plan will address both sea and land-based activities, focusing on Arctic-specific marine litter sources and pathways that will play an important role in demonstrating Arctic States' stewardship efforts towards reducing the negative impacts of marine litter, including microplastics, to the Arctic marine environment. PAME is the working group for the projects, where Iceland is in lead.[139]

Blue Bioeconomy in the Arctic Region

The project was initiated under the Icelandic Chairmanship (2019-2021) with the objective of considering opportunities and possible challenges for the development of the Blue Bioeconomy in the Arctic region. With a focus on balancing economic growth, social inclusion and environmental protection, the project links to the priority area of Sustainable Business Involvement and Development in SDWG's Strategic Framework.[140]

Arctic Shipping Best Practice Information Forum

The Arctic Shipping Best Practice Information Forum facilitates an exchange of information and best practices on shipping topics like hydrography, search and rescue logistics, industry guidelines and ship equipment, systems and structure. The forum is a response to the International Code for Ships Operating in Polar Waters, the Polar Code, by the International Maritime Organisation (IMO).[141]

Arctic Remote Energy Networks Academy (ARENA)

Combining visits to communities and participant knowledge exchanges with presentations and laboratory demonstrations, ARENA connects current and emerging energy professionals with hands-on learning experiences, mentors, and project development leaders from throughout the circumpolar north. ARENA is designed specifically for individuals living and working in remote circumpolar Arctic communities.[142]

Terrestrial Biodiversity Monitoring

For some species that feed and reproduce in the short Arctic summer, longer growing seasons may be an advantage, but specialized Arctic wildlife are predicted to be negatively affected.

Exactly how these pressures - alone and in combination - affect terrestrial species and ecosystems is unknown because the Arctic's complexity and size make it difficult to detect and attribute changes. In addition,

136 Gender Equality in the Arctic. Retrieved 17.9.2020: https://arcticgenderequality.network/index#background
137 Gender Equality in the Arctic. Retrieved 17.9.2020: https://arcticgenderequality.network/
138 Sustaining Arctic Observing Networks - International Arctic Science Committee. Retrieved 17.9.2020: https://iasc.info/data-observations/saon
139 Regional Action Plan on Marine Litter. 2020. Retrieved 17.9.2020: https://pame.is/index.php/projects/arctic-marine-pollution/regional-action-plan-on-marine-litter
140 SDWG - Blue Bioeconomy in the Arctic Region. Retrieved 17.9.2020: https://www.sdwg.org/blue-bioeconomy-in-the-arctic-region/
141 Arctic Council - Arctic Shipping Best Practice Information Forum.2020. Retrieved 17.9.2020: https://arctic-council.org/en/projects/arctic-shipping-best-practice-information-forum/
142 About. Retrieved 17.9.2020: http://arena.alaska.edu/about/

existing terrestrial monitoring efforts are often uncoordinated, limiting the ability to efficiently make effective management decisions, despite increasing urgency and pressure to act.

The Circumpolar Biodiversity Monitoring Programme (CBMP) is working with partners, including existing terrestrial monitoring networks, across the Arctic to harmonize and enhance long-term terrestrial monitoring efforts.[143]

Arctic Marine Tourism: Development in the Arctic and enabling real change
The project will, among other activities, include a compilation of data on tourism vessels in the Arctic, identify gaps in data on vessels, and summarize existing site-specific guidelines for near-shore and coastal areas of the Arctic visited by passengers of marine tourism vessels and pleasure crafts with the aim to identify common themes in existing guidelines, and make them publicly available in one place.[144]

Arctic Renewable Energy Atlas (AREA)
The Arctic Renewable Energy Atlas (AREA) is a project of the Arctic Council's Sustainable Development Working Group, focused on supporting sustainable development and healthy, resilient communities in the Arctic. The project brings together tools for Arctic communities working to transition to renewable energy and showcase this transition to the world. Tools include GIS mapping data, community stories, best practices, training, financing and policy information.

The online atlas provides solar, wind, geothermal, marine and hydrokinetic resource maps within an easily accessible format. AREA will also eventually overlay existing energy generation capabilities to allow easy visualization of localized supply and demand and encourage clean energy prospecting and investment. In an effort to profile and share best practices gleaned from traditional and local knowledge, AREA will display videos from Arctic community stakeholders discussing successes and challenges found in developing clean energy projects.[145]

Digitalization of the Linguistic and Cultural Heritage of Indigenous Peoples of the Arctic
The Arctic Council's Digitalization of Linguistic and Cultural Heritage of the Indigenous Peoples of the Arctic Project is focused on preserving and developing Indigenous languages, traditional knowledge and cultures of the Arctic Indigenous peoples including food heritage as a foundation for diversification of local economies and new approaches to adapt to Arctic change. The Project envisages wide use of modern digital technologies, creation of a GIS map and Arctic Indigenous peoples' knowledge database on a uniform multilingual portal. The Project will provide access to information, promote better understanding and facilitate adaptation to Arctic changes based on the knowledge and resources of affected communities and peoples.[146]

MOSAiC
MOSAiC is the largest exploration expedition to the Arctic of all time. Trapped in ice, the German research vessel Polarstern drifted for a year through the Arctic Ocean. As a result, the more than 300 participating scientists from 20 countries have gathered and evaluated important measurement data for the first time throughout the year, including during the Arctic winter. The mission is led by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI).

Over 125 years ago, Fridtjof Nansen set out on his sailing ship Fram for the first drift expedition of its kind. But an expedition like the one planned now has never happened before. The MOSAiC project brought a modern research icebreaker loaded with scientific instruments close to the North Pole for the first time in winter. In addition to Polarstern, other icebreakers were used to assist in a sophisticated choreography, so that there was always a supply of fuel and food at the right time. In addition, a whole network of stations on the ice was built around the ship. Here, several research teams set up measuring points to explore the ocean, ice and atmosphere as well as the Arctic life in winter.[147]

143 Arctic Council - Terrestrial Biodiversity Monitoring. 2020. Retrieved 17.9.2020: https://arctic-council.org/en/projects/terrestrial-biodiversity-monitoring/
144 Arctic Marine Tourism. 2020. Retrieved 17.9.2020: https://pame.is/projects/arctic-marine-shipping/arctic-marine-tourism-project-amtp-workshop-report
145 SDWG. Arctic Renewable Energy Atlas (AREA). Retrieved 18.11.2020: https://sdwg.org/what-we-do/projects/arctic-renewable-energy-atlas-area/
146 SDWG-Digitalization of the Linguistic and Cultural Heritage of Indigenous Peoples of the Arctic. Retrieved 18.11.2020: https://sdwg.org/what-we-do/projects/digitalization-of-the-linguistic-and-cultural-heritage-of-indigenous-peoples-of-the-arctic/
147 MOSAiC. About. Retrieved 13.10.2020: https://follow.mosaic-expedition.org/site/about/

Results

Arctic research is actively pursued in several universities, many research institutes and a number of companies in Iceland. Of special interest is the wide participation of Icelandic research partners in international research programmes and projects. Many Icelandic scientists seem to be well integrated into the international Arctic science community. It is hoped that this report will make the Icelandic Arctic research community more accessible and visible in the international Arctic science community.

The Arctic Circle assemblies, which have become the largest international gathering on the Arctic, have been held yearly in Iceland since 2013. The Arctic Circle dialogues have clearly highlighted an increasing need for more observations and research activities on the connection between climate change and societal development in the Arctic region and its global relevance.[148] Both the Arctic Circle assemblies and forums have been extremely useful and important for dialogue between scientists and policy makers on the rapid changes which are occurring in the Arctic. The Arctic Circle has raised the profile of Iceland in international Arctic cooperation in various sectors, not least in Arctic science.

There is a lack of updated policy both in terms of Arctic affairs in general and Arctic research. The only comprehensive reports from the Government on Arctic policy were published approximately 10 years ago. This refers to Iceland´s position in the Arctic by the Ministry for Foreign Affairs (2009) and a Parliamentary Resolution on Iceland's Arctic Policy (2011). While these reports were useful at the time they were published, there has been rapid development in Arctic affairs since, which a new policy needs to take into account. Yet, it is encouraging that a Parliamentary Committee is currently undertaking a review of Iceland's Arctic policy. It is recommended that a new Arctic research policy would address both the institutional and funding landscape for Arctic research.

A considerable part of the financial support from the largest funds dealt with here, the Icelandic Research Fund and Horizon 2020, goes into Arctic research. The yearly average allocation to Arctic research projects from the Icelandic Research Fund in 2009-2019 was 118,089,700 ISK and the yearly average allocation from Horizon 2020 in the years 2014-2020 was 141,844,917 ISK. Of the total IRF grant allocations, the proportion supporting Arctic research is 7% and the percentage of Arctic research projects out of the total funding from Horizon 2020 to Icelandic participants is 6%.

As would be expected, the Icelandic Research Fund is the largest domestic contributor to funding Arctic research, granting almost 1,2 billion ISK over the period of 2009-2019. However, its pattern of funding appears uneven as 72% of the total Arctic research funding goes to Natural Science and Environment projects, while no part goes to Social Science projects. In addition, 70% of grants from the Icelandic Research Fund are allocated to go to the University of Iceland, which is a very different pattern to the Arctic research projects funded by Horizon 2020.

The Horizon 2020 programme is no less important for funding Arctic research in Iceland than the Icelandic Research Fund as total grants to Icelandic partners in Horizon 2020 Arctic research (2014-2020) amount to approximately 976 million ISK over a period of the last seven years. The funding pattern from Horizon 2020 to various research partners is very different from the Icelandic Research Fund. While a large majority of the grants from the Icelandic Research Fund is allocated to the University of Iceland, the funding pattern of the Horizon 2020 is more diverse and its grants go to universities, research institutes and companies in Iceland which are involved in Arctic research, assessment and information dissemination. It is interesting to note that more than 40% of the Horizon 2020 grants are awarded to Arctic research performers and other actors in Akureyri. This is an indication of an active Arctic research, and project, milieu in Akureyri, which is largely dependent on international sources of funding, Horizon 2020 and NordForsk. Further exploration of future opportunities for research performers is needed.

148 Home. Arctic Circle. Retrieved 22.10.2020: www.arcticcircle.org

In addition, there are important international funding opportunities for Arctic research other than Horizon 2020, such as the Belmont Forum. However, funding schemes such as Belmont Forum require co-funding from its partners, which so far has not been a possibility to achieve from domestic funding sources.

Access to strong competitive research funds is highly important and necessary for Arctic scientists, but it is not sufficient. For Arctic research seeking knowledge on rapid natural and societal changes comprehensive and consistent monitoring and observing is also needed to create time-series of events and observations. Research institutes and their infrastructures have an essential role in observations and monitoring and they cannot rely on short-term research funding for this kind of long-term mission. A targeted policy addressing this challenge is needed.

In terms of Arctic research policy, there is a strong case for the establishment of a dedicated Icelandic Strategic Research and Development Programme on Arctic Research. This programme would be an open competitive programme with priorities which are determined by the Icelandic Science and Technology Policy Council. Rannís could be responsible for the administration of this programme, while the Icelandic Joint Committee on Arctic Affairs would play an important role in developing such an initiative. In this kind of programme, projects should entail a close collaboration between research organisations and universities in the field of Arctic Science, based on interdisciplinary quality research proposals, in consultation with community stakeholders, civil society, policy-makers and industry. The success of various Icelandic research actors in the Horizon 2020 programme should be an incentive to the Icelandic research community to develop such a research effort and provide a solid foundation for the upcoming Horizon Europe programme.

Appendix

Appendix I
Arctic EU Horizon 2020 projects

Proof of Concept – Arctic Data Management System Beta version – capacity building for interpretation and data management system of the Arctic-related data and knowledge (Arctic Data Management System)	ADMS	Arctic Portal
Advanced Prediction in Polar regions and beyond: Modelling, observing system design and LInkages associated with ArctiC ClimATE change	APPLICATE	Arctic Portal
Arctic Research Icebreaker Consortium: A strategy for meeting the needs for marine-based research in the Arctic	ARICE	Arctic Portal
Edu-Arctic – Innovative educational program attracting young people to natural sciences and polar research	EDU-ARCTIC	Arctic Portal
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	Arctic Portal
Permafrost thaw and the changing arctic coast: science for socio-economic adaptation	Nunataryuk	Arctic Portal
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	CAFF
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	CAFF
Arctic Impact on Weather and Climate	Blue-Action	HAFRANNSOKNASTOFNUN
Arctic biodiversity change and its consequences: Assessing, monitoring and predicting the effects of ecosystem tipping cascades on marine ecosystem services and dependent human systems	ECOTIP	HAFRANNSOKNASTOFNUN
Global drivers, local consequences: Tools for global change adaptation and sustainable development of industrial and cultural Arctic “hubs”	ArcticHubs	Háskólinn á Hólum
Microorganisms in Warming Arctic Environments	MicroArctic	Icelandic Institute of Natural History
Rugged Long-lasting Vertical-Axis Wind Turbine for Extreme Wind Conditions	NJORD	ICEWIND
Rugged durable small wind turbine for powering telecom towers on residential buildings in extreme weather conditions areas	NJORD	ICEWIND
Drivers and Feedbacks of Changes in Arctic Terrestrial Biodiversity	CHARTER	Landbúnaðarháskóli Íslands
A glimpse into the Arctic future: equipping a unique natural experiment for next-generation ecosystem research	FutureArctic	Landbúnaðarháskóli Íslands
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	Landbúnaðarháskóli Íslands
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	Landbúnaðarháskóli Íslands
Arctic and North Atlantic Security and Emergency Preparedness Network	ARCSAR	LANDHELGISGAESLA ISLANDS
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	RANNSOKNARSTODIN RIF
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	RANNSOKNARSTODIN RIF
Toward Just, Ethical and Sustainable Arctic Economies, Environments and Societies	JUSTNORTH	STOFNUN VILHJALMS STEFANSSONAR
Permafrost thaw and the changing arctic coast: science for socio-economic adaptation	Nunataryuk	STOFNUN VILHJALMS STEFANSSONAR
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	SUDURNES SCIENCE AND LEARNING CENTER
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	SUDURNES SCIENCE AND LEARNING CENTER
A glimpse into the Arctic future: equipping a unique natural experiment for next-generation ecosystem research	FutureArctic	SVARMI EHF
Microorganisms in Warming Arctic Environments	MicroArctic	University of Akureyri
Global drivers, local consequences: Tools for global change adaptation and sustainable development of industrial and cultural Arctic “hubs”	ArcticHubs	University of Iceland
Eruption Source Parameters for Explosive Eruptions in Iceland Over the Last 3 ka	ESPSI	University of Iceland
Proglacial and subglacial aquifers: their evolution under climate change and the potential impacts in terms of resources and natural hazards, through the case of eastern Iceland	IceAq	University of Iceland
EU-PolarNet 2	EU-PolarNet 2	Icelandic Centre for Research

Arctic FP7 projects

ARCTIC EDGE	ARCTIC EDGE	THE ICELANDIC CENTRE FOR RESEARCH
Changing Permafrost in the Arctic and its Global Effects in the 21st Century	PAGE21	NORDURSLODAGATTIN EHF
Creating the technology for safe, long-term carbon storage in the subsurface	CARBFIX	HASKOLI ISLANDS
Enabling Intelligent GMES Services for Carbon and Water Balance Modeling of Northern Forest Ecosystems	NORTH STATE	HASKOLI ISLANDS
Ice2sea - estimating the future contribution of continental ice to sea-level rise	ICE2SEA	HASKOLI ISLANDS
International Network for Terrestrial Research and Monitoring in the Arctic	INTERACT	LANDBUNADARHASKOLI ISLANDS
LICHen population gENetics and genOMICS - Gene expression, neutral and adaptive genetic variation in natural populations of Peltigera membranacea	LICHENOMICS	HASKOLI ISLANDS
North Atlantic Climate: Predictability of the climate in the North Atlantic/European sector related to North Atlantic/Arctic sea surface temperature and sea ice variability and change	NACLIM	HAFRANNSOKNASTOFNUNIN

Appendix II

The following letter was sent as a request for information on Arctic activities from research performers:

Dear receiver,

In cooperation with Rannís, the Icelandic Arctic Cooperation Network and the Stefansson Arctic Institute, a summer project is ongoing with the aim of mapping Icelandic Arctic research and Icelandic-international cooperation on the topic. Furthermore, the project will be used in the preparation for the third Arctic Science Ministerial Meeting (ASM3) and the chairmanship of Iceland in the Arctic Funders Forum (i.e. by building a database and updating the website). The results of the project will then be presented via a report, but are scheduled to be presented in a shorter format (such as a pamphlet), which will be used for the presentation of Icelandic Arctic research in an international context.

That being said, we reach out to you and your institute in continuation of the Overview of Arctic Research Projects from 2010 by the Icelandic Joint Committee on Arctic Affairs, to check if the overview has been updated and if not to offer assistance to update the overview from 2010. We would appreciate receiving an updated overview of Arctic research projects at the latest 12th of August 2020. As part of this work, we will review databases of various research funds and institutional websites and coordinate the data with the information we receive from each institute with the aim of creating a comprehensive overview of Arctic research in Iceland.

Best regards,
Emil Ísleifur Sumarliðason
Santiago Villalobos
Sóley Ólafsdóttir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