



Report
2019:24

Norwegian polar research, High North research and research in Svalbard

A mapping survey 2018



Dag W. Aksnes and Kristoffer Rørstad

NIFU

Report
2019:24

Norwegian polar research, High North research and research in Svalbard

A mapping survey 2018

Dag W. Aksnes and Kristoffer Rørstad

Report 2019:24

Published by Nordic Institute for Studies in Innovation, Research and Education
Address P.O. Box 2815 Tøyen, N-0608 Oslo. Visiting Address: Økernveien 9, N-0653 Oslo.

Project No. 21046

Customer The Research Council of Norway
Address Postboks 564, 1327 Lysaker

Fotomontage NIFU

ISBN 978-82-327-0436-1 (print)
ISBN 978-82-327-0455-2 (online)
ISSN 1892-2597 (online)



Copyright NIFU: CC BY-NC 4.0

www.nifu.no

Preface

This report presents a mapping of Norwegian polar research, High North research and research in Svalbard. The study is carried out by the Nordic Institute for Studies in Innovation, Research and Education (NIFU) as part of the R&D statistics agreement with the Research Council of Norway. The report is written by Dag W. Aksnes (project leader) and Kristoffer Rørstad. In addition, Ekaterina Denisova has contributed to the data collection. We would like to thank the many institutes, university and university college departments and companies which have responded to our survey and made this project possible.

Oslo, 15.01.20

Vibeke Opheim
Deputy Director

Michael Mark
Head of Research

Contents

Summary	7
Sammendrag	11
Čoahkkáigeassu	15
1 Introduction	18
1.1 Purpose and content of the mapping survey	18
2 Data and methods	20
2.1 Definitions of polar and High North research.....	20
2.2 Definition of R&D	23
2.3 R&D mapping survey.....	24
2.4 Survey of research in Svalbard.....	27
2.4.1 Number of researcher days	27
2.4.2 Survey of research infrastructure in Svalbard	31
3 Norwegian High North research	33
3.1 Norwegian research relating to the High North in 2018	33
3.2 Funding of the High North research	34
3.3 High North research by sector and institutions.....	37
3.4 Geographical distribution of High North research	41
3.5 High North research by fields.....	43
3.6 Human resources involved in High North research.....	46
4 Norwegian polar research	48
4.1 Polar research in 2018 and development over time	48
4.2 Funding of polar research	51
4.3 Polar research by sector and institutions.....	55
4.4 The geographical distribution of polar research.....	58
4.5 Polar research by fields.....	61
4.6 Human resources in polar research.....	65

5	Research in Svalbard	67
5.1	Introduction	67
5.2	Norwegian research related to Svalbard	69
5.3	Researcher days Svalbard	74
5.3.1	Main findings	75
5.3.2	Distribution by country	78
5.3.3	Distribution by geographical area	81
5.3.4	Ny-Ålesund	82
5.4	Research sites and installations.....	83
5.4.1	Ny-Ålesund	84
5.4.2	Longyearbyen.....	92
5.4.3	Other locations.....	97
	References.....	104
	Appendix 1 Questionnaire.....	106
	Appendix 2 Units included in the mapping	115
	Appendix 3 Survey - research activities in Svalbard.....	118
	List of tables.....	122
	List of figures.....	124

Summary

Based on the quantitative mappings carried out in the project, the summary below provides an overview of some key figures for Norwegian High North research, polar research, and Norwegian and foreign research in Svalbard.

High North research

This mapping shows that a total of 1,572 R&D work years full time equivalents (FTEs) of High North research were carried out in 2018. Institutes in the institute sector contributed to 47 per cent of this research, institutions in the higher education sector to 41 per cent, while companies in the industrial sector conducted the rest (12 per cent).

Based on the reported figures, it is estimated that a total of 2,412 million NOK was spent on High North research in 2018. This includes the current costs, only. About 70 per cent of the total research relating to the High North was funded by public sources. The Research Council of Norway funded about one fourth of the total national expenditures.

The largest institution in the higher education sector is the Arctic University of Norway with a total of 330 FTEs. This corresponds to approximately one fifth of the national total. The primary research institutes were the largest institute group with about 340 FTEs or 22 per cent of the total national R&D efforts relating to the High North. This group includes four institutes where the Institute of Marine Research by far is the largest.

About one third of the research was related to the three northernmost counties. Nordland and Troms each accounted for 12 per cent of the total national research efforts, while Finnmark had a proportion of 8 per cent. Research relating to Svalbard accounted for about one fifth (18 per cent) of the total High North research and was the largest land area for such research. The Barents Sea and the northern part of the Norwegian Sea accounted of 21 per cent of the national total of High North research.

The High North research covers all the major fields. However, the natural sciences accounted for the majority of the research, about 960 FTEs and about 60 per cent. The three largest fields were basic marine biology with about 230 FTEs, fishery biology, marine resources with 170 FTEs and geology with 130 FTEs. The social sciences accounted for about 140 FTEs or 10 per cent. Approximately 125 FTEs, about 8 per cent of the national total of High North research were related to indigenous people.

Almost 2,800 people were involved in High North research in Norway in 2018. Of these, about 1,450 worked at a research institute, about 1000 at a higher education institution, while almost 310 people worked at a company.

Polar research

The mapping shows that a total 958 R&D FTEs were devoted to Norwegian polar research in 2018. About 65 FTEs (7 per cent of the total) were related to Antarctic areas, while the large majority was related to Arctic areas.

Research institutes accounted for slightly more than half (54 per cent) of the total national polar research efforts measured by FTEs. Institutions in the higher education sector, primarily universities, conducted 40 per cent, while companies in the industrial sector accounted for the 6 per cent.

The results show that there has been steady growth in the Norwegian research efforts related to polar areas over time. However, while the number of FTEs increased significantly from 2006 to 2010 and from 2010 to 2014, there was hardly any increase at all in the most recent period. In 2018, 2.1 per cent of the total R&D efforts in Norway measured in FTEs were related to the polar areas. This proportion was slightly higher in the previous years (2.5 per cent in 2006 and 2010 and 2.4 per cent in 2014). These findings indicate that the relative position of polar research in the Norwegian research profile has declined from 2014 to 2018.

Based on the reported figures, it is estimated that a total of 1,515 million NOK was spent on polar research in 2018. This includes the current costs, while capital costs such as investments in new buildings and research vessels are not included. Public funding sources contributed to around three quarters (76 per cent) of the total R&D expenditures devoted to polar research. The Research Council of Norway funded about 25 per cent of the polar research.

The institute sector is the largest contributor to polar research, with a proportion of 54 per cent of the national total measured in FTEs. Institutions in the higher education sector account for about 40 per cent while the industrial sector has a proportion of 6 per cent.

The largest institution for polar research in the higher education sector is UiT – The Arctic University of Norway, with a share of 16 per cent of the total polar research. In the institute sector, institutes in the group for “other research institutes” make the largest contribution to polar research with a proportion of 20 per cent of the national total. Here, Norwegian Polar institute and the Norwegian Meteorological Institute are the largest. Primary research institutes accounted for 19 per cent of the national total. Here Institute of Marine Research is the largest.

Of the total Norwegian polar research activity, about 38 per cent was related to land areas while 60 per cent was related to sea/ocean areas. Most of the terrestrial Norwegian polar research relate to Svalbard, and the archipelago accounts for 30 per cent of the total polar research. The Barents Sea and the northern part of the Norwegian Sea are important areas for marine polar research and accounted for 34 per cent of the national total.

Polar research is carried out within all the major research areas. However, the large majority of the research is within the natural sciences. In 2018, this area accounted for 770 FTEs, or about 80 per cent the total polar research (measured as FTEs). The three largest fields were basic marine biology with about 170 FTEs, geology with 120 FTEs and oceanography and geophysics with almost 110 FTEs.

A total of about 1,900 people were involved in the polar research activities in 2018. Of these, about 1,200 worked at a research institute, about 640 at a university department, while almost 110 persons worked at a company.

Research in Svalbard

The mapping of research in Svalbard applies an activity indicator based on number of researcher days. This measure is used as an indicator of the extent of the different countries' research activities on the archipelago.

In 2018, there was a decrease in the research activity measured by researcher days and the number is significantly lower than in 2014. However, compared with the previous years, the activity in 2014 was exceptionally high, and the number of researcher days in 2018 is still larger than in 2002, 2006 and 2010.

Researchers from Norwegian institutions accounted for 42 percent of the researcher days in 2018, while researchers from foreign institutions accounted for the remaining 58 percent. The figures include UNIS for Norway, both field activity and presence in the offices in Longyearbyen (corrected for teaching activity). If only UNIS's field activity had been included, the Norwegian share would have dropped to 34 per cent.

The second largest nation measured in researcher days in 2018 was Poland with a proportion of 15 per cent, followed by Russia with 13 per cent. Most of the Russian research is carried out in Barentsburg, while the Hornsund station

accounts for the majority of the researcher days for Poland. In total, Norway, Poland and Russia accounted for more than two-thirds of the total research efforts in Svalbard measured by researcher days. Researchers from German institutions do also have extensive research activities in Svalbard. Germany is the fourth largest nation with a proportion of 6 per cent of the researcher days in Svalbard in 2018. In addition, researchers from institutions in a number of other countries have been involved in research activities on the archipelago in 2018. According to our registrations, these researchers are affiliated with institutions in 20 different countries.

The researcher days have been distributed according to geographical Svalbard zones. Zone 1, which includes Longyearbyen, Barentsburg, Pyramiden, Isfjorden and Svea, accounts for the largest proportion with 42 per cent of the Svalbard total of researcher days in 2018. The research activity in Zone 2 (Ny-Ålesund, Kongsfjorden and adjacent areas) accounted for 37 per cent of the total. The research activities in the other parts of Svalbard are more limited with a proportion of 21 per cent.

Sammendrag

I denne rapporten presenteres resultatene av en kartlegging av norsk polarforskning, nordområdeforskning samt forskning på Svalbard. Et hovedformål med undersøkelsen har vært å fremskaffe et bredt sett av indikatorer som kan gi et grunnlag for å vurdere ulike aspekter ved norsk polarforskning og nordområdeforskning. Nøkkelindikatorer omfatter FoU-årsverk, FoU-utgifter og finansiering. I kartleggingen av omfanget av forskningsaktiviteten på Svalbard, inngår både norsk og utenlandsk aktivitet. Undersøkelsen bygger videre på tidligere kartlegginger som har vært gjennomført av norsk polarforskning og forskning på Svalbard. Nedenfor følger et sammendrag med noen hovedfunn. Her inngår også noen sammenligninger med tall fra tidligere kartlegginger av norsk polarforskning. Sammenlignbare tidligere tall for nordområdeforskningen foreligger imidlertid ikke.

Nordområdeforskning

Kartleggingen viser at nordområdeforskningen i Norge omfattet totalt 1 572 FoU-årsverk i 2018. Institusjoner i instituttsektoren bidro til 47 prosent av denne forskningen, institusjoner i universitets- og høyskolesektoren til 41 prosent, mens bedrifter gjennomførte resten (12 prosent).

Basert på de rapporterte tallene, er de totale kostnadene til norsk nordområdeforskning estimert til 2 412 millioner kroner i 2018. Dette inkluderer bare driftskostnadene. Rundt 70 prosent av forskningen knyttet til nordområdene ble finansiert av offentlige kilder. Norges forskningsråd finansierte omtrent en fjerdedel av de totale nasjonale utgiftene.

Den største institusjonen i sektoren for høyere utdanning var UiT Norges arktiske universitet med til sammen 330 årsverk. Dette tilsvarer omtrent en femtedel av den nasjonale totalen. Primærnæringsinstituttene var den største instituttgruppen med omtrent 340 årsverk eller 22 prosent av den nasjonale FoU-innsatsen knyttet til nordområdene. Denne instituttgruppen inkluderer fire institutter hvor Havforskningsinstituttet var det største.

Omtrent en tredjedel av nordområdeforskningen var relatert til de tre nordligste fylkene. Nordland og Troms utgjorde hver 12 prosent av den totale nasjonale forskningsinnsatsen, mens Finnmark hadde en andel på 8 prosent. Forskning knyttet til Svalbard utgjorde omtrent en femtedel (18 prosent) av forskningen. Barentshavet og den nordlige delen av Norskehavet utgjorde 21 prosent av den nasjonale totalen.

Nordområdeforskningen dekker alle fagområder. Imidlertid sto naturvitenskapene for størstedelen av forskningen, omtrent 60 prosent. De tre største fagfeltene var grunnleggende marin biologi med 230 FoU-årsverk, fiskeribiologi/marine ressurser med 179 FoU-årsverk og geologi med om lag 130 FoU-årsverk. Den samfunnsvitenskapelige forskningsinnsatsen utgjorde til sammen 140 FoU-årsverk eller ca. 10 prosent av de totale FoU-årsverkene til nordområdeforskning. Cirka 125 årsverk, eller 8 prosent av forskningsinnsatsen, var relatert til urfolk. Nesten 2 800 personer var involvert i nordområdeforskning i Norge i 2018. Av disse arbeidet rundt 1 450 ved et forskningsinstitutt, omtrent 1000 ved et universitet eller høgskole, mens nesten 310 personer jobbet i næringslivet.

Polarforskning

Kartleggingen viser at totalt 958 FoU-årsverk ble viet til polarforskning i Norge i 2018. Hovedtyngden av norsk forskning er knyttet til Arktis. Innsatsen i Antarktis og i havområdene rundt kontinentet utgjorde 65 årsverk, eller 7 prosent av den totale norske polarforskningen.

Institutter i instituttsektoren bidro til litt over halvparten (54 prosent) av den totale norske polarforskningsinnsatsen målt i årsverk. Institusjoner i sektoren for høyere utdanning, primært universiteter, bidro 40 prosent, mens bedrifter i næringslivet hadde en andel på 6 prosent.

Resultatene viser at det har vært jevn vekst i den norske forskningsinnsatsen knyttet til polare områder over tid. Selv om antallet årsverk økte betydelig fra 2006 til 2010 og fra 2010 til 2014, var det imidlertid knapt noen økning fra 2014 til 2018. I 2018 var 2,1 prosent av den totale FoU-innsatsen i Norge målt i årsverk, relatert til polarområdene. Denne andelen var litt høyere de foregående år (2,5 prosent i 2006 og 2010 og 2,4 prosent i 2014). Disse funnene indikerer at den relative posisjonen til polarforskning i den norske forskningsprofilen har gått ned fra 2014 til 2018.

Basert på de rapporterte tallene anslås det at totalt 1 515 millioner kroner ble brukt på polarforskning i 2018. Dette inkluderer driftskostnadene, mens kapitalkostnader slik som investeringer i bygg og forskningsskip ikke er inkludert. Offentlige finansieringskilder bidro til rundt tre firedeler (76 prosent) av de totale

FoU-utgiftene som ble brukt til polarforskning. Norges forskningsråd finansierte rundt 25 prosent av polarforskningen.

Instituttsektoren er den største sektoren når det gjelder polarforskning, med en andel på 54 prosent av den nasjonale innsatsen målt i årsverk. Høyere utdanningsinstitusjoner stod for om lag 40 prosent mens næringslivet hadde en andel på 6 prosent.

Den største bidragsyter til norsk polarforskning i universitets- og høyskolesektoren var UiT - Norges arktiske universitet, med en andel på 16 prosent av den totale polarforskningen. I instituttsektoren hadde institutter i gruppen for "andre forskningsinstitutter" det største bidraget med en andel på 20 prosent av den nasjonale totalen. Her var Norsk Polarinstitutt og Meteorologisk institutt de største. Primærnæringsinstituttene hadde en andel på 19 prosent av den nasjonale totalen. Her var Havforskningsinstituttet det største.

Av den totale norske polarforskningsinnsatsen var rundt 38 prosent relatert til landområder mens 60 prosent var relatert til sjø/havområder. Det meste av den terrestriske norske polarforskningen er relatert til Svalbard, og øygruppen hadde en andel på 30 prosent av den samlede polarforskningen. Barentshavet og den nordlige delen av Norskehavet er viktige områder for marin polarforskning og utgjorde 34 prosent av den nasjonale totalen.

Polarforskning utføres innenfor alle fagområder, men størstedelen er naturvitenskapelig. I 2018 utgjorde dette fagområdet rundt 80 prosent av den totale polarforskningen målt som årsverk. De tre største fagfeltene var grunnleggende marin biologi med 170 FoU-årsverk, geologi med 120 FoU-årsverk og oseanografi og geofysikk med nesten 110 FoU-årsverk.

Totalt var rundt 1900 personer involvert i polarforskning i Norge i 2018. Av disse arbeidet rundt 1200 ved et forskningsinstitutt, omtrent 640 ved et universitet eller høyskole og nesten 110 personer i næringslivet.

Forskning på Svalbard

I kartleggingen av forskning på Svalbard benyttes antall forskerdøgn som indikator på omfanget av de ulike lands forskningsaktivitet på øygruppen.

I 2018 observerer vi for første gang en nedgang i forskningsaktiviteten målt i forskerdøgn, og antallet var betydelig lavere enn i 2014. Sammenlignet med de foregående årene var imidlertid aktiviteten i 2014 spesielt høy, og antallet forskerdøgn i 2018 var likevel høyere enn i 2002, 2006 og 2010.

Forskere fra norske institusjoner sto for 42 prosent av forskerdøgnene i 2018, mens forskere fra utenlandske institusjoner sto for de resterende 58 prosent. Tallene inkluderer Universitetscenteret på Svalbard (UNIS) for Norge, både feltaktivitet og tilstedeværelse på kontorene i Longyearbyen (korrigert for

undervisningsaktivitet). Hvis bare UNIS' feltaktivitet hadde blitt inkludert, ville den norske andelen sunket til 34 prosent.

Den nest største nasjonen målt i forskerdøgn i 2018 var Polen med en andel på 15 prosent, etterfulgt av Russland med 13 prosent. Det meste av den russiske forskningen utføres i Barentsburg, mens Hornsund står for størstedelen av forskerdøgnene til Polen. Totalt utgjorde Norge, Polen og Russland mer enn to tredjedeler av den totale forskningsinnsatsen på Svalbard målt av forskerdøgn. Forskere fra tyske institusjoner har også omfattende forskningsaktiviteter på Svalbard. Tyskland var den fjerde største nasjonen med en andel på 6 prosent av forskerdøgnene på Svalbard i 2018. I tillegg har forskere fra institusjoner i en rekke andre land vært involvert i forskningsaktiviteter på øygruppen i 2018, til sammen dreier dette seg om 20 forskjellige land. Forskerdøgnene har blitt fordelt på geografiske Svalbard-soner. Sone 1, som inkluderer Longyearbyen, Barentsburg, Pyramiden, Isfjorden og Svea, stod for den største andelen med 42 prosent av totalt antall forskerdøgn i 2018. Forskningsaktiviteten i sone 2 (Ny-Ålesund, Kongsfjorden og tilgrensende områder) utgjorde 37 prosent av totalen. Forskningsaktivitetene på de andre delene av Svalbard er mer begrenset og andelen utgjorde 21 prosent.

Čoahkkáigeassu

Vuodđuduvvan kvantitatiivvalaš kártemiidda mat čadahuvvojedje prošeavttas, dát čoahkkáigeassu vuolábealde fállá oppalaš gova guovddáš loguin norgalaš davviguovllu dutkamušas, poláradutkamis ja Norgga ja olgoriikkalaš dutkamušas Svalbárddas.

Davviguovlluid dutkan

Kárten čájeha, ahte oktiibuot 1572 bargojagit čadahuvvojedje davviguovlluid dutkamis 2018:s. Institušuvdnasuorggi institušuvnnat dahke 47% dutkamušas, alit oahpposuorggi institušuvnnat 41% ja industriijasuorggi fitnodagat čadahedje loahpa (12%).

Raporterejuvvon loguid vuodul lea árvoštallon, ahte davviguovlluid dutkamii geavahuvvui oktiibuot 2412 miljovna ruvnu 2018:s. Dát sisttisoallá dušše dálá goluid. Sullii 70% buot davviguovlluid dutkamušain lei ruhtaduvvon almmolaš gálduid bokte. Norgga dutkanráđdi ruhtadii ovttá njealjádasa oppalaš našuvnnalaš goluin.

Stuorámuš institušuvdna alit oahpposuorggis lea Norgga árkálaš universitehta oktiibuot 330 bargojagiin. Dát vástida sullii ovttá viđáda našuvnnalaš oppalašvuodas. Primára dutkaninstitušuvnnat ledje stuorimus institušuvdnajoavkkut sullii 340 bargojagiin dahjege 22% našuvnnalaš davviguovlluid guoski FoU-rahčamušain. Dát joavku sisttisoallá njeallje institušuvnna, main Meerradutkaninstitušuvdna lea stuorámuš.

Okta goalmádas dutkamušain laktasedje golbma davimus fylkkaide. Nordlanda ja Romsa goappašat čadahedje 12% buot našuvnnalaš dutkandoaimmain, seammás go Finnmárkku oassi lei 12% buot našuvnnalaš dutkandoaimmain. Svalbárdii laktaseaddji dutkamuš rehkenastui sullii okta viđádas (18%) olles davviguovlluid dutkamis ja lei viidásamos eanadat dutkamušas. Bárentsáhpi ja Davimus Norggamearra gokče 21% davviguovlluid dutkama našuvnnalaš oppalašvuodas.

Davviguovlodutkamuš gokčá buot dieđasurggiid. Goittotge, luonddudiedálaš dutkamuš govččai eanáš dutkamušas, sullii 60%. Davviguovlluid dutkamuša našuvnnalaš oppalašvuodas sullii 125 bargojagi 8% guske eamiálbmogiid.

Sullii 2800 olbmo oassálaste davviguovlluid dutkamii Norggas 2018:s. Dáin sullii 1450 barge dutkaninstitušuvnnain, sullii 1000 alit oahpu institušuvnnain ja measta 310 barge fitnodagain.

Poláradutkamuš

Kárten čájeha, ahte oktiibuot 958 FoU-bargojagi ledje biddjon poláradutkamuššii Norggas 2018:s. Sullii 65 bargojagi (7% oppalašvuodas) guske Antarktisa seammás go stuorra eanetlohku guoskkai árktalaš guovlluid.

Dutkaninstitušuvnnat gokče binná eanet go beali (54%) lohkkjuvnon bargojagiid ektui buot našuvnnalaš poláradutkamuša doaimmain. Institušuvnnat alit oahpahussuorggis, erenomážit universitehtat, čađahedje 40% dutkamušain ja industriijasuorggis 6%.

Bohtosat čájehit, ahte áiggi mielde leamašan stádis lassáneapmi norgalaš dutkamušdoaimmain mat gusket poláraguovlluid. Goittotge, vaikko bargojagiid logut lassánit viehka ollu 2006:s 2010 rádjái ja 2010:s 2014 rádjái, lea illá makkárge lassáneapmi mañemuš áigodagas. 2018:s, 2,1% buot Norgga FoU-rahčamušain lohkkjuvnon bargojagit guske poláraguovlluid. Dát oassi lei binná alladut go ovddibu jagiin (2,5% 2006:s ja 2010 ja 2,4% 2014:s).

Raportta loguid vuodul lea árvvoštallon, ahte ollislaččat 1515 miljovna ruvnu geavahuvvui poláradutkamuššii 2018:s. Dát sisttisoallá maiddá dálá goluid, muhto ii kapitalagoluid dego investeremiid ođđa dáluin ja dutkanlanjaid. Almmolaš ruhtadangáldut ledje oassin sullii golbma njealjádasa (76%) buot FoU-goluin mat geavahuvvojedje poláradutkamušas. Norgga dutkanráđđi ruhtadii sullii 25% poláradutkamušas.

Institušuvdnasuorgi lea stuorámus mii bohtá poláradutkamuša juolludeapmái, rehkenastton 54% osiin našuvnnalaš oppalašvuodas. Institušuvnnat alit oahpposuorggis gokčet sullii 40% ja industriijasuorggis 6% osiin.

Stuorámus poláradutkamuša institušuvdna lea UiT – Norgga árktalaš universitehta, mas lea oktiibuot 16% poláradutkamušas. Institušuvdnasuorggis, institušuvnnat joavkkus “eará dutkaninstitušuvnnat” dahket stuorámus oasi poláradutkamušas 20% našuvnnalaš oppalašvuodas. Dás, Norgga Polar-institušuvdna ja Meteorologalaš institušuvdna leat stuorámusat. Primára dutkaninstitušuvnnat gokčet 19% našuvnnalaš oppalašvuodas. Dáin Mearradutkaninstitušuvdna lea stuorámus.

Norgalaš poláradutkamušdoaimmain 38% lei čatnon eatnamiidda ja fas 60% lei čatnon merrii/áhpái. Norgalaš poláradutkamuš mii čađahuvvui eatnama alde Svalbárddas ja sulluin gokče 30% oppalaš poláradutkamušas. Bárentsáhpai ja davimus oassi Norggamearas leat dehálaš guovllut mearaid poláradutkamii ja dahke 34% našuvnnalaš oppalašvuodas.

Poláradutkamuš lea čađahuvvon buot dieđasurggiin. Stuorámus goittotge lea luonddudieđa, man siste čađahuvvui sullii 80% oppalaš poláradutkamuša bargojagiin.

Oppalaččat 1900 olbmo oassálaste poláradutkamušdoaimmaide 2018:s. Sis sullii 1200 barge dutkaninstitušuvnnain, sullii 640 universitehtas ja sullii 110 olbmo barge fitnodagain.

Dutkamuš Svalbárddas

Kártendutkamuš Svalbárddas geavaha doaimmaindikáhtora mii vuodđuduvvá dutkanbargobeivviid loguide. Lohkan lea geavahuvvon indikáhtorin eará riikkaid dutkandoaimmaid viidodagas sulluin.

Fuomášeimmet dutkandoaimmaid unnuma vuosttaš háve 2018:s dutkanbeivviin loguid vuodul ja logut ledje vuollelis go 2014:s. Goittotge veardádallámis árat jagiiguin, 2014 aktivitehta lei erenomáš allat ja dutkanbeivviid logut 2018:s leat eanet go 2002:s, 2006:s ja 2010:s.

Norgga institušuvnnaid dutkit rehkenaste 42% dutkanbeivviid 2018:s, seammás go dutkit olgoriikkalaš institušuvnnain gokče loahpa 58%. Dát logut sisttisdoallet UNIS (Norgga Svalbárdda universitehtaguovddáža) sihke gieddeaktivitehta ahte kantuvrabargguid Longyearbyen (mii lea oaivvilduvvon oahpahušulbmilii) ja jus beare UNISa gieddeaktivitehta livččii váldon mielde, de dalle norgalaš oassi livččii gahččan 34%.

Nubbi stuorámus našuvdna dutkanbeivviin lohkamis 2018:s lei Polska 15% osiin ja das maŋŋá Ruošša 13%. Eanáš ruošša dutkamuš lea čađahuvvon Barentsburggas, go fas Hornsund stašuvnnas gokčá eanáš polskalaš dutkanbeivviid. Oktiibuot Norga, Polska ja Ruošša gokčēt eanet go guokte goalmádasa oppalaš dutkandoaimmain Svalbárddas dutkanbeivviid loguin. Dutkit duiskkalaš institušuvnnain dahket maiddái viiddis dutkamuša Svalbárddas. Duiska lea njealját stuorámus našuvdna 6% osiin dutkanbargobeivviin Svalbárddas 2018:s. Dasa lassin eará riikkaid dutkit eará institušuvnnain leat oassálastán dutkamii sulluin 2018:s. Min registreremiid mielde dát dutkit leat lihtodan institušuvnnaiguin 20 sierra riikkas.

Dutkanbeaivvit leat leamašan juhkkon Svalbárdda geográfalaš guovlluid mielde. Guovlu 1, mii sisttisdoallá Longyearbyen, Barentsburgga, Pyramida, Isfjorda ja Svea, rehkenasto viidásamos 42% Svalbárdda oppalaš dutkanbeivviid loguin. Dutkanaktivitehta Guovlu 2 (Ny-Ålesund, Kongsfjorden ja birastahtti guovllut) gokčēt 37% ollisvuodas. Dutkanaktivitehtat eará sajiin Svalbárddas leat eanet ráddjejuvvon 21%.

1 Introduction

Based on a mapping survey, this report presents indicators of Norwegian polar research, High North research and research in Svalbard. The focus is on the research profile and volume in terms of R&D efforts (R&D work years full time equivalents (FTEs) and expenditures) in 2018.

1.1 Purpose and content of the mapping survey

Polar and other areas in the High North are becoming increasingly important in international research. In particular, this is due to the recognition that these areas are important for the understanding of global climate change, and there is a growing international interest in resource extraction in polar areas, business and social development. Norway has long traditions as a polar nation, and for a long time the polar and northern regions have been important parts Norwegian research.

Against this background, the Norwegian polar research efforts have been regularly mapped, based on the initiative of the Research Council of Norway. The first survey was conducted in 2003 covering the year 2002 (Aksnes & Maus 2003). Then new surveys have been conducted every fourth year (Aksnes & Rørstad 2008; Aksnes, Rørstad & Røsdal 2012; Aksnes & Rørstad 2015). The present mapping is the fifth in a series of reports and covers the year 2018. The survey, like the previous ones, has been carried out by NIFU.

In terms of content, indicators presented, analyses and structure, the present report has large similarities with the previous reports. However, there are also some differences. The most important is that the survey also encompasses a mapping of the Norwegian High North research. These results are presented in a separate chapter (Chapter 3). The High North covers areas also south of the polar Arctic regions (see Chapter 2). Previous reports included a mapping of polar research in terms of publication output, which is not conducted in 2018. Moreover, there are also some differences when it comes to survey questions and data collected. This is further described in Chapter 2.

Norwegian research in the High North has been mapped only one time previously (Aksnes et al., 2010). However, the geographical delimitation of the High North in the previous survey differed significantly from the one used in this report. Results from the first mapping will therefore not be comparable with the results of this new mapping for 2018. Therefore, it is not possible to analyse how the Norwegian research efforts relating to the High North have developed over time. For the mapping of polar research, on the other hand, the geographical demarcation has been consistent across the various surveys, which allows analyses of the temporal dimension.

The main purpose of the survey is to present indicators that can provide a basis for assessing various aspects of Norwegian polar research and High North research. Core indicators include the volume in terms of:

- R&D FTEs
- sources of funding
- how the research efforts are distributed at the level of sectors and across institutions.

In addition to providing indicators on Norwegian polar research and High North research, the report contains a mapping of research in Svalbard. In this mapping, both the Norwegian and foreign research activities are included and data on researcher days have been collected. These data are used as an indication of the extent of the research activity of the various nations in Svalbard. In addition, a minor survey has been sent to the institutions with their own stations/installations in Svalbard. The purpose has been to provide information on the activity at the stations, the scope of the research, and the further plans.

The report is organized in five chapters. The next chapter (Chapter 2) describes the methods and data for the various surveys. Chapter 3 presents the mapping of the Norwegian research relating to the High North, while Chapter 4 provides the similar results for Norwegian polar research. Chapter 5 contains indicators and analyses of Norwegian and foreign research in Svalbard, including a descriptive overview of main stations and installations.

2 Data and methods

This chapter describes the data and method applied in the surveys and the definitions used to delineate polar and High North research.

2.1 Definitions of polar and High North research

Polar and High North research are not traditional scientific disciplines and encompass a range of disciplines from the humanities to engineering, although the greatest proportion of research is carried out within the natural sciences. Rather than being defined according to thematic focus, the categories are geographically delimited.

A main purpose of this project has been to investigate and map the resources spent on research in the polar and northern areas. These are partly overlapping categories. Polar research encompasses research carried out in the Arctic and Antarctic. Northern research encompasses part of the Arctic research, in addition to research carried out in the High North, subarctic areas.

In the project, polar research is based on the definition which for a long time has been adopted by the Norwegian government and the Research Council of Norway (cf. St.meld. nr. 42 1992/93) as well as in NIFU's previous mappings of Norwegian polar research. The definition of the High North research originates from the Norwegian strategy for northern areas which was launched in 2017 (Departementene, 2017). It should also be noted that some other countries and organisations may apply other definitions of polar and northern areas. For example, both Arctic and sub-Arctic areas (e.g. northern part of Norway) are included in definition of Arctic developed by Arctic Monitoring and Assessment Programme (AMAP). This is an important issue, as applying alternative definitions would of course change the volume of the Norwegian research carried in polar and northern areas.

Below, the definitions applied in the survey are further described:

Definition of polar research (R&D)

Research (R&D) carried out on the basis of material from the polar areas (Arctic and Antarctic), concerning phenomena localized in the polar areas or aiming at application in the polar areas. All disciplines are included.

***Arctic:** The polar part of the Arctic, including Svalbard, Jan Mayen, the northern part of the Norwegian Sea, the Barents Sea, the Greenland Sea and the Arctic Ocean*

***Antarctic:** The area south of the Antarctic Convergence. This encircles Antarctica, and is where cold, northward-flowing Antarctic waters meet and mix with the warmer waters of the sub-Antarctic. Its position varies, but it normally lies between 50°S and 60°S. Also the sub-Antarctic islands such as Bouvet Island and South Georgia, which may at times be north of the Antarctic Convergence are included.*

Definition of research in the High North (R&D)

Research (R&D) carried out on the basis of material from the High North, concerning phenomena localized in the northern areas, having thematic relevance for the northern areas or aiming at application in the northern areas. All disciplines are included (including medical research based on biological/clinical/health material or data collected in the northern areas). The research (R&D) may be carried out at units that have their address in the northern areas or outside.

***High North areas:** Covers the three northernmost Norwegian counties including the fjords and coastal regions, northern parts of the Norwegian Sea, the Barents Sea and Svalbard as well as northern Sweden, northern Finland and northwest Russia.*



Figure 2.1 Map of Arctic and northern areas as delineated in the survey*

) **Arctic: The shaded area indicates the boundary of the Arctic as defined in the survey. Includes areas north of the forest boundary with continuous permafrost and sea areas north of the maximum sea ice extent. In the Norwegian sector, the boundary follows the 72. latitude and not the borders for maximum spread of sea ice. **Northern areas:** Includes the area within the black line (the three northernmost Norwegian counties with the fjord and coastal areas, northern parts of the Norwegian Sea, the Barents Sea and Svalbard). In addition, northern Sweden, northern Finland and northwest Russia are included, marked with grey shading in the map.*



Figure 2.2 Map of Antarctica as delineated in the survey*

**) The area south of the Antarctic Convergence. This encircles Antarctica, and is where cold, northward-flowing Antarctic waters meet and mix with the warmer waters of the sub-Antarctic. Its position varies, but it normally lies between 50°S and 60°S. Also, the sub-Antarctic islands such as Bouvet Island and South Georgia, which may at times be north of the Antarctic Convergence are included.*

2.2 Definition of R&D

In this, and similar surveys that NIFU conducts, we have used the OECD's definition of R&D: *Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge.*

R&D activities are further divided into the following R&D types:

- Basic research: Experimental or theoretical activities carried out primarily to provide new knowledge of the underlying foundations of phenomena and observable facts - with no intention of particular application or use.

- Applied research: An activity of an original nature that is carried out to provide new knowledge. Applied research is primarily aimed at specific practical goals or applications.
- Development work: Systematic activities that use existing knowledge from research and practical experience, aimed at producing new or substantially improved materials, products or devices, or introducing new or substantially improved processes, systems and services.

2.3 R&D mapping survey

The mapping of the High North research and the polar research was carried out using a single web survey questionnaire. Since the mapping aims at providing complete coverage of the national research efforts within these fields, the survey was sent to all the three research performance sectors: departments in the higher education sector, institutes in the institute sector and companies in the industrial sector. The questionnaire was developed by NIFU in cooperation with the Research Council of Norway. A copy of the questionnaire is attached in Appendix 1.

The questionnaire was designed in three versions, one for each sector. These versions had the same structure and main questions, although with some differences. This mainly relates to the questions about expenditures and funding sources. As key-indicator we have used the number of polar and High North research in terms of work-years 2018 or full-time equivalents, FTEs. This is an adequate and relevant indicator of the scope of research, which also allows comparisons across disciplines, institutions and sectors. When we use the term “FTEs” in this report, we more specifically refer to FTEs of R&D.

The companies in the industrial sector were also asked to report the amount of resources spent on R&D within the fields. In the higher education sector and the institute sector, the costs were indirectly estimated on the basis of reported FTEs of polar/High North research and the FTE expenditures from the latest regular R&D statistical survey, adjusted for price growth (calculated by Statistics Norway). For both sectors, FTE expenditures for each department/institute was used, based on the R&D statistics in 2017, adjusted for price growth for research from 2017 to 2018 (3.4%). By using this method, estimates for the relevant current R&D expenditures for each unit were provided.

The questionnaire was sent to departments, institutes and companies that were considered as relevant candidates for having carried out polar and High North research. All institutes and departments in institutions located in Nordland, Troms and Finnmark were included. For the remaining higher education sector, the questionnaire was sent to all departments within the natural sciences, in addition

to selected departments in other fields. In the institute sector, we selected the institutes that had reported polar research in the previous survey. For the industrial sector we received a list of relevant companies prepared by the Research Council of Norway. As a quality assurance, we checked our mailing lists against the one from the previous surveys we conducted, as well. In addition, we included units that had published articles within polar research the recent years.

The survey period was from May 10th to October 1st, 2019. Our first inquiry to all the respondents included an information letter signed by the directors of the Research Council of Norway and NIFU. The survey was sent to 110 departments in the higher education sector, 45 research institutes, 6 hospital trusts and 563 companies, all together. In the survey period we sent up to five reminders to respondents that did not answer the survey. Numbers of respondents, and response rates by sector of performance are shown Table 2.1.

Table 2.1 Overview of the numbers of units and response rates by sector of performance.

Sector of performance	Number of units invited to respond	Number of units responding	Response rate	Number of units included in the analysis
Higher education sector	110	92	84 %	54
Research institutes	45	39	87 %	33
Hospital trusts	6	5	83 %	1
Industrial sector	563	337	60 %	49
Total	722	471		135

Source: NIFU

The response rate for the HE- and institute sector is 84 and 87 percent, respectively. These response rates should be considered as very high, which is important as the sectors account for the majority of the relevant research. In the industrial sector, the response rate was lower, with 60 per cent, but in these kinds of surveys this is still quite high. In total, the survey was sent to 722 units, where 471 responded. Of these, 135 reported to have conducted R&D according to the definitions. This means that 336 units did not conduct either polar or High North research. Overall, most of the units that did not perform relevant research (a total of 288) were companies. In the industrial sector, 49 of 337 (15 %) responding companies reported to have conducted R&D. The corresponding numbers for the HE-sector were 54 departments of 92 (59 %) and for the institute sector 33 institutes of 39 (85%). These numbers indicate that the survey was sent to a large number of companies that were not really relevant for this mapping. However, we did receive response from most of the large companies we consider as central to this mapping.

- The Norwegian research system are divided in three sectors of performance. These are the higher education sector, the institute sector and the industrial sector.
- The higher education sector consists of universities, specialized university institutions, university colleges and health trust with university hospital functions.
- The industrial sector consists of all companies (i.e. a technical organizational unit for productive business with economical purpose to provide return on invested capital).
- The institute sector consists of research institutes, public institutions with R&D (which do not offer education), museums and health trust without university hospital functions. The institute sector is often divided into two groups: pure research institutes (that spend more than half of their resources on R&D) and other institutions with less than 50 per cent of their resources on R&D. The latter group consists of public institutions that do not have R&D as their primary purpose. The research institutes are again divided into areas of research according to The Research Council of Norway's funding arenas: These are: Social science research institutes, Environmental research institutes, Technical industrial research institutes and Primary research institutes. Some institutes are not classified according to this system, these are termed Other research institutes. A complete list of institutions and research institutes with research area affiliations can be found in Appendix 2.

It should be noted that in these types of mappings, it may be challenging for the respondents to give exact answers on how much of the activity that should be classified as R&D and falls into the definition of the relevant fields. The boundary to related activities, which should not be regarded as R&D, is not always clear. It is therefore important to emphasize that the results are subject to uncertainty. The reported figures are based on estimates, which despite attached guidance material involve subjective elements. This is generally true when reporting these kinds of statistical data. Overall, the uncertainty of the results will be greater at the detailed level and in cases where the numbers are based on responses from few units.

Generally speaking, the survey has three sources of error: 1) Units with relevant R&D activity that have not been identified and thus were not sent a questionnaire, 2) Missing responses from units having relevant R&D activity and 3) Reliability of the respondents' answers. We consider the first source of error to have relatively limited influence as we believe we have identified and covered most of the relevant units. For the polar research mapping this also holds for factor 2, while it may have larger impact for the mapping of High North research. This is due to the fact that response rate for the industrial sector was significantly lower than for the other two sectors and most of the R&D activity of industrial sector is within High

North research. This means that the R&D-activity of this sector might be underestimated in the survey. With regard to factor 3, the reliability of the respondents' answers, the source of error is considered to have moderate to large significance since the figures reflect discretionary assessments. At the aggregate level, however, this source of error might to some extent be compensated by the fact that some units might have reported too high figures others too low.

Overall, it is important to emphasize that the survey should be regarded as providing rough estimates rather than accurate quantification of Norwegian polar and High North research. A list of the respondents which are included in the analysis can be found in the appendix 2. The overview does not include companies in the industrial sector as the names of the companies are not given for confidentiality reasons.

2.4 Survey of research in Svalbard

2.4.1 Number of researcher days

The project included a separate survey of the research activity in Svalbard. Here we used the same methodology as in previous studies. The main objective has been to provide a quantitative measure of the extent of the different countries' research activities on the archipelago. Ideally, this would be an indicator of how much financial resources the different countries spend on research in Svalbard. However, obtaining such data is an almost insurmountable task, both because it is difficult to identify all the different actors and because the different actors may not have records of these costs.

In the project we therefore used an alternative indicator as an estimate of the research activity, namely *researcher days* - the number of days that researchers spend in Svalbard and near shore waters to conduct research (the purpose of the stay should be to carry out research or to collect data used primarily for research). As researchers, scientists, PhD-students, technicians, research assistants, etc. are included, but not master's/bachelor's students.

By counting how many days researchers from different countries and institutions have spent on the archipelago, we are able to provide an indicator of the extent of the countries' research efforts. Researchers who come to Svalbard would normally need a place to stay overnight, and the choice of possible accommodations is limited. At the same time, there are already good accommodation statistics for Ny-Ålesund, compiled by Kings Bay AS.

To be able to obtain a complete statistics of number of researcher days for 2018, we have carried out a survey to other stations and research institutions. In

addition, we have used the RiS (Research in Svalbard) database, which is operated by the Svalbard Science Forum (SSF). All project leaders who wish to conduct research activities in Svalbard are encouraged to register their projects in this database. From RiS we have obtained information on individual projects that fall outside the registrations we have received from the individual research stations and institutions.

The definition of "research" when calculating researcher days is based on the same principles as for polar research in general. Activities such as topographic mapping and monitoring are not included unless this activity is primarily conducted for research purposes. Teaching activities are not included either. Broadly speaking, the researchers in Svalbard can be divided into the following categories: a) Researchers who are staff or visit the various research stations/installations in Svalbard, b) Staff and other researchers affiliated with the University Centre in Svalbard in Longyearbyen (UNIS), c) Researchers doing field research involving stays in tents or cabins in Svalbard, d) Researchers conducting marine research involving ships and research vessels.

In the case of a) we had access to research day statistics for Ny-Ålesund. In addition, we obtained similar information for Kjell Henriksen Observatory at Longyearbyen, Tromsø Geophysical Observatory's installations/Sousy Svalbard radar at Longyearbyen, SINTEF's station in Svea, EISCAT-Svalbard's facility at Longyearbyen, the Czech research stations in Petuniabukta (Petunia Bay) and Longyearbyen, and the Polish research stations in Hornsund, Kaffiøyra and Billefjorden as well as for the Russian research activity related to Barentsburg. In addition, we received a separate report for the Norwegian Polar Institute's overall activity and stay in Svalbard. The Norwegian Meteorological Institute did not report any significant research activity related to the stations on Bjørnøya (Bear Island) and Hopen. Concerning SvalSat in Longyearbyen, we have chosen to exclude this installation in the calculation of research days, because SvalSat is primarily operated for commercial, non-scientific purposes.

UNIS (b) represents a special case in relation to the measurement of researcher days. Generally, much of the research in Svalbard is done by researchers being on the archipelago for shorter periods, and where the research material or data is processed and analyzed at the home institutions. For UNIS, this is different since employees stay in Svalbard throughout the year. This situation generates many researcher days. As in the previous surveys, the calculation of researcher days is based on converting the number of R&D work-years by UNIS to number of researcher days (1 work-year is assumed to correspond to 240 days). Note that teaching activity is not included in the statistics. An employee with, for example, 60 per cent of the working time spent on research will thus have almost 150 researcher days registered (the remaining 40 per cent spent on teaching and

adjacent administration are not registered as researcher days). From UNIS we also received data on field work activities. This is based on information that is recorded internally through the "Field Work Reporting Form" (all projects and courses at UNIS must provide such overviews in detail prior to doing field research/activities). Both students and academic staff are included in the report, but teaching activity and students are not included in the statistics underlying this report. The difference between the number of R&D work years measured as researcher days and the number of days in the field has been counted as "office days" Longyearbyen. As this represent a significant number of days, it is shown separately in some of the figures. It should be noted that although all UNIS R&D work-years have been transformed into Svalbard researcher days, some of the research could still include regions other than Svalbard.

For c) we used information from the RiS database. We identified all project marked as "active/ongoing" with field research 2018 and which were not likely to have been included by the other parts of the survey. The project leaders of each project were asked to report the number of researcher days in Svalbard in 2018 by geographical area and the country of the institutional affiliations of the project members. An email request was sent to the project leaders of 56 projects. Responses were received for 82 per cent of the projects. For the remaining projects, we did not receive a reply of the or email address was not in use anymore. However, some of the projects did not report field activity in 2018 or were found to be registered through the reports from the stations. About 35 projects had field activity in 2018 and were included in the statistics. In total, about 1,800 researcher days were reported from these projects.

Each year, various research vessels carry out research cruises around Svalbard, both Norwegian and foreign. The study includes researcher days spent on research vessels in the waters around Svalbard. Here we have found it reasonable to draw the limit for what should be counted as "Svalbard research" to 12 nautical miles (Svalbard's territorial border) - although in practice it will be difficult to limit the vessels' research activity within such a border.

In order to get an overview of this activity, we used the POGO database (see <http://www.pogo-oceancruises.org/>) which includes various relevant data and information concerning such cruises. We also contacted the Institute of Marine Research, which prepares national cruise plans for most Norwegian research vessels. An email request was sent to all project leaders of cruises in the waters around Svalbard and number of researcher days was collected. We obtained responses for all relevant cruises. In several cases, the research activity was carried out outside the territorial border and was not included.

In addition to the total number of research days and distribution per country (national institutional affiliation), overviews of the geographical distribution were obtained. The following categories were used (see the map, Figure 2.3):

- Zone 1: Management area 10a, includes Longyearbyen, Barentsburg, Pyramiden, Isfjorden and Svea.
- Zone 2: Management area 10b includes Ny-Ålesund and Kongsfjorden
- Zone 3: North West Svalbard, includes Prins Karls Forland
- Zone 4: East Svalbard, includes East Spitsbergen, Nord Austlandet, Kong Karls land, Hopen and Edgeøya
- Zone 5: South Svalbard, includes Hornsund and Bjørnøya

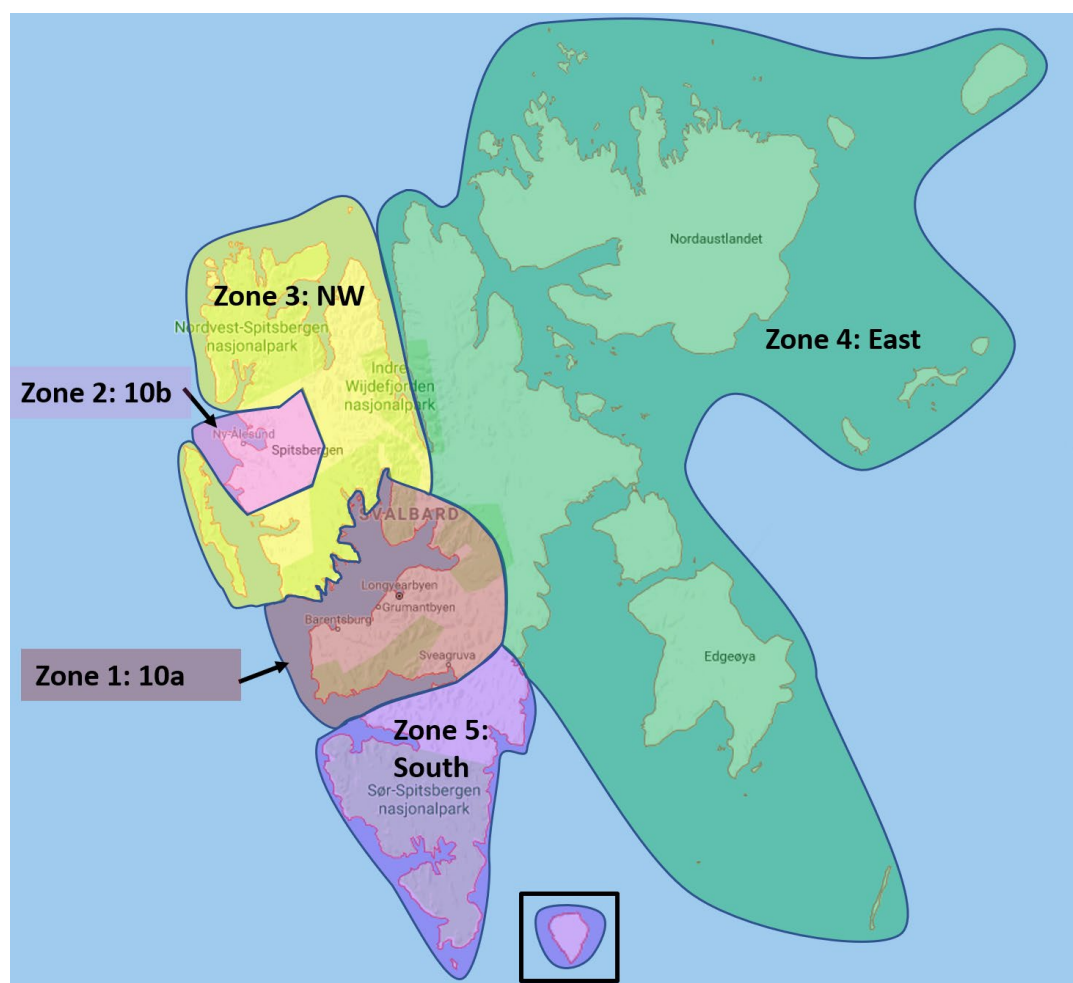


Figure 2.3 Map of Svalbard and zones used in the survey

Source: Svalbard Science Forum

It should be emphasized that the statistics of researcher days has different sources of errors. These can be divided into three categories:

1. *Lack of coverage.* This concerns the question whether the survey is complete, that is, whether there are research activities in Svalbard which are not captured by the survey. Here we find it reasonable to believe that the survey has a good and satisfactorily coverage. We have obtained reports of number of researcher days for all the research stations and installations, and most of the research in Svalbard is affiliated with these stations. Concerning the individual projects, however, we may not have been able to capture all the relevant projects, either because of lack of response or missing information in the RiS database. However, the importance of this source of error is probably small compared with the total number of researcher days already registered.

2. *Double counting.* The survey involves various approaches to identify number of researcher days. This might potentially lead to cases of double counting if one and the same person is included in the statistics from multiple sites (e.g. if a researcher from UNIS has been involved in research in Hornsund and then would be included in the figures from both UNIS and Hornsund). Probably there might be a few cases. However, the importance of this factor is probably minor with little influence on the overall patterns.

3. *Reliability of the answers.* As for the R&D statistical survey, the statistics of researcher days is based on discretionary assessments made by the institutions and project leaders. NIFU does not have background information to verify whether the figures reported are accurate or reasonable, and we have to trust the assessments made by the respondents. For Ny-Ålesund, detailed and reliable statistics is available by Kings Bay. Other institutions/stations do not systematically register researcher days, and the figures reported should be considered as rough estimates. Compared with the previous surveys we in some cases find large variations in the reports for some institutions/stations, particularly this has been noted for the research activities in Barentsburg. We believe that some of these variations relate to lack of reliability. Overall, this source of error is considered to have the largest impact on the results.

In conclusion, it should be emphasized that the statistics of researcher days is subject to uncertainty. This means that the survey should be regarded as a rough rather than precise quantification of the volume of research in Svalbard measured through researcher days.

2.4.2 Survey of research infrastructure in Svalbard

As part of the project, a separate survey of Norwegian and foreign research installations in Svalbard was carried out. A questionnaire was sent to the owners of the various stations and research installations present on the archipelago. The aim of this study was to obtain, among other things, more detailed information on

the research being carried out, capacity, staffing and further plans. The survey represents a supplement to the survey conducted by NIFUs in the 2014 mapping of research in Svalbard. The final chapter of this report describes the results of this study. The text here is mainly based on the information we received through the survey. The questionnaire used is included as an attachment to the report.

3 Norwegian High North research

This chapter gives an overview of the Norwegian research relating to the High North in 2018. Work-years measured as full-time equivalents (FTEs) is used as the main indicator, but the chapter also provides information on the R&D resources spent as well as on human resources involved in the research.

As noted in the introduction, Norwegian research in the High North was previously mapped in 2009 (Aksnes et al., 2010). However, the boundaries for the 2009 survey differed significantly from the boundaries used in the current report. In the 2009-mapping, coastal areas north of the 62 latitude (Stadt – the north-western coast) were included, while the present survey has used the geographical boundaries of the 2019 strategy “Research and Innovation for the North” (Forskningsrådet, 2019). In addition, the definition is more limited when it comes other Arctic areas. Results from the 2009 mapping will therefore not be comparable to the present mapping.

3.1 Norwegian research relating to the High North in 2018

This mapping shows that a total of 1,572 R&D work years (FTEs) of were related to the High North in 2018. The institute sector contributed to about 740 FTEs, or slightly less than half (47 per cent) of the total research. The higher education sector accounted for about 640 FTEs of research (41 per cent), while companies in the industrial sector conducted the rest, around 190 FTEs, or 12 per cent of the total, see Figure 3.1.

Figures from the official R&D statistics in Norway (Norges forskningsråd, 2018) show that a total of 3,168 R&D work-years were carried out in northern Norway in 2017. This includes R&D carried out by institutions, research institutes and companies located in the three northernmost counties in Norway as well as Svalbard. Thus, this figure is almost twice as high as the number of High North FTEs in the present survey. The reason is that a significant part of the research carried out in northern Norway would not count as high north research given the definition applied in the survey. At the same time, research carried out by institutions located in southern Norway may count as High North research

according to this definition. Another contributing factor relates to the response rate, which for the industrial sector was 60 per cent only. This indicates that the R&D-activity of this sector might be underestimated in the survey.

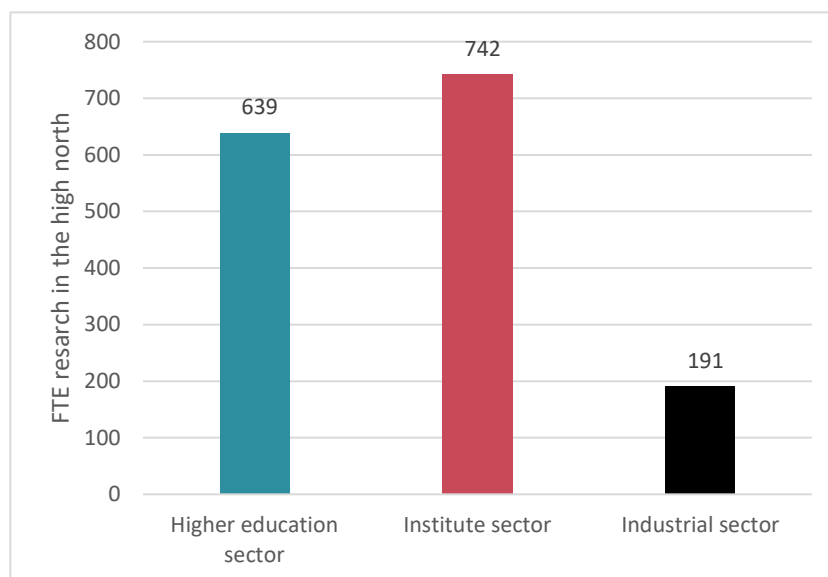


Figure 3.1 Number of FTEs research relating to the High North, by sector of performance, 2018.

Source: NIFU

As noted above and in Chapter 2, results from the 2009 mapping are not comparable to the present mapping. However, a total of 1,756 FTEs High North research were reported in 2009. The higher education sector accounted for 45 per cent of this research, the institute sector for 42 per cent, while the industrial sector contributed with 13 per cent. Thus, the relative distribution across sectors does not differ significantly from present mapping. However, in 2018 the total volume of FTEs was 10 per cent lower. Here, the more limited geographical delimitation of the High North is probably a main explanation.

3.2 Funding of the High North research

Based on the reported figures, we have estimated that a total of 2,412 million NOK was spent on High North research in 2018. This includes the current costs (salaries, social costs and costs to research activities), while capital costs such investments in new buildings and research vessels are not included. The relative distribution of the expenditures across sectors does not differ much from the distribution of FTEs. The institute sector has the largest spending and the current expenditures amounted to 1,149 million NOK (48 per cent of the total). The higher education sector contributed to 892 million NOK (37 per cent), while companies

accounted for the rest of the research efforts, 371 million NOK, or about 15 per cent of the total.

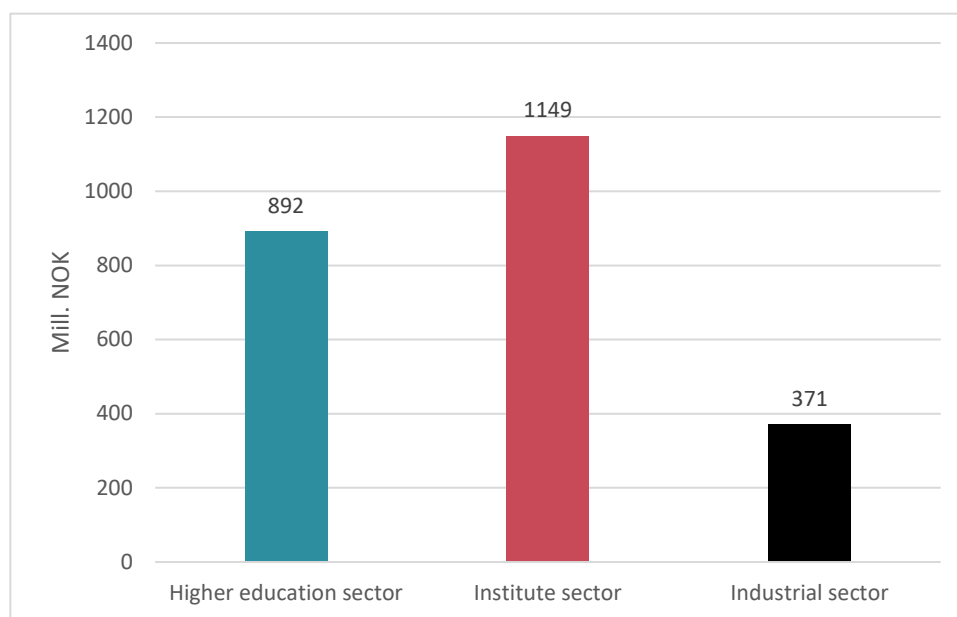


Figure 3.2 Current expenditures to research relating to the High North, by sector of performance in 2018.

Source: NIFU

The funding of the High North research by major funding source and sector of performance is summarized in Table 3.1. In total, 775 million NOK (32 per cent of the R&D expenditures) were funded by ministries in terms of general university funds (basic funding of the institutions in the higher education sector) and core grants to research institutes (funding of research institutes from their affiliated ministries. The Research Council of Norway funded about 624 million NOK (26 per cent of the total High North research), this includes project and programme funding as well as core grant funding to research institutes that receives such funding according to the governmental funding guidelines. Overall, about 70 per cent of the total research relating to the High North was funded by public sources.

In total, around 500 million NOK, (21 per cent) of the R&D expenditures were funded by industry. This includes expenses concerning the R&D activities within the companies as well as commissioned assignments and funding of R&D in other sectors.

The relative importance of the various funding sources varies significantly across sectors. For the higher education sector, public sources accounted for about 83 per cent, and the share was 76 per cent for the research institutes. Companies in the industrial sector funded about two third of their own research while public sources accounted for 26 per cent.

Table 3.1 Current expenditures to research relating to the High North by source of funds and sector of performance in 2018. Mill NOK.

Sources	HE-sector	Institute sector	Industrial sector	Total	Share (%)
General university funds/Core grant	333	442	0	775	32 %
The Research Council of Norway	311	286	27	624	26 %
Ministries and directorates	67	101	57	225	9 %
Counties and municipalities	27	39	1	67	3 %
Industry	76	177	249	502	21 %
EU-Commission	35	26	1	62	3 %
Abroad, not specified	7	18	0	25	1 %
Other national sources	36	61	2	99	4 %
SkatteFUNN*	0	0	24	24	1 %
Innovation Norway*	0	0	10	10	0 %
Total	892	1,149	371	2,412	100 %

Source: NIFU

*) In the national R&D statistics, Innovation Norway is included within the category for departments and ministries, while SkatteFUNN is classified as other national sources. In this mapping, these sources have been specified separately.

The survey included a question to the industrial sector concerning intramural and purchased R&D services. Of the 49 companies reporting to have carried out intramural R&D, 18 had also purchased R&D services from institutes/institutions located in the three northernmost counties, 19 from other national institutes/institutions and 10 from institutes/institutions in other countries (some companies appear in more than one category), see Table 3.2. Thus, a significant share of the companies relies on both intramural and purchased R&D. Some companies did not carry out intramural R&D but purchased R&D services from other institutes/institutions. Of these, 11 purchased R&D from units in the three northernmost counties.

Table 3.2 Intramural and purchased R&D services related to High North research. Industrial sector 2018

	Purchased R&D from institutions in the three northernmost counties	Purchased R&D from other national institutions	Purchased R&D from institutions in other countries
Companies with intramural R&D	18	19	10
Companies with no intramural R&D	11	16	4

Source: NIFU

3.3 High North research by sector and institutions

The total High North research has been distributed across sectors, institute groups and institutions (Figure 3.3). In the figure, the largest higher education institutions in terms of FTEs of High North research have been shown separately. Figures for individual institutes are not shown, even though some institutes such as the Institute of Marine Research and Norwegian Polar Institute have extensive volume of High North research. This is due to the confidentiality of the reported figures and the regulations in the Act of statistics.

Instead the institutes have been divided into areas or groups according to the classification system of the Research Council of Norway. In this system, the institutes are divided into four areas:

- primary research institutes
- environmental research institutes
- technical industrial research institutes
- social science research institutes,
- other research institutes (remaining institutions with R&D)

The largest institution in the higher education sector is the Arctic University of Norway with a total of 330 FTEs or about one fifth of the national total of High North research. The second and third largest institutions in the sector are the University of Oslo and the University of Bergen with proportions of 6 and 4 per cent of the national total, respectively. The Norwegian University of Science and Technology (NTNU) is a relatively small contributor to High North research and conducted 34 FTEs or 2 per cent of the total. Other higher education institutions contributed with a share 8 per cent. A list of departments and institutions which have reported High North research in 2018, can be found in Appendix 2.

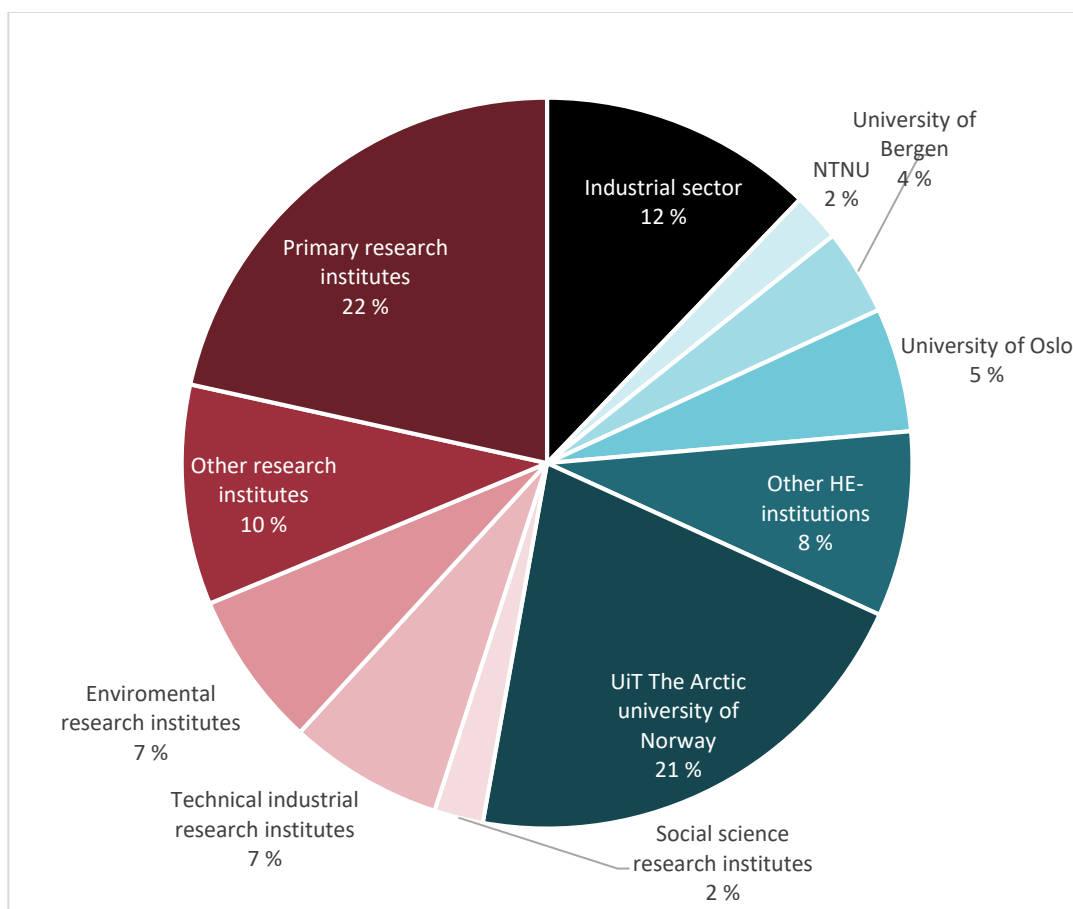


Figure 3.3 FTEs of High North research by institutions, groups and sector of performance in 2018. Relative contributions in percentage.

Source: NIFU

In the institute sector, the primary research institutes was the largest group with about 340 FTEs which corresponds to 22 per cent of the national total of High North research. The primary research institutes consist of four institutes with High North research of which the Institute of Marine Research is by far the largest. The second largest group is the “other research institutes”. This group consists of ten research institutes with High North research where the Norwegian Polar Institute is the largest. Examples of other institutes included in this category are Akvaplan Niva and the Norwegian Meteorological Institute. In total, the other research institutes contributed to 9 per cent of the national total of High North research. The environmental research institutes and the technical industrial research institutes are equal in size and contributed each with about 110 FTE or 7 per cent of the total. The environmental research institutes category consists of seven research institutes with High North research where Norwegian Institute for Air Research (NILU) and Norwegian Institute for Nature Research (NINA) contribute with almost half of this group’s FTEs. The group of technical-industrial research institutes includes five institutes where SINTEF is by far the largest. Even

though most of the research relating to the High North is within the natural sciences and technology, eight social research institutes contribute with a share of two per cent, or 34 FTEs. In this group Nordland Research Institute is the largest.

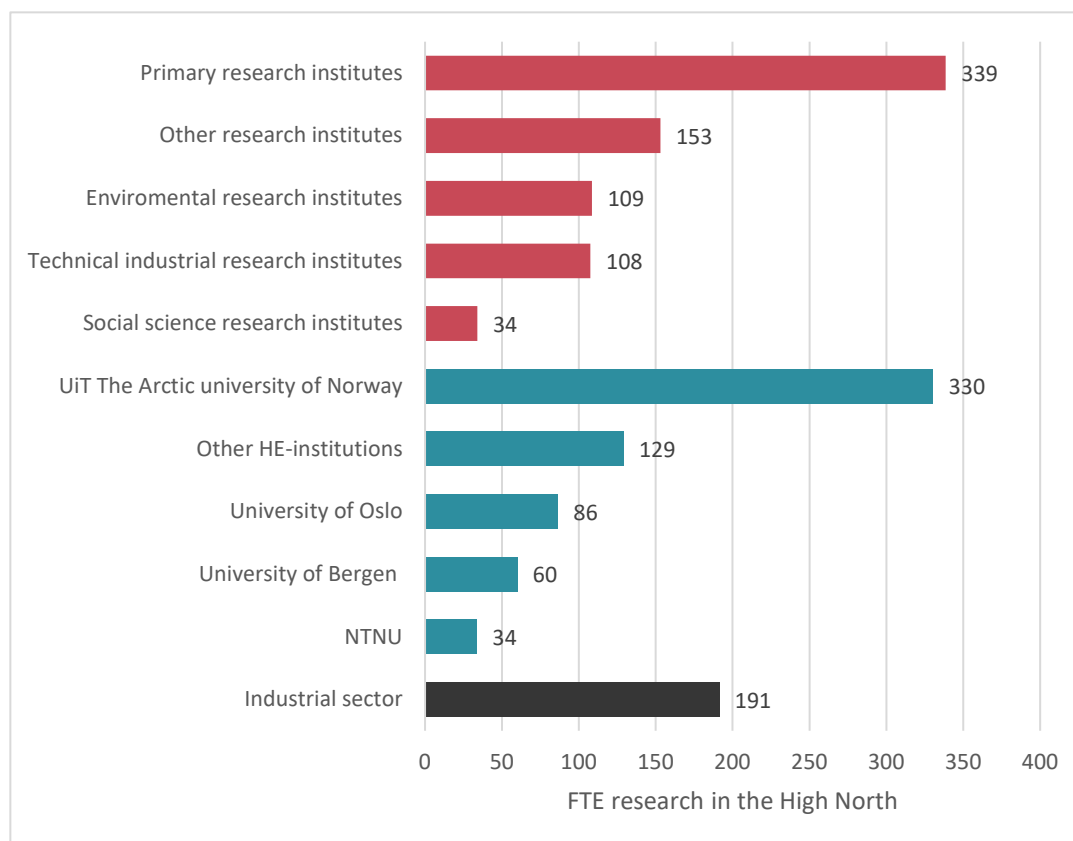


Figure 3.4 FTEs of High North research by institutions, groups and sector of performance in 2018.

Source: NIFU

A total of 47 companies reported to have carried out High North research/R&D in 2018. These companies differ considerably in size, ranging from a few employees to more than 1000. Table 3.3 shows the distribution of the company size measured as number of employees and the R&D volume the companies carried out. Companies with 10-49 employees accounted for the highest proportion of the R&D volume.

Table 3.3 Distribution of companies in the industrial sector by size (number of employees) and volume of High North research (R&D) in 2018.

Company size (number of employees)	Number of companies reporting High North research (R&D)	Total R&D expenditures, High North research (R&D), mill NOK
Below 10	13	30
10-49	14	102
50-199	3	14
100-249	4	48
250-500	4	22
500-999	4	49
More than 1000	5	107
Total	47	371

Source: NIFU

The 47 companies that reported to have carried out High North research/R&D, were classified in ten main industry categories (Table 3.4). The category mining and quarrying accounted for the largest volume with total R&D expenditures of almost 100 million NOK by seven companies. Then followed professional, scientific and technical activities with a R&D volume of almost 100 million NOK by 16 companies. A total of 12 companies classified as industry amounted to a total of 88 million NOK. The table also shows the total numbers of employees of the companies which were involved in High North R&D. Obviously, only a very small fraction of these people are involved in such R&D.

Table 3.4 Distribution of companies in the industrial sector standard industrial classification (NACE), number of companies, number of total employees and R&D expenditures in 2018.

Standard Industrial classification	Numbers of companies	Number of employees	R&D expenditures
Agriculture, forestry and fishing	5	1,722	32
Industry	12	3,033	88
Mining and quarrying	7	21,182	109
Professional, scientific and technical activities	16	4,107	96
Other*	7	572	46
Total	47	30,616	371

Source: NIFU

Note: Other refers to 7 companies in the following industries: Accommodation and food service activities; Construction; Electricity, gas, steam and air conditioning supply; Information and communication; Water supply, sewerage, waste management and remediation activities and wholesale and retail trade; repair of motor vehicles and motorcycles.

3.4 Geographical distribution of High North research

The Norwegian High North research covers both terrestrial and marine disciplines. The mapping also includes a question concerning where the research has been conducted and/or where the data are collected from. Based on this information the geographical distribution of Norwegian High North research is shown (Figure 3.5).

About one third of the research was related to the three northernmost counties.¹ Nordland and Troms each accounted for 12 per cent of the total national research efforts, while Finnmark had a proportion of 8 per cent. Research relating to land areas in the north of Sweden, Finland and Russia accounted for 2 per cent of the total. Research relating to Svalbard accounted for about one fifth (18 per cent) of the total High North research and was the largest land area for such research.

Altogether, the land areas accounted for 52 per cent of the High North research, while 39 per cent was related to sea areas. The remaining 9 per cent of the research was unspecified or not related to specific geographical regions.

The Barents Sea and the northern part of the Norwegian Sea accounted of 21 per cent of the national total of High North research.

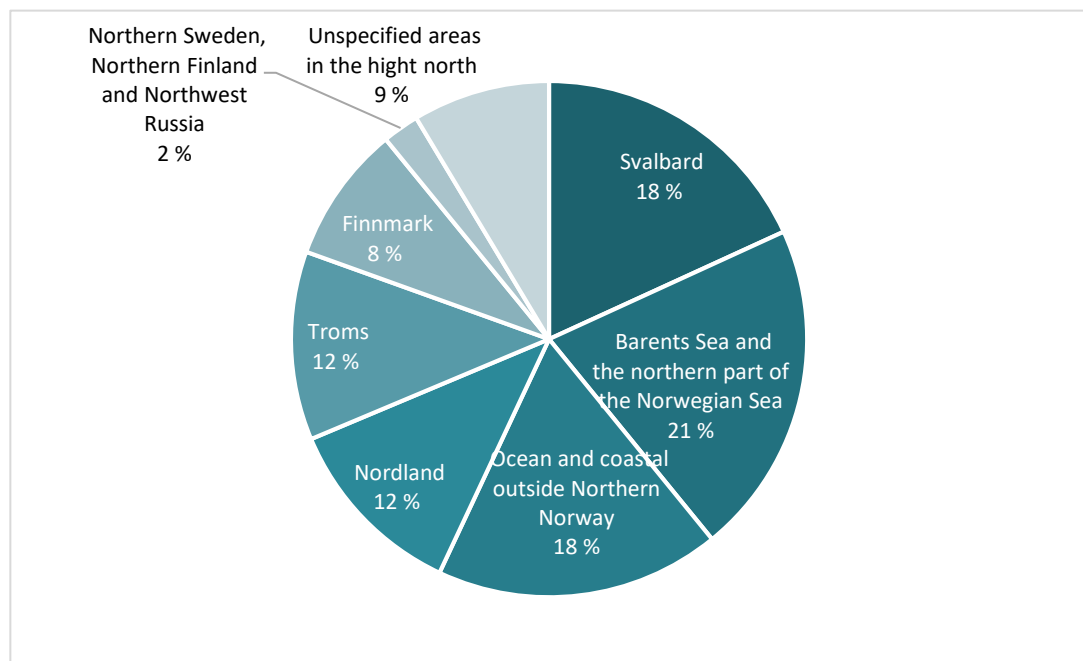


Figure 3.5 FTEs High North research in 2018 by geographically area.

Source: NIFU

¹ As the mapping was carried out in 2019, the former structure of Norwegian counties is used in the report.

Table 3.5 gives a detailed overview of the FTEs of research relating to the High North by geographical areas and by sector of performance. Research relating to Svalbard, was mainly carried out by the higher education institutions and research institutes. Each sector accounted for almost half of this research.

Table 3.5 FTEs High North research in 2018 by geographical areas and sector of performance.

Geographical area	HE- sector	Institute sector	Industrial sector	Total	Share (%)
Svalbard	136	134	16	286	18 %
Barents Sea and the northern part of the Norwegian Sea	104	186	39	329	21 %
Oceans and coastal areas outside Northern Norway	49	164	68	281	18 %
Nordland	81	70	32	184	12 %
Troms	94	86	6	186	12 %
Finnmark	59	56	20	135	9 %
Northern Sweden, Northern Finland and Northwest Russia	23	12	1	36	2 %
Unspecified areas in the High North	93	33	9	135	9 %
Total	639	742	191	1,572	100 %

Source: NIFU

The figures referred to in Table 3.4 are based on a classification according to which areas the research relates to, for example in terms of data collection. This does not necessarily mean that all the FTEs were carried out in these areas. For example, data and observations collected in specific geographical areas would typically be further analysed at the home institutions of the researchers and these institutions may be located in other parts of Norway. In order to provide a complementary picture of the geographical profile, we have made an additional analysis using data on where the institutions, institutes and companies are located in Norway. Some units are located in several counties, in such cases we have used the address of the main office (for example, the Institute of Marine Research has departments in several counties, but the main office is in Hordaland county).

Figure 3.6 shows the results of this analysis. Here numbers of FTEs have been distributed according to counties and sector of performance. In total, about 450 FTEs were conducted by institutions and companies located in Troms. Most of the research, about 330 FTEs, were carried out by departments in the higher education sector. The second largest county in terms of localisation of the institutions and companies was Hordaland, with a total of about 215 FTEs High North research.

For the industrial sector, Rogaland was the largest county, followed by Nordland and Trøndelag. Only a small part of the R&D was carried out by companies located in Troms and Finnmark. However, it should be recalled that the

response rate for this sector was lower than for the other two sectors. On the other hand, one would expect if companies in Troms and Finnmark carried out R&D in the North they would have reported this.

The units that conducted research relating to the High North were located in 10 counties all in all, including Svalbard.

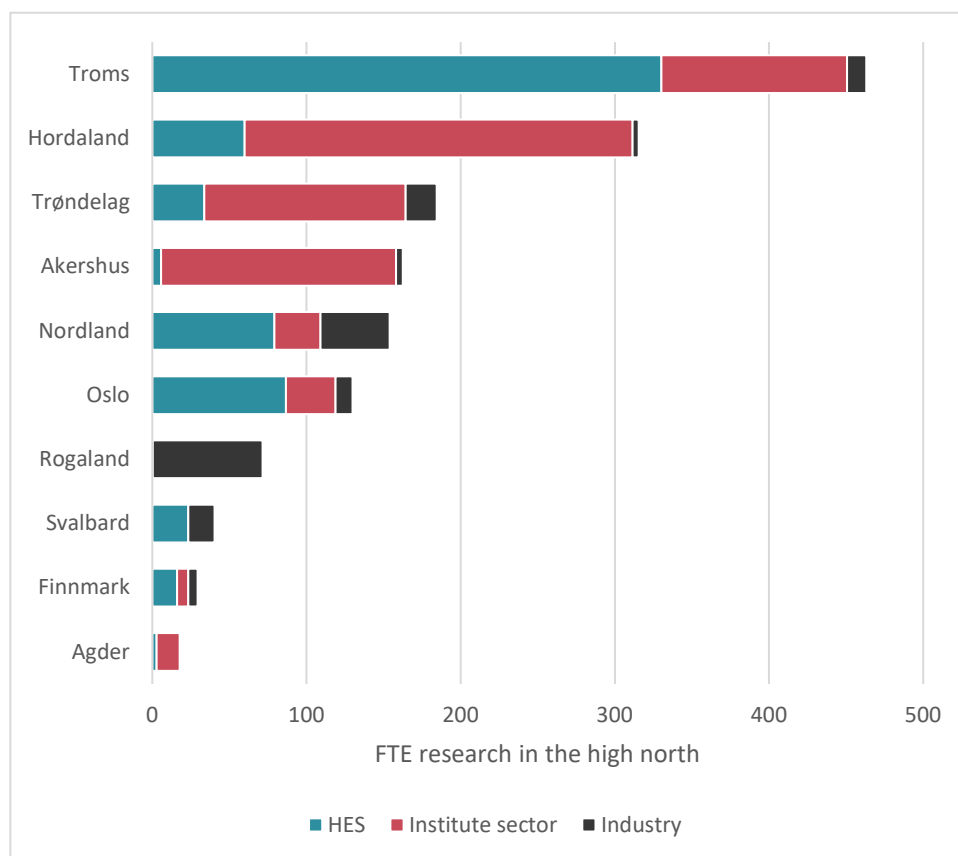


Figure 3.6 FTEs of High North research by county of the institutions/institutes/companies and sector of performance in 2018.

Source: NIFU

3.5 High North research by fields

The field distribution of the High North research measured as FTEs is shown in Figure 3.7. The research covers all the major domains. However, the natural sciences accounted for the majority of the research, in total about 960 FTEs, or about 62 per cent of the total research volume. The largest field was *basic marine biology*, followed by *fisheries biology and marine resources*, *geology* and *terrestrial biology*.

Technology is the second largest domain and accounted for 17 per cent of the total research volume. Within this domain, the categories for *fisheries and*

aquaculture technology and *petroleum technology* account for the largest number, 76 and 61 FTEs, respectively.

The social sciences accounted in total for about 10 per cent of the research volume, while the proportion of the humanities was three per cent, only. Within these domains, *economics* and *history, archaeology, cultural heritage, arts and theology* were the two largest with 24 and 33 FTEs, respectively.

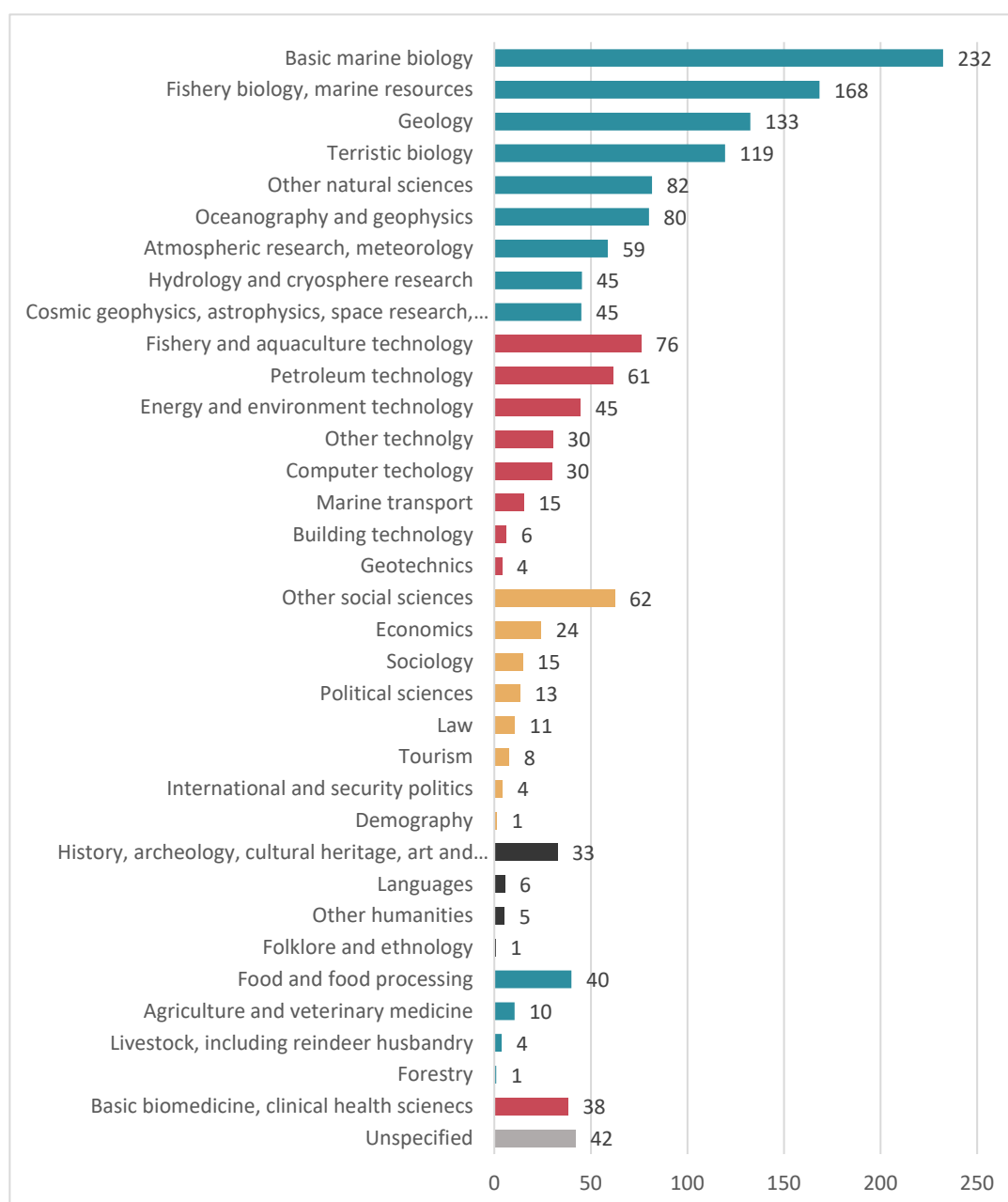


Figure 3.7 FTEs of High North research by field in 2018

Source: NIFU

Table 3.6 FTEs of High North research in 2018 by fields and sector of performance.

Fields	HE-sector	Institute sector	Industrial sector	Total
Basic marine biology	117	113	2	232
Fisheries biology, marine resources	30	127	12	168
Geology	115	14	3	133
Terrestrial biology	95	25		119
Oceanography and geophysics	24	48	8	80
Atmospheric research, meteorology	17	42		59
Hydrology and cryosphere research	31	14	1	45
Cosmic geophysics, astrophysics, space research, earth observations	27	6	12	45
Other natural sciences	8	69	4	82
Sum natural sciences	464	458	42	964
Fisheries and aquaculture technology	0	40	36	76
Petroleum technology	1	18	43	61
Energy and environment technology	1	25	20	45
Computer technology	1	14	15	30
Marine transport	1	13	2	15
Building technology		6		6
Geotechnics	1	4		4
Other technology	4	26	1	30
Sum technology	7	145	116	268
Economics	2	22		24
Sociology	8	7		15
Political sciences	8	6		13
Law	9	1	1	11
Tourism	4	3	1	8
International and security politics	0	4		4
Demography		1		1
Other social sciences	38	23	1	62
Sum social sciences	69	67	3	139
History, archaeology, cultural heritage, art and theology	28	5		33
Languages	6			6
Folklore and ethnology		0	1	1
Other humanities	4	1		5
Sum humanities	38	6	1	44
Food and food processing		36	4	40
Livestock, including reindeer husbandry	0	4		4
Forestry			1	1
Agriculture and veterinary medicine		8	2	10
Sum agriculture and veterinary sciences	0	48	7	55
Basic biomedicine, clinical fields and health sciences	29	9		38
Unspecified	32	10	23	65
Total	639	743	163	1,572

Source: NIFU

Further details on the distribution of FTEs by fields and sector of performance can be found in Table 3.6. For instance, the industrial sector mainly conducted R&D in different technology fields, where *petroleum technology* and *fisheries and aquaculture technology* were the two largest.

The survey also included a question on research relating to indigenous people where the respondents were asked to report the research volume by FTEs according to specific themes.

The results are summarized in Table 3.7. A total of 125 FTEs research were related to indigenous people, where *reindeer husbandry* and *health sciences* accounted for 25 FTEs each. However, the category *other fields* accounted for the highest number of FTEs, 46. There is no further information on what kind of research this category covers as the respondents did not provide such specifications. The higher education institutions conducted the majority of the research and accounted for about 60 per cent of the total.

Table 3.7 FTEs of High North research in 2018 with specific themes related to indigenous people

Topic	HE- sector	Institute sector	Industrial sector	Total
Reindeer husbandry	14	7	4	25
Health sciences	20	5		25
Culture and history	11	2	0	13
Law and legal rights	7	1		8
Languages	7		0	7
Other fields	16	28	2	46
Total	75	43	7	125

Source: NIFU

3.6 Human resources involved in High North research

The number of people involved in High North research in 2018 by sector of performance and type of personnel is shown in Table 3.8. The units responding to the survey, reported a total of about 2,800 people involved in the research activities in 2018. Of these, about 1,450 worked at a research institute, about 1000 at a higher education institution, while almost 310 people worked at companies. A vast majority, about 87 per cent, of the people were scientific R&D personnel. The rest had technical or administrative tasks and are referred to as “other personnel”.

Concerning the gender aspect of the R&D personnel, the survey shows that in all sectors, men were in majority. The female proportion was about 45 per cent in both the higher education and institute sector, but only 28 per cent in the

industrial sector. If we compare these findings with the total R&D personnel in Norway, the share of women in the higher educational sector is 49 per cent, and in the institute sector it is 44 per cent. In other words, in the higher education sector the share of women in High North research is slightly lower than the average for the sector. In the institute sector, the share of women is the almost identical. In other word, in terms of gender balance, the personnel of High North research do not deviate much from the research personnel in other fields.

In total, the units in the higher education sector reported that 62 people were awarded doctoral degrees with topics relating to High North research in 2018. The corresponding figure for the institute sector was 11.

Table 3.8 Personnel involved in High North research by sector of performance and type staff in 2018, number of people and share of women

Personnel	Higher education sector		Institute sector		Industrial sector		Total
	Total	Share of women	Total	Share of women	Total	Share of women	
R&D personnel	848	45 %	1,244	44 %	309	28 %	2,401
<i>PhD-students</i>	276	58 %	50	48 %			326
<i>Postdocs</i>	101	39 %	55	66 %			156
Other personnel	156	47 %	212	48 %			368
Total	1,004	45 %	1,456	44 %	309	28 %	2,769

Source: NIFU

4 Norwegian polar research

This chapter provides an overview the Norwegian research effort on polar research in 2018, using full-time equivalents (FTEs) and amount spent as key-indicators. As described in Chapter 2, Norwegian polar research has previously been mapped in 2002, 2006, 2010, and 2014. Thus, we are also able to present time series based on four-year intervals. Even though the definition of polar research has remained unchanged in all the surveys, the methods for measuring the R&D expenditures differ somewhat and has not been consistent across all the mappings. Therefore, most of the indicators presented are based on R &D work years, full-time equivalents (FTEs).

4.1 Polar research in 2018 and development over time

The mapping shows that a total 958 R&D FTEs were devoted to polar research in Norway in 2018. This includes R&D carried out by higher education institutions, institutes in the institute sector and companies/industry. About 65 FTEs (7 per cent of the total) were related to Antarctic areas, while the vast majority were related to Arctic areas.

Research institutes accounted for about 520 FTEs, or slightly more than half (54 per cent) of the total efforts measured by FTEs. Institutions in the higher education sector (HES), primarily universities, conducted about 380 FTEs or 40 per cent of the total, while companies in the industrial sector accounted for the rest, about 60 FTEs (Figure 4.1). Most of the Antarctic research is carried out by the institute sector, mainly the Norwegian Polar Institute.

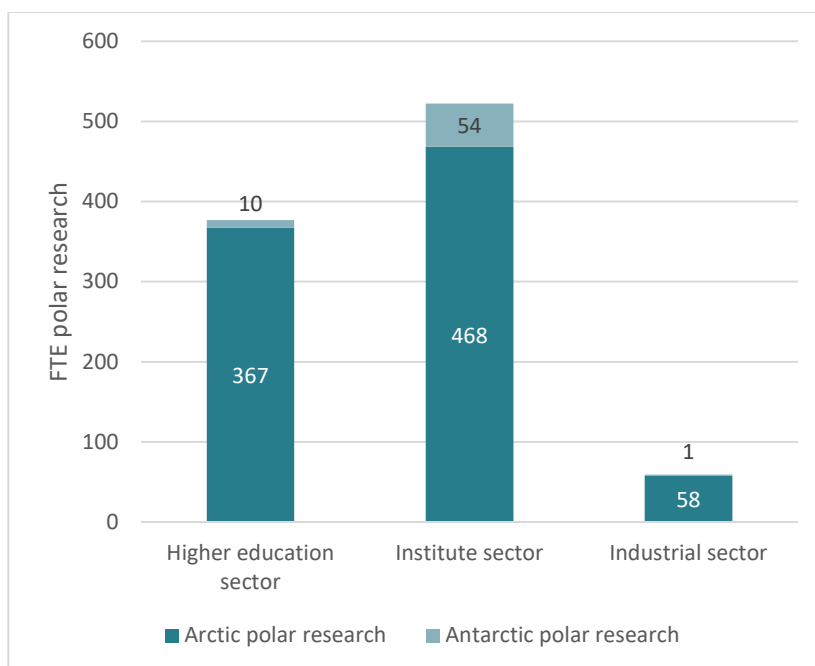


Figure 4.1 FTEs in polar research 2018, by Arctic and Antarctic areas and sector of performance.

Source: NIFU

When analysing the development over time, the results show that there has been steady growth in the Norwegian research efforts related to polar areas. However, while the number of FTEs increased significantly from 2006 to 2010 and from 2010 to 2014, there was hardly any increase at all in the most recent period. With 958 FTEs in 2018, the polar research volume is only marginally higher than in 2014, when 951 FTEs were conducted (Figure 4.2).

However, at the levels of sectors, the number of FTEs declined in 2018 for both the higher education sector and industrial sector, while the institute sector had an increase compared with the 2014 figures. An important reason for the decline for the industrial sector is however methodological: One larger unit (Akvaplan Niva) which was classified in the industrial sector in the 2014 survey is now classified in the institute sector (in accordance with the national R&D-statistics). If this unit had been excluded, the decline for the industrial sector would have been much smaller and the institute sector would have shown a less strong growth.

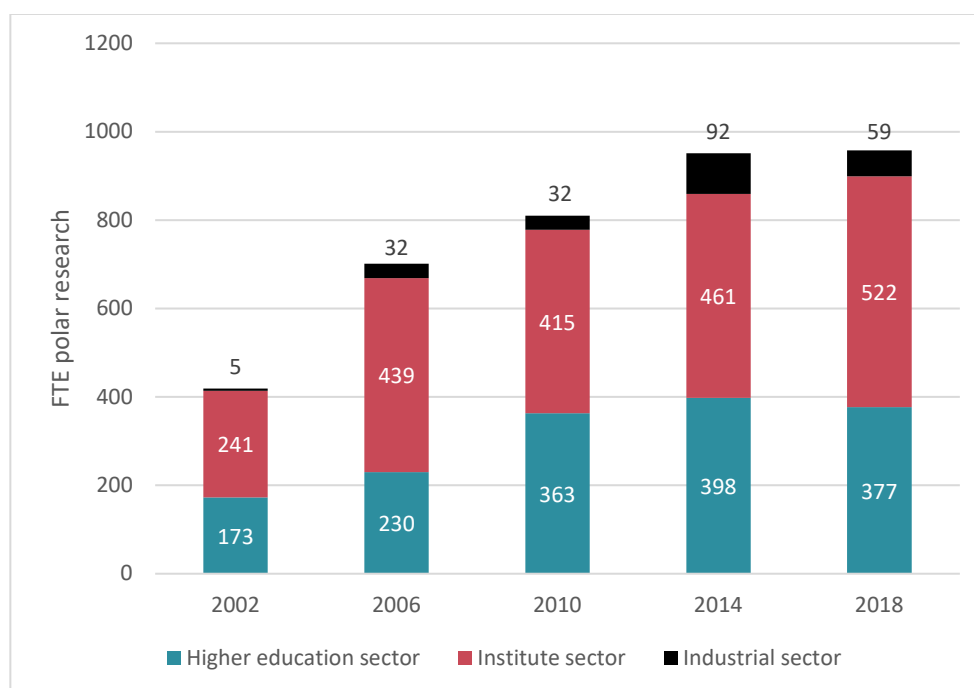


Figure 4.2 FTE in polar research, by sector of performance in 2002, 2006, 2010, 2014 and 2018.

Source: NIFU

Table 4.1 shows the numbers of units (usually departments, institutes and companies) reporting polar research for each mapping by sector of performance. In the higher education sector and institute sector the number of units has been quite stable, but the number of companies has increased, especially from the two first mappings to the last two. This might partly explain the large increase in the R&D efforts of the industrial sector from 2010 to 2014. The figures are also influenced by organisational changes during the period and mergers of institutes. For example, one merged institute such as NORCE, counting as one unit in 2018 would have counted as multiple units in previous mappings.

Table 4.1 Numbers of entities reporting polar research by sector of performance in 2002, 2006, 2010, 2014 and 2018

Sector of performance	2002	2006	2010	2014	2018
Higher education sector	58	47	52	47	40
Institute sector	23	27	27	31	28
Industrial sector	2	4	8	22	20
Total	83	78	87	100	88

Source: NIFU

Table 4.2 shows the proportion polar research of each sector's total R&D work-years for the 2002-2018 period. In 2018, 2.1 per cent of the total R&D efforts in

Norway measured in FTEs was related to the polar areas. This proportion was slightly higher in 2006 to 2014 where polar research accounted for about 2.5 per cent, but higher than in 2002 where the share was 1.7 per cent. The relative incidence of polar research is much higher in the institute sector than in the other sectors. In the institute sector the proportion of polar research was 5.6 per cent in 2018, while this proportion was 2.2 per cent in the higher education sector and 0.5 per cent in the industrial sector. For the institute sector the proportion increased by 0.6 percentage points from 2014 while it decreased with 0.7 percentage points for the higher education sector. Overall, the findings suggest that the relative position of polar research in the Norwegian research profile has declined somewhat. Possibly this may indicate that polar research has been slightly less prioritised in 2018 compared with the situation previously.

Table 4.2 Share of polar research of total R&D FTEs in Norway, by sector of performance in 2002, 2006, 2010, 2014 and 2018.

Sector of performance	2002	2006	2010	2014	2018
Higher education sector	2.7 %	2.0 %	2.9 %	2.9 %	2.2 %
Institute sector	4.1 %	6.2 %	5.0 %	5.0 %	5.6 %
Industrial sector	0.0 %	0.9 %	0.6 %	0.7 %	0.5 %
Total	1.7 %	2.5 %	2.4 %	2.4 %	2.1 %

Source: NIFU

4.2 Funding of polar research

Based on the reported figures, we have estimated that a total of 1,515 mill NOK was spent on polar research in 2018. This includes the current costs, while capital costs such as investments in new buildings and research vessels are not included. The relative distribution of the expenditures across sectors does not differ much from the distribution of FTEs (cf. Figure 4.3).

The amount spent on polar research shows a similar trend over time as the one for R&D work-years. There was a very strong growth from 2002 to 2006 and a moderate growth in the 2010 to 2018 period. As noted in the introduction of this chapter, there has been change in the method underlying the calculation of costs.² To get comparable figures, the R&D expenditures of the previous years have been

² In the present mapping only current costs to polar research are included, while in the previous mappings, total costs (i.e. both current costs and capital expenditures) related to polar research also were included. To be able to compare the figures of the present mapping with the previous mappings, we have recalculated the R&D expenditures for 2006, 2010 and 2014 according to the method which is applied in the present mapping. The figures for R&D expenditures for 2002, 2006 and 2010 in this report will therefore deviate from the figures that is reported and published in the previous reports.

recalculated according to the method used in the 2018-mapping. Thus, only current costs are included. The results are shown in Figure 4.3.

From 2014 to 2018 the amount current costs increased with about 230 mill NOK, to 1,515 million NOK. The corresponding increase from 2010 to 2014 was 260 mill NOK and from 2006 to 2010, 230 mill NOK. However, the growth is less strong when taking inflation into account. This is shown in the figure using fixed 2010 prices, based on the inflation index for national R&D expenditures. Measured in fixed prices, the growth from 2014 to 2018 was almost 7 per cent or 1.7 per cent annually on average. This is higher than the growth of work years (FTEs) which was 1 per cent from 2014 to 2018. This can be explained by increasing costs of R&D work-years and variations in the expenditures of the reporting units across the two surveys.

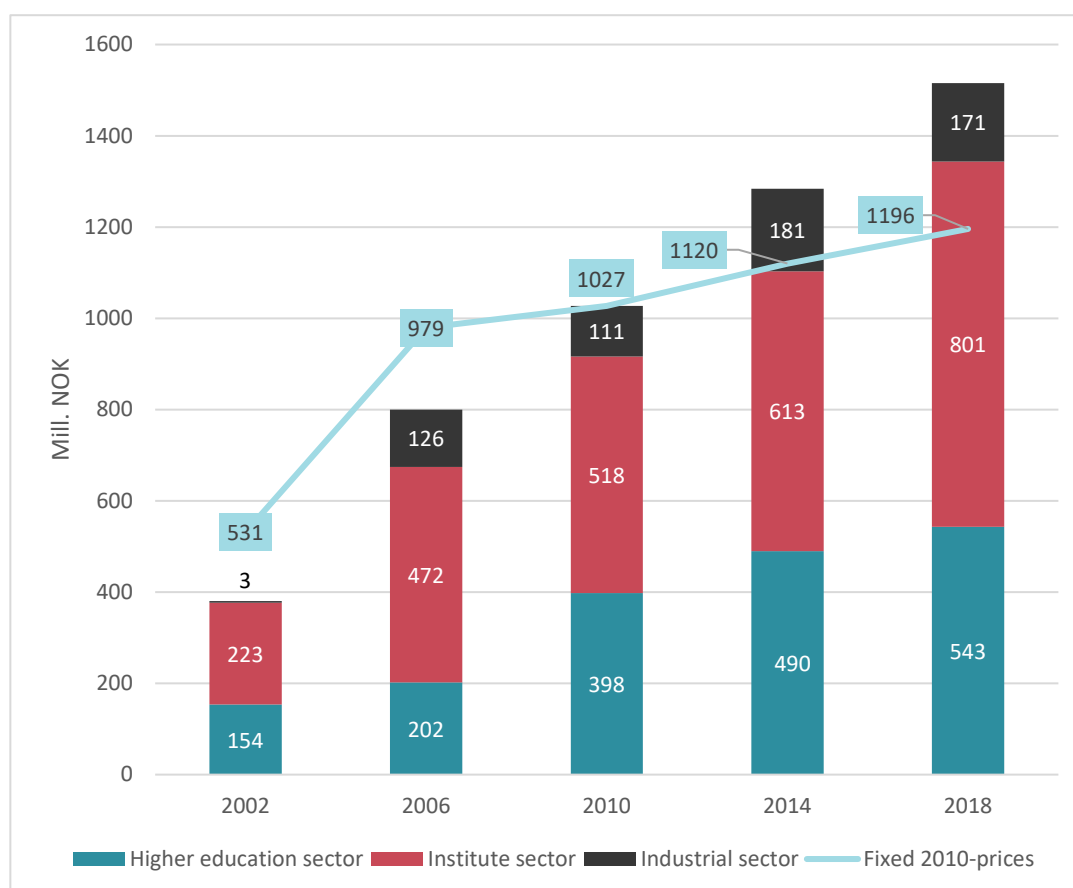


Figure 4.3 Current expenditures to polar research, by sector of performance in 2002, 2006, 2010, 2014 and 2018, mill NOK.

Source: NIFU

The Norwegian polar research in 2018 was funded by several sources, the distribution according to funding sources is shown in Table 4.3. Around 40 per cent of the total R&D expenditures were funded by ministries in terms of general

university funds. This includes basic funding of the institutions in the higher education sector and core grants to the research institutes which receive basic funding from their affiliated ministries (relevant for institutes such as the Norwegian Polar Institute and the Norwegian Meteorological Institute). The Research Council of Norway funded about 25 per cent of the polar research, this includes project and programme funding as well as core grant funding to research institutes that receives such funding according to the governmental funding guidelines (i.e. research institutes such as SINTEF, NORCE and NILU). Additional funding from ministries and directorates amounted to 10 per cent of the total costs, and counties and municipalities contributed to around 1 per cent of the total expenditures. In total, these public funding sources contributed to around three quarters (76 per cent) of the total R&D expenditures devoted to polar research. The figures show large variations across sectors, and further details can be seen in Table 4.3.

Table 4.3 Current expenditures to polar research by source of funds and sector of performance in 2018. Mill NOK.

Source of funds	HES	Institute sector	Industrial sector	Total	Share (%)
General university funds/Core grants	184	428	0	612	40 %
The Research Council of Norway	215	152	5	372	25 %
Ministries and directorates	17	75	60	92	10 %
Counties and municipalities	11	3	0	15	1 %
Industry	55	46	94	194	13 %
EU-Commission	37	27	1	65	4 %
Abroad, not specified	1	36	0	37	2 %
Other national sources	23	33	5	61	4 %
SkatteFUNN	0	0	7	7	0 %
Total	543	801	171	1,515	100 %

Source: NIFU

It is interesting to compare the funding structure with the results of the previous mappings of polar research. The figure below shows the relative contribution of each main source of funding by sector of performance for the period 2006- 2018. The proportion of general university funds/core grants has been reduced from about 47 per cent in 2006 to 40 per cent in 2018. The relative contribution of funding from the Research council of Norway has varied over the years. In 2006 and 2014, funding from the Research council accounted for just below 20 per cent, while the share was about 25 per cent in 2010 and in 2018. The actual numbers funded by the Research council were 269 mill NOK in 2014, 260 mill NOK in 2010, while in 2006 the number was 133 mill NOK. Funding from industry shows quite large variations, highest in 2014 and 2006, 23 and 20 per cent, respectively, and

lowest in 2010 with 11 per cent, slightly below the figure of 2018 (13 per cent). The R&D activity of the industry is mainly funded by the companies themselves. Thus, these variations mainly reflect differences in the research efforts of the industry over time relative to other sectors.

Since the units only report the distribution according to main funding source, we do not have more detailed information, for example concerning the role of specific research programs. However, it seems likely that the major research program *Nansen Legacy*, with start-up in 2018 (total funding 740 mill NOK over six years), has contributed to the increase in the relative contribution of the Research Council.

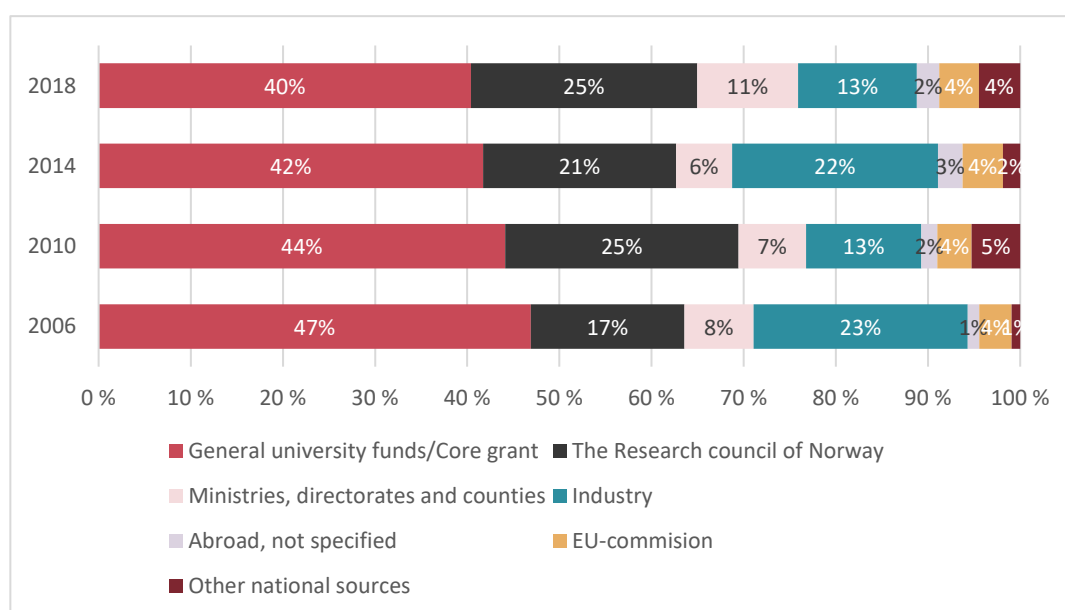


Figure 4.4 Current expenditures to polar research by source of in 2006, 2010, 2014 and 2018. Percentage of total

Source: NIFU

The operating costs of the polar research carried out in Antarctica (land and sea areas) is estimated to about 105 million NOK. This accounts for about 7 per cent of the total expenditures to Norwegian polar research (which is identical to the proportion measured by work-years, see below). Compared with the 2014-mapping, Antarctic polar research also accounted for 7 per cent. The Antarctic polar research was mainly carried out by the institutes in the institute sector (mainly Norwegian Polar Institute) which accounted for about 80 per cent of the total amount. Institutions in the higher education sector had expenditures of 12 million NOK, while a couple of companies contributed with 8 million NOK.

Table 4.4 Current expenditures to Antarctic polar research by source of funds and sector of performance in 2018. Mill NOK.

Source of funds	HES	Institute sector	Industrial sector	Total	Share (%)
General university funds/Core grant	4.9	66.1		71.0	68 %
The Research council of Norway	6.5	7.4		13.9	13 %
Ministries and directorates	0.1	0.1		0.2	0 %
Counties and municipalities	0.1	0.0		0.1	0 %
Industry	0.0	0.0	5.0	5.0	5 %
EU-commission	0.2	0.1		0.4	0 %
Abroad, not specified	0.0	0.0		0.0	0 %
Other national sources	0.4	10.8		11.2	11 %
SkatteFUNN			3.0	3.0	3 %
Total	12.3	84.4	8.0	104.8	100 %

Source: NIFU

4.3 Polar research by sector and institutions

As shown in Figure 4.1, the institute sector is the largest contributor to polar research, with 520 FTEs (about 54 per cent) of the total R&D measured in FTEs. Institutions in the higher education sector account for about 380 FTEs (40 per cent) of the total while companies account for the rest, about 60 FTEs (6 per cent) of the total FTEs.

Figures 4.5 to 4.7 show the distribution of FTEs by sectors and institutions using absolute and relative measures. Here, figures for the largest higher education institutions in terms of FTEs of polar research have been shown separately. Figures for individual institutes are not shown, despite the fact that some institutes such as the Institute of Marine Research and Norwegian Polar Institute have extensive volume of polar research. This is due to the confidentiality of the reported figures and the regulations in the Act of statistics.

Instead the institutes have been divided into areas or groups according to the classification system of the Research Council of Norway. In this system, the institutes are divided into four areas (primary research institutes, environmental research institutes, technical-industrial research institutes and social science research institutes), while the remaining institutes are referred to as “other research institutes”. A list of the institutes with research area affiliation, can be found in Appendix 2.

The largest institution in the higher education sector is the UiT – The Arctic University of Norway, with a share of 16 per cent of total polar research (about 150 FTEs). The second largest institution in the sector is the University of Oslo with a share of 9 per cent of the total R&D FTEs. Then follows University of Bergen with 7 per cent and NTNU with a share of 4 per cent. Other institutions in the sector

accounts for about 4 per cent of the total polar research measured in FTEs. A list of departments and institutions which have reported polar research in 2018, can be found in Appendix 2.

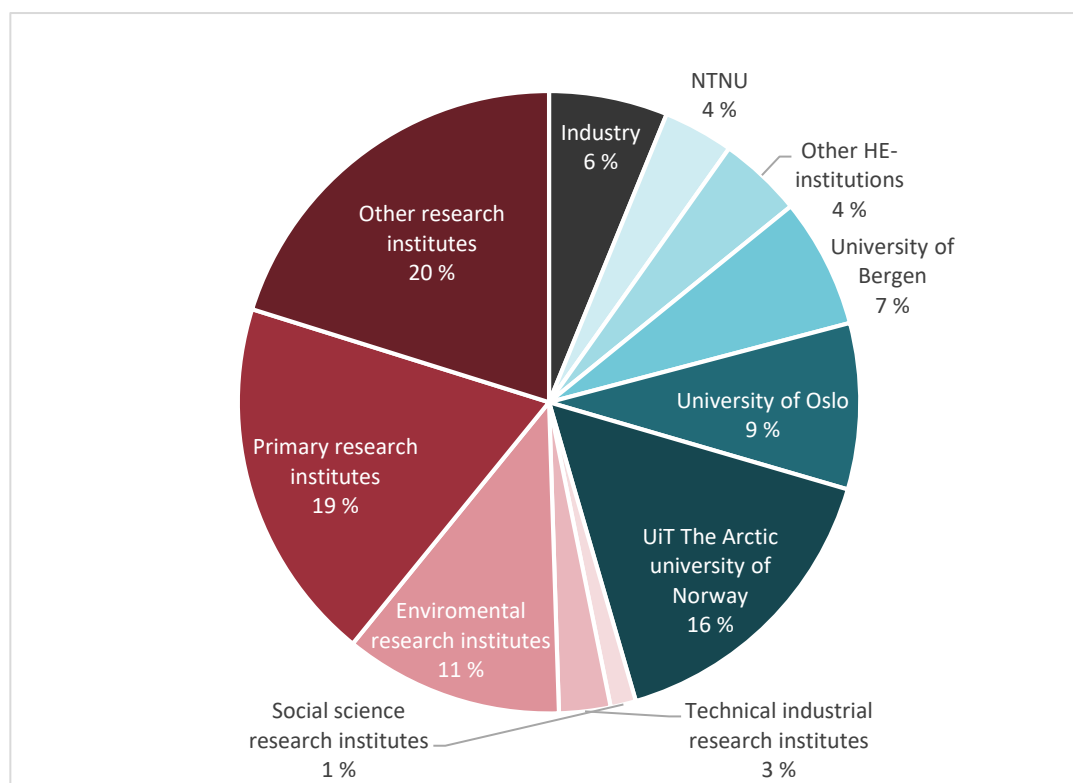


Figure 4.5 FTE in polar research by institutions, groups and sector for performance in 2018. Relative contributions in percentage.

Source: NIFU

The institutes in the category for “other research institutes” account for the highest number of FTEs, about 190, or 20 per cent of the total polar research efforts in Norway. This group consists of seven research institutes with polar research, four which have minor efforts and three with a larger. The Norwegian Polar Institute is by far the largest, followed by The Norwegian Meteorological Institute. The second largest group accounting for 19 per cent of the total (about 180 FTEs) consists of the primary research institutes. Here three institutes have reported polar research of which Institute of Marine Research is the largest. The third largest group is the environmental research institutes where seven institutes have reported polar research. In this group, the Nansen Environmental and Remote Sensing Centre and Norwegian Institute for Air Research are the two largest institutes in terms of polar research activity. The technical-industrial research institutes and the social sciences institutes include five institutes each

and contributed with a share of 3 and 1 per cent of the polar research measured in FTEs, respectively.

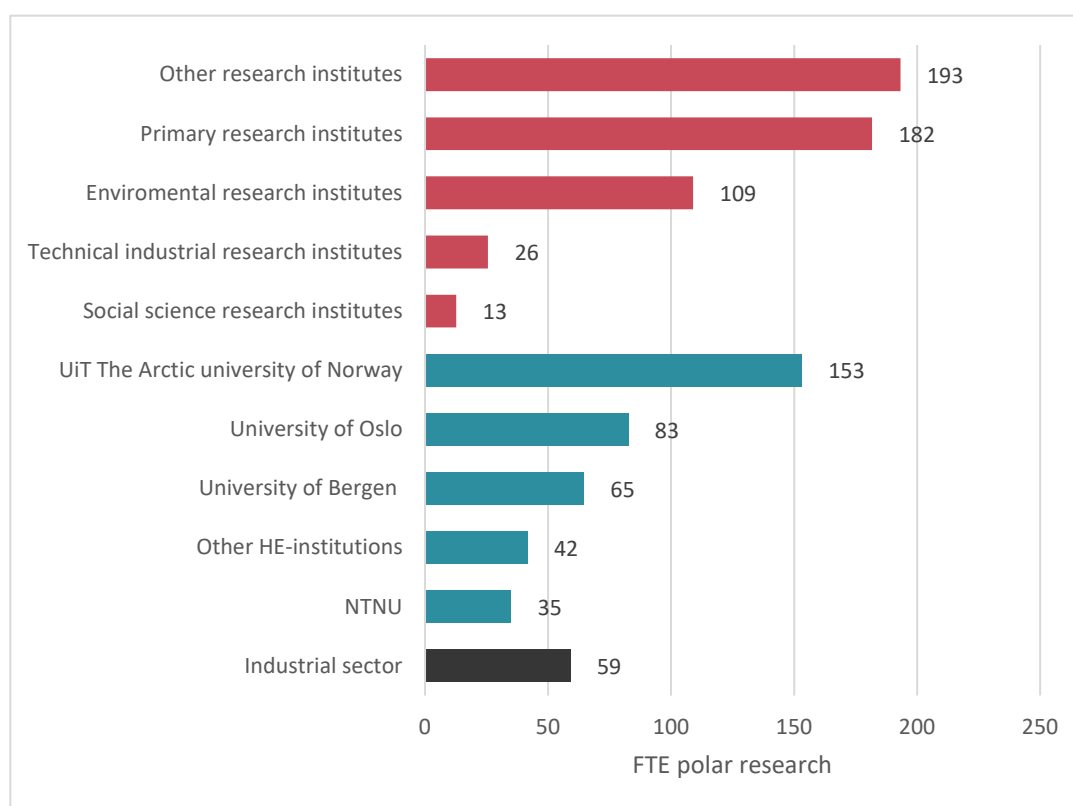


Figure 4.6 FTEs in polar research by institutions and sector for performance in 2018.

Source: NIFU

In Figure 4.7 we have compared the 2018 figures with those reported in 2014 for the various institutions and institute groups. As can be seen, there is a substantial growth for the primary research institutes. This is partly explained by an increase for the Institute of Marine Research. There is also a marked increase for the Arctic University of Norway. In addition, we find a growth in activity for the University of Oslo, the environmental research institutes, the social science research institutes and the group of other research institutes. On the other hand, some institutions and institute groups have a reduced activity. Particularly, there is a decrease for the technical-industrial institutes, the Norwegian University of Science and Technology (NTNU), and for the industrial sector. The total growth is therefore only 7 FTEs from 2014 to 2018 (see also Chapter 4.1).

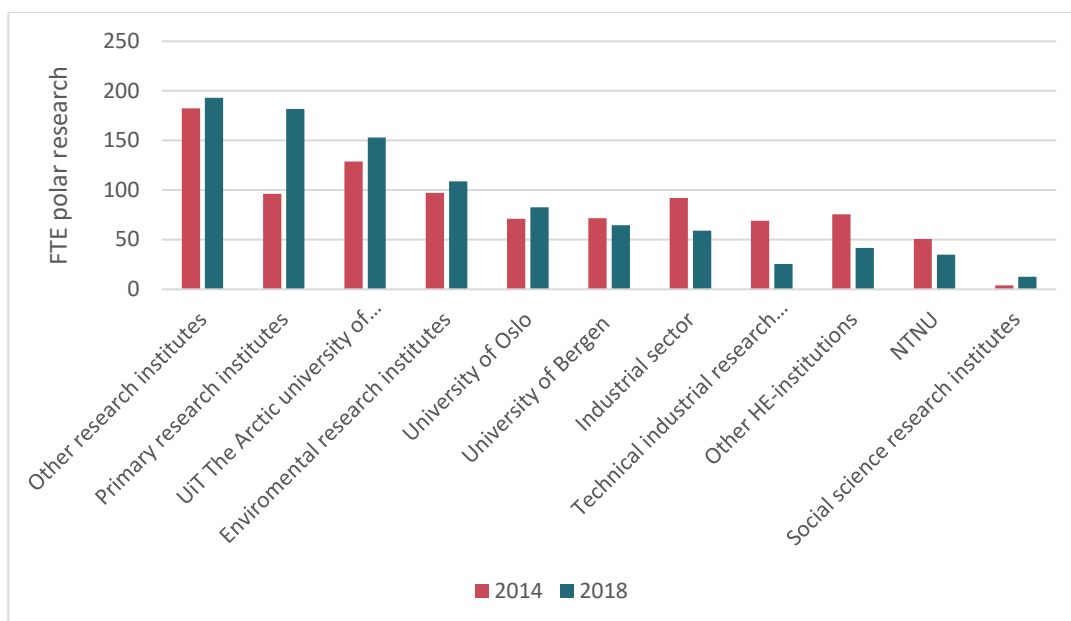


Figure 4.7 FTEs in polar research by institutions and sector of performance in 2014 and 2018.

Source: NIFU

4.4 The geographical distribution of polar research

The Norwegian polar research covers both terrestrial and marine disciplines. The mapping also includes a question concerning where the research has been conducted or the data are collected from. Based on this information we are able to show the geographical distribution of Norwegian polar research. The results are summarized in Figure 4.8 which shows the relative distribution of FTEs according to geographical areas.

Of the total Norwegian polar research activity, about 38 per cent was related to land areas while 60 per cent was related to sea/ocean areas. A small proportion, three per cent of the research, was not specified to either ocean or land areas. Compared with the previous survey in 2014, the distribution between land and ocean polar research has changed. In 2014, the figures for land and sea areas were 38 and 50 per cent, respectively, while a much higher proportion was not related to specific geographical areas. In other words, since we do not have further information about the research conducted in unspecified areas, it is difficult to make comparisons. However, it seems likely that the marine research has increased relatively more than the terrestrial research.

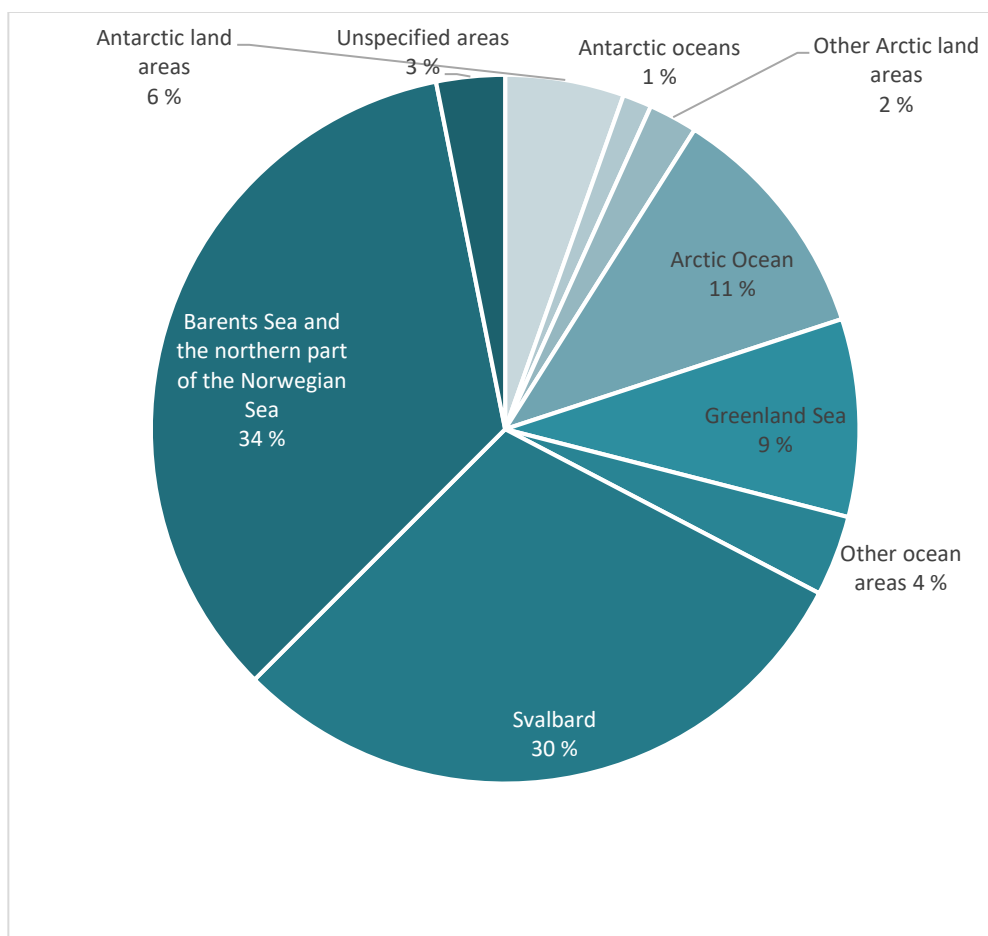


Figure 4.8 FTEs polar research in 2018 by geographical area.

Source: NIFU

Of the specified geographical categories, the Barents Sea and the northern part of the Norwegian Sea account for the largest proportion of the Norwegian polar research. About 34 per cent of all polar research was carried out in these oceans.

Most of the terrestrial Norwegian polar research relate to Svalbard, and the archipelago accounts for 30 per cent of the total polar research. A more detailed overview of this activity according to geographical Svalbard zones can be found in Chapter 5.

Table 4.5 gives a more detailed overview over the polar research by geographical areas and sector of performance, measured in FTEs in 2018.

Table 4.5 FTEs polar research in 2018 by geographical areas and sector of performance.

Polar research by geographical areas	HES	Institute sector	Industrial sector	Total	Share (%)
Antarctic land areas	4.1	47.9	0.0	52	5 %
Antarctic oceans	5.5	6.1	1.1	13	1 %
Other Arctic land areas	15.0	6.4	0.0	21	2 %
Arctic Ocean	40.7	64.7	0.0	105	11 %
Greenland Sea	43.0	43.3	0.2	86	9 %
Other ocean areas	10.6	24.1	0.5	35	4 %
Svalbard	136.2	133.6	15.9	285.7	30 %
Barents Sea and the northern part of the Norwegian Sea	104.1	185.9	37.4	329	34 %
Unspecified areas	17.8	10.2	2.0	30	3 %
<i>Sum Antarctic areas</i>	9.6	54.0	1.1	65	7 %
<i>Sum Arctic areas</i>	367.3	468.2	58.0	893	93 %
Total polar research	376.9	522.1	44.6	958	100 %

Source: NIFU

Based on the results from the previous mappings, Figure 4.9 shows the development over time by geographical areas. The research effort related to Svalbard shows a strong growth during the 2006-2014 period but decreased slightly in 2018 compared with 2014. About 300 FTEs was related to Svalbard in 2014 while the figure was 286 in 2018.

As mentioned above, the Barents Sea and the northern part of the Norwegian Sea is the largest research area for Norwegian polar research. A total of about 330 work years (FTEs) were related to these oceans. The volume of the research activities in this region show a mixed pattern over time. The highest figure measured in FTEs was recorded in 2006, then it decreased from 2006 to 2010 and from 2010 to 2014, while there was a significant growth from 2014 to 2018 (about 50 FTEs).

The volume of the research related to other ocean areas has been increasing over the entire period. This category includes research related to oceans such as the Greenland Sea, the Arctic Ocean and the Kara Sea. While about 130 FTEs were related to these waters in 2006, the number was almost 230 in 2018.

Research related to the Antarctic (the content and the surrounding oceans) amounted to 65 FTEs in 2018. This number has been increasing all years since the mapping in 2006 when about 20 FTE were related to these areas.

When interpreting the figures, it should be recalled that there is an uncertainty in the reported figures, this particularly holds for the delimitation of the sea areas.

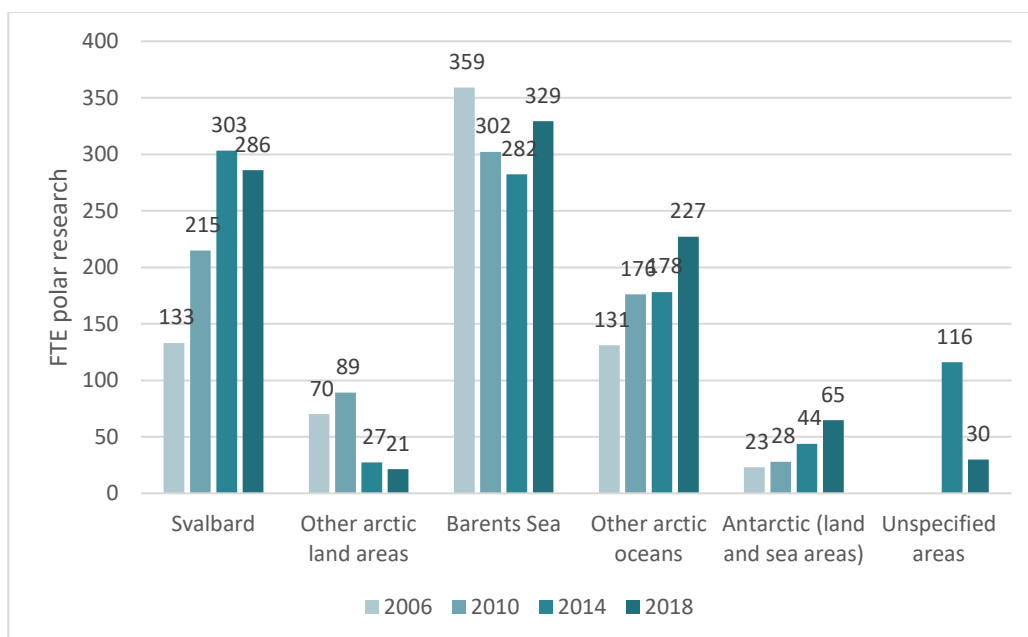


Figure 4.9 Polar research by geographically areas in 2006, 2010, 2014 and 2018, FTEs.

Source: NIFU

4.5 Polar research by fields

In this chapter, results concerning the field and discipline distribution of polar research measured by FTEs are presented. Polar research is carried out within all the major research areas. However, the large majority of the research is within the natural sciences. In 2018, this area accounted for about 80 per cent the total polar research (measured as FTEs). Technology accounted for about 15 per cent of the research efforts, while only a small part of the research was within the social sciences and humanities. Compared with the last mapping in 2014, the relative distribution between major fields has changed. In 2014, the natural sciences accounted for 74 per cent of the research efforts, and technology for 22 per cent.

Basic marine biology accounted for the largest number of FTEs in 2018, about 170. In the related field fisheries and marine resources, 96 FTEs were carried out. The second largest field is geology where 120 FTEs were conducted. Oceanography is the third largest field and amounted to about 110 FTEs. Thus, three out of four of the largest discipline categories are marine, which reflect the fact that the amount of polar research in the sea areas is significantly higher than in the land areas (cf. Figure 4.8).

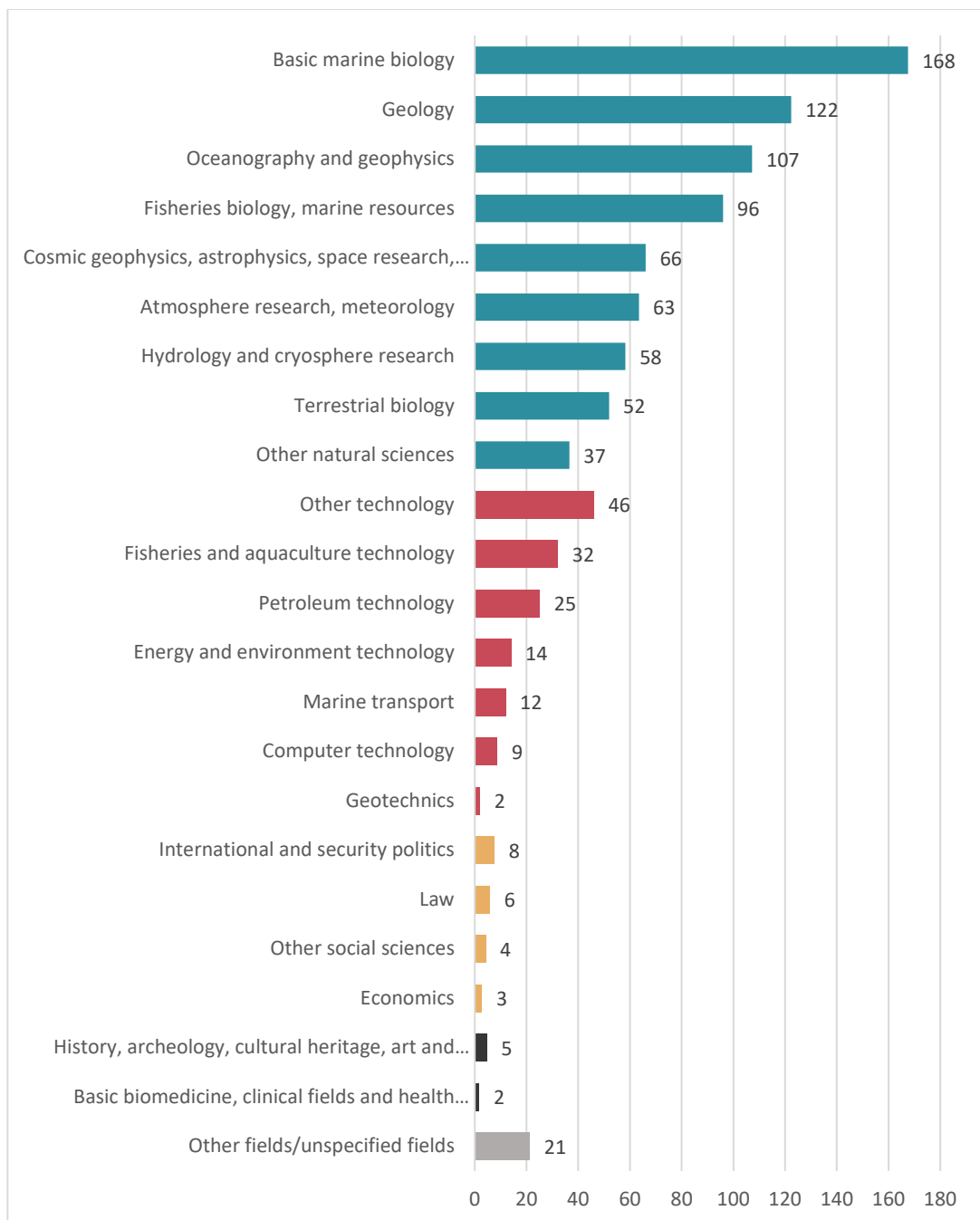


Figure 4.10 FTEs polar research by fields of subject in 2018

Source: NIFU

Table 4.6 gives the number of FTEs in 2018 compared with 2014 for the largest fields. While the research volume in some of the basic natural sciences have increased, the research effort in most technology fields has decreased. This applies for example to petroleum technology and energy and environmental technology. In 2014, polar research within petroleum technology amounted to more than 60 FTEs, four years later the research effort was halved. A main reason for this is that

both the higher education and institute sector have almost no such research in 2018, while this was not the case in 2014. Similarly, research in energy and environment technology which amounted to 48 FTEs in 2014, was reduced to less than one third in 2018.

Table 4.6 FTEs polar research by selected fields in 2014 and 2018.

Fields	2014	2018	Change 2014- 2018
Basic marine biology	127	168	41
Geology	114	122	8
Oceanography and geophysics	141	107	-33
Fisheries biology, marine resources	71	96	25
Cosmic geophysics, astrophysics, space research, earth observations	11	66	55
Atmosphere research, meteorology	93	63	-30
Hydrology and cryosphere research	58	58	0
Terrestrial biology	60	52	-8
Other technology	28	46	19
Social sciences and humanities	18	42	24
Fisheries and aquaculture technology	47	32	-15
Petroleum technology	63	25	-37
Energy and environment technology	48	14	-34
Marine transport	23	12	-11
Other fields	51	53	3
Total	951	958	7

Source: NIFU

Table 4.7 provides further details on the distribution of the polar research in 2018 by sector. As can be seen there are notable differences across sectors. For example, the higher education institutions account for most of the polar research in geology, while the opposite pattern can be found for fisheries biology and marine resources as well as oceanography.

Table 4.7 FTEs polar research by fields of subject and sector of performance in 2018

Fields	Higher education sector	Institute sector	Industrial sector	Total
Basic marine biology	75	92	0	168
Geology	107	13	3	122
Oceanography and geophysics	26	74	7	107
Fisheries biology, marine resources	8	86	2	96
Cosmic geophysics, astrophysics, space research, earth observations	27	28	12	66
Atmosphere research, meteorology	17	46		63
Hydrology and cryosphere research	28	29	1	58
Terrestrial biology	45	7		52
Other natural sciences	7	29		37
Sum natural sciences	340	405	24	770
Fisheries and aquaculture technology		32	0	32
Petroleum technology	2	3	21	25
Energy and environment technology	0	11	3	14
Marine transport	7	4	2	12
Computer technology	2	7		9
Geotechnics	2	1		2
Other technology	6	41		46
Sum technology	17	98	26	140
International and security politics	1	7		8
Law	5	1		6
Economics		3		3
Political science	1	0		1
Demography		1		1
Other social sciences	2	2	0	4
Sum social sciences	7	15	0	22
History, archaeology, cultural heritage, art and theology	4	1		5
Agriculture and veterinary medicine		1		1
Basic biomedicine, clinical subjects, health sciences		2		2
Other fields/unspecified fields	8	2	9	19
Total	377	522	59	958

Source: NIFU

**Other fields include fields with less than 3 FTEs and are not shown separately in the figure. These fields include basic biomedicine, clinical subjects, health sciences, political sciences, agriculture and veterinary medicine, demography, folklore and ethnology and livestock, reindeer husbandry.*

4.6 Human resources in polar research

The number of people who were involved with polar research in Norway in 2018 is shown in Table 4.8. The university departments, research institutes and companies that performed polar research reported a total of about 1,900 people involved in such research activities. Of these, about 1,200 worked at a research institute, about 640 in the higher education sector, while almost 110 persons were employed by a company. A vast majority, 85 per cent, were scientific R&D personnel. The rest had technical or administrative tasks and are referred as other personnel.

The majority of the polar researchers were men. The proportion of women was 42 per cent both in the higher education sector and among the research institutes. The share of women among the R&D personnel in the industrial sector was around one third.

Table 4.8 Personnel involved in polar research by sector of performance and type of staff in 2018, number of people and share of women

	Higher educational sector		Institute sector		Industrial sector		Total
	Total	Share of women	Total	Share of women	Total	Share of women	
R&D personnel	527	42 %	999	43 %	107	34 %	1,633
<i>PhD-students</i>	163	56 %	40	43 %			203
<i>Postdocs</i>	73	41 %	50	66 %			123
Other personnel	110	42 %	172	37 %			282
Total	637	42 %	1,171	42 %	107	34 %	1,915

Source: NIFU

Compared to the previous mapping in 2014, there has been a slight reduction in the number of people involved in polar research. In 2014, the total number was 2,058. About 760 of these were employed in the higher education sector, 1,000 in the institute sector and about 290 people were employed by a company. Thus, there is a decrease for the higher education sector and industry and an increase for the institute sector.

A total of 44 doctoral degrees with polar research as a main theme were awarded at Norwegian higher education institutions in 2018. In addition, five degrees were awarded researchers at research institutes, see Table 4.9.

Compared with the results of the previous mappings, there has been an increase in the number of awarded doctoral degrees at the higher education institutions and in the period 2012-2014 the annual figure was 30.

Awarded degrees by employees in the institute sector are much lower during the entire period. Here it should be noted that since research institutes do not

award doctoral degrees themselves, these people may also have been reported by the awarding higher education institutions, resulting in double counts.

Table 4.9 Number of awarded doctoral degrees with polar research as a main theme in different periods.

	2000-02*	2004-06*	2008-10*	2012-14*	2018
Higher education sector	14	21	34	30	44
Institute sector	0	8	9	6	5

Source: NIFU. *) Annual average

5 Research in Svalbard

5.1 Introduction

Research in Svalbard has long traditions. A systematic exploration of Svalbard developed in the 19th century and continued after the turn of the century (Arlov 1996). Today, there is considerable research activity in Svalbard, and research and higher education represent an increasingly important activity for maintaining permanent settlement on the archipelago. Svalbard is unique in the way of offering modern research facilities and infrastructure and has a geographical location which is advantageous for research on various issues relating to the Arctic. The presence of researchers from many different countries also offers great opportunities for international cooperation.

There are two main research centers in Svalbard: Longyearbyen and Ny-Ålesund. In addition, there are significant research activities in Barentsburg and Hornsund.

Longyearbyen is the largest settlement in Svalbard and is also important when it comes to research. Several research installations are located in the area. The University Centre in Svalbard (UNIS), the world's northernmost higher education institution, was established in Longyearbyen in 1994. UNIS is located in Svalbard Science Centre. In 2018, about 780 students from 43 countries spent shorter or longer periods at UNIS. The educational provision has an international profile, the teaching is given in English as a large part of the students are foreign. UNIS has four departments: Arctic biology, Arctic geology, Arctic geophysics and Arctic technology.

The Svalbard Science Forum (SSF) acts as an information and coordination unit for the research in Svalbard. The SFF, which is coordinated by the Research Council of Norway, is located in Longyearbyen. Main tasks of the secretariat include information about research infrastructure and activities, coordination of research and facilitation of data sharing between researchers as well as advisory functions.

The Norwegian authorities have established Ny-Ålesund as a research station for international research cooperation. The site offers varied terrestrial and

marine environments and is advantageous located for conducting research in many disciplines. There are currently 11 institutions from 10 countries with permanent presence in Ny-Ålesund (Norway, Germany, the UK, Italy, France, Japan, South Korea, China, the Netherlands and India). In addition, several other institutions and nations regularly visit Ny-Ålesund to carry out research. In this way, the town is an international "scientific village".

Kings Bay AS owns land, facilities and is responsible for the on-site infrastructure. Kings Bay AS was formerly a coal company but is now a state-owned limited company. According to the mandate of Kings Bay, the company's activities shall in particular aim to provide services and promote research and scientific activities as well as contributing to the development of Ny-Ålesund as an international Arctic scientific research station.

The research in Ny-Ålesund is coordinated by the Ny-Ålesund Science Managers Committee (NySMAC). The committee consists of members from the institutions with major vested interests in Ny-Ålesund. NySMAC gives advice on issues such as research projects, research planning and coordination, infrastructure development, and environmental protection.

The Norwegian Polar Institute has extensive activities in Svalbard, including research, environmental monitoring, topographical mapping, geological mapping, logistics services, operation of research station, lighthouse maintenance and expert and strategic advice concerning polar issues for Norwegian and local authorities. In addition to office in Longyearbyen, the institute performs Norway's host role in Ny-Ålesund and operates the Sverdrup and the Zeppelin Observatory

The Institute of Geophysics at the Polish Academy of Sciences has established a research station in Hornsund, located at the Hornsund fjord, West Spitsbergen. The history of the station dates to the late 1950s, and since 1978 there has been permanent staffing at the station. In addition, the station is used for guest researchers from various, primarily Polish institutions. In addition to the station in Hornsund, Poland has also established smaller research stations in Petunia Bay and Kaffiøyra.

Russian research is primarily carried out in and around the mining village Barentsburg, and to a lesser degree in Pyramiden. Research has been conducted in Barentsburg since 1962. The research carried out encompasses various disciplines, including archaeology, biology, geology, cryospheric research, hydrology, atmospheric research, oceanography and geophysics. Several Russian institutions are involved in research in Barentsburg.

Other stations with research facilities include the University of South Bohemia from the Czech Republic which has a research station and laboratories in Longyearbyen and a field station in the Petunia Bay, which is located together with the Polish station.

In Chapter 5.4 the research sites and installations in Svalbard are further described, while Chapter 5.3 provides an overview of research in Svalbard based on various quantitative indicators, primarily researcher days. The next chapter, 5.2, contains an overview of Norwegian research related to Svalbard.

5.2 Norwegian research related to Svalbard

Chapter 4 described the geographical distribution of Norwegian polar research. Svalbard accounted for 30 per cent of Norwegian polar research measured in R&D work-years (FTE). Svalbard holds a key position concerning Norwegian terrestrial polar research. In total 286 work-years of research were carried out in 2018. This figure includes work-years performed in Svalbard as well as work-years carried out in mainland Norway when this research is based on material/data obtained in Svalbard. The latter activity probably accounts for the majority of this effort. Compared with 2014, we observe a slight decrease in the Svalbard research activity measured in R&D work years, although this is probably within the margin of error involved in the mapping. In 2014, this amounted to 303 work years. However, in 2010 the number was 214, and thus significantly lower than in 2018.

In order to be able to provide a rough estimate of the total expenses relating to Svalbard research, we used data on number of Svalbard R&D work years and the costs per R&D work-years for each institute/department. In this way, we estimated that a total of approximately 450 million NOK were spent on research related to Svalbard in 2018. It should be noted that this sum includes operating R&D costs only, and other costs such as R&D investments and expenses associated with educational programmes would not be included.

The Norwegian higher education (HE) sector and institute sector have almost equal volumes of Svalbard research measured by number of R&D work-years in 2018. This is shown in Figure 5.1. The contribution of the industrial sector is much more limited (15.9 work-years).

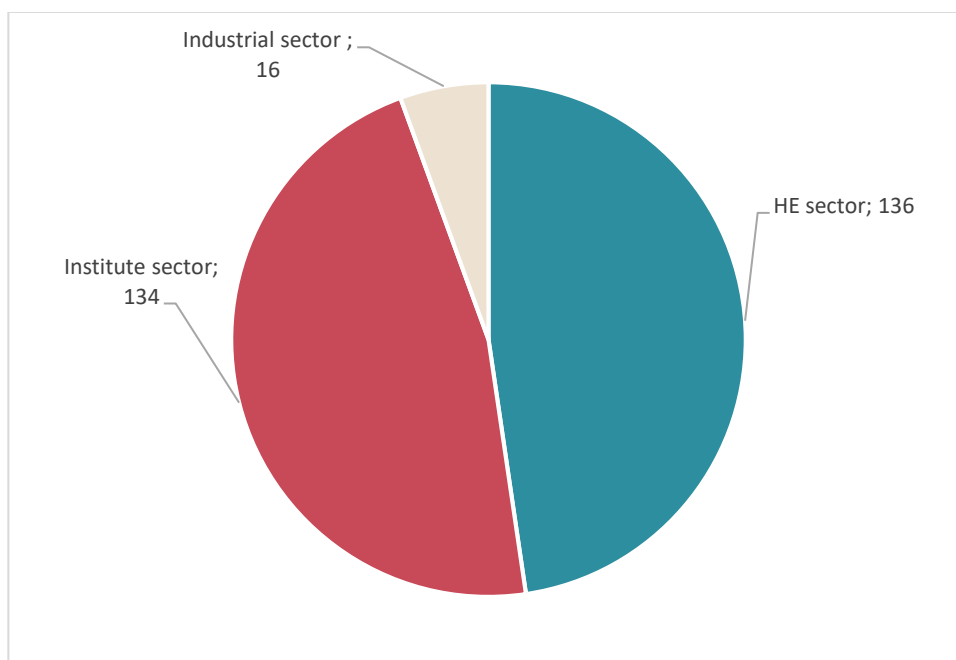


Figure 5.1 Norwegian Svalbard research by sector, number of R&D work-years, FTE. 2018.

Source: NIFU

Figure 5.2 shows the development over time (2010, 2014 and 2018) for Norwegian Svalbard research by sector. For all sectors, the research efforts measured in R&D work-years were higher in 2018 than in 2010. However, for the higher education sector there was a notable decrease from 2014 to 2018, while the institute sector has a continuous growth.

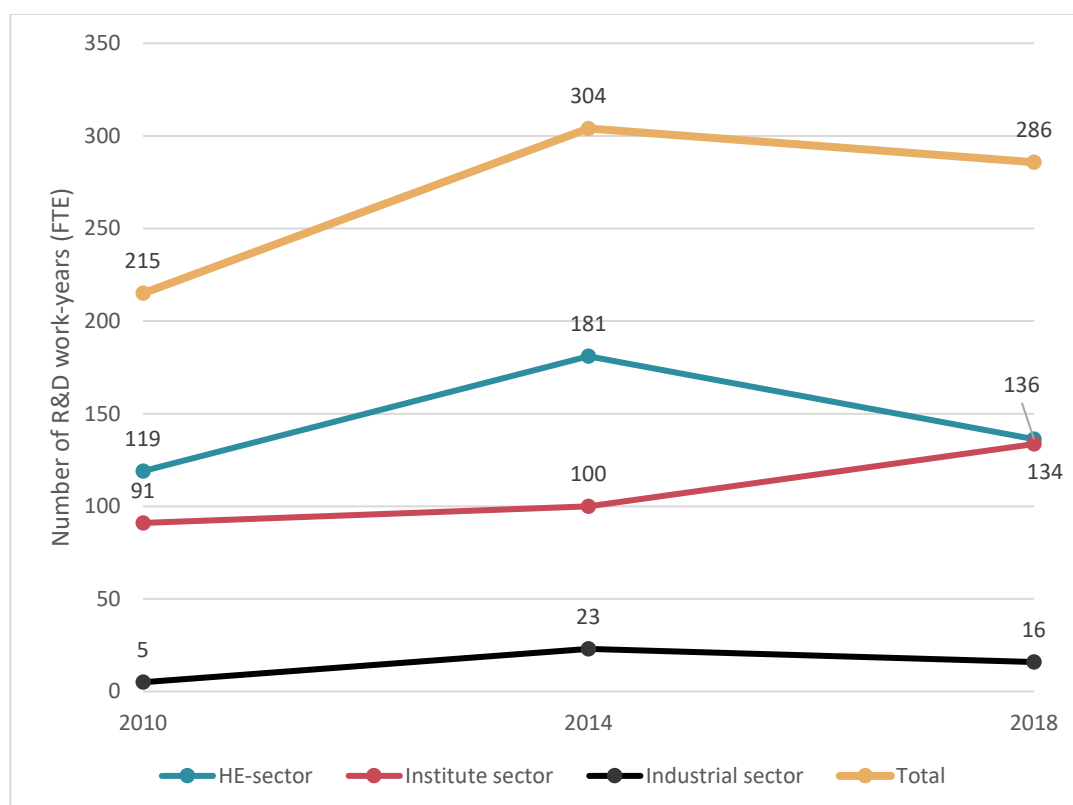


Figure 5.2 Norwegian Svalbard research by sector, number of R&D work-years, FTE. 2010-2018.

Source: NIFU

Figure 5.3 shows how the Norwegian Svalbard research was distributed by geographical zones (where the research was carried out or where the material/data was obtained).

Zone 1 and 2 are almost equal in volume and account for 36 and 39 per cent, respectively, of the Norwegian Svalbard related R&D work years in 2018. Zone 1 covers Management area 10a (includes Longyearbyen, Barentsburg, Pyramiden, Isfjorden and Svea, see Figure 2.3). Here, Longyearbyen and nearby areas would probably account for the large majority of this activity. Zone 2 covers Management area 10b which includes Ny-Ålesund and Kongsfjorden.

The other zones account in total for 25 per cent of the research activity measured in work years. Here zone 4 is the largest (13 per cent of the total). Zone 4 also covers the largest geographical area as it includes the second and third largest Svalbard islands, Nord Austlandet and Edgeøya, as well as East Spitsbergen. Zone 3 covering North West Svalbard accounts for 8 per cent of the research activity. Zone 5, South Svalbard, is the smallest in terms of research volume with a proportion of 4 per cent.

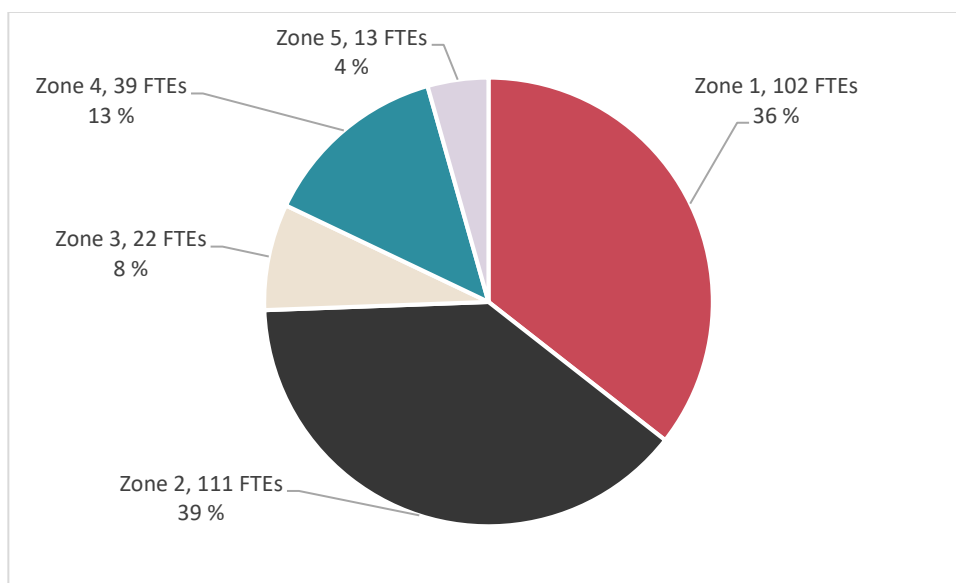


Figure 5.3 Distribution of Norwegian Svalbard research by geographical zones* (R&D work-years, FTE), 2018.

Source: NIFU

*) Zone 1: Management area 10a, includes Longyearbyen, Barentsburg, Pyramiden, Isfjorden and Svea. Zone 2: Management area 10b includes Ny-Ålesund and Kongsfjorden. Zone 3: North West Svalbard, includes Prins Karls Forland. Zone 4: East Svalbard, includes East Spitsbergen, Nord Austlandet, Kong Karls land, Hopen and Edgeøya. Zone 5: South Svalbard, includes Hornsund and Bjørnøya. See the map below.

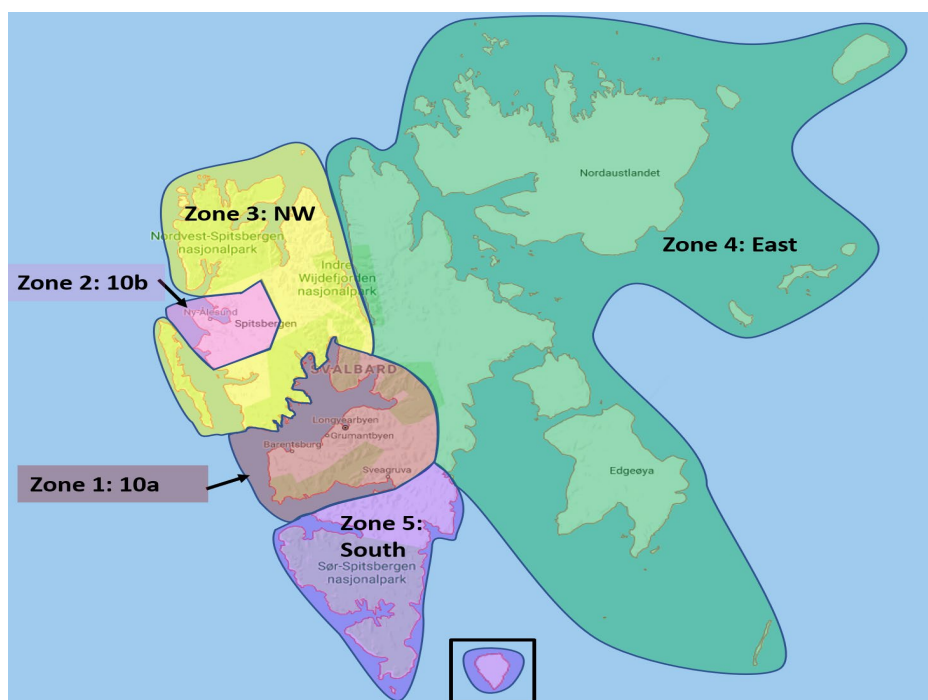


Figure 5.4 Map of Svalbard and zones used in the survey

Source: Svalbard Science Forum

Figure 5.5 shows the distribution of R&D work-years by sectors and geographical zones. Both the higher education sector and the institute sector have research activities related to all the geographical zones. However, while the higher education sector contributes significantly more than the institute sector to research in zone 1, there is an opposite pattern for zone 2 (Ny-Ålesund and Kongsfjorden). These findings are particularly influenced by the fact that UNIS is located in zone 1.

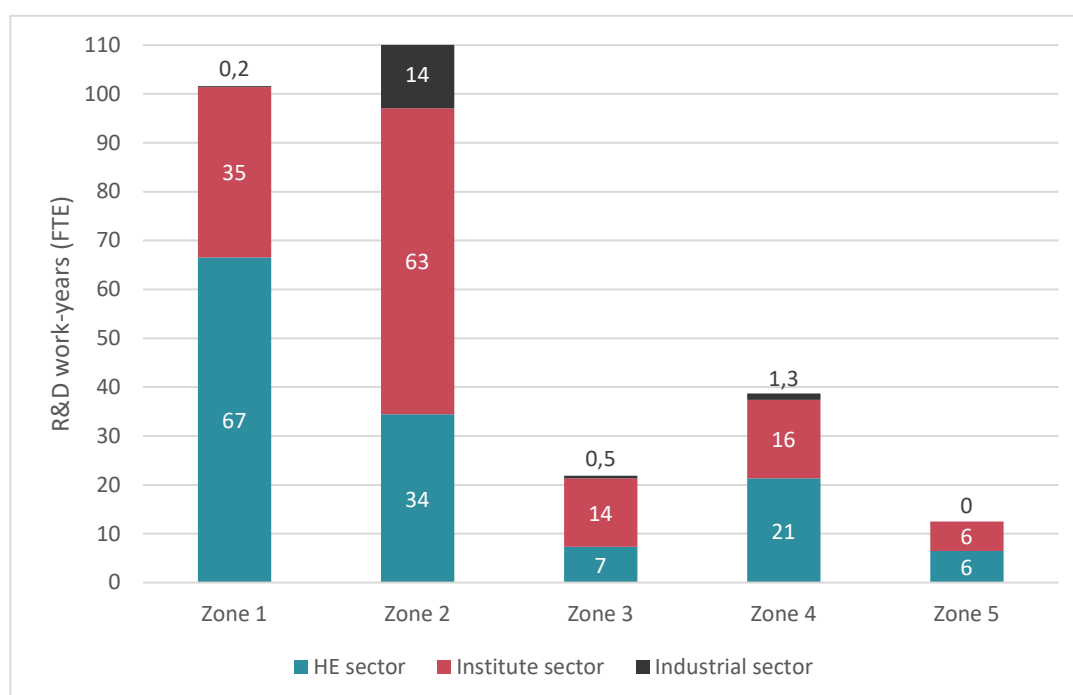


Figure 5.5 Distribution of Norwegian Svalbard research by geographical zones and sector (R&D work-years, FTE), 2018.

Source: NIFU

Figure 5.6 shows figures for the largest institutions (in terms of R&D work years) and institute groups. The institutes in the institute sector have been classified according to the classification system of the Research Council of Norway. For UNIS only the research relating to Svalbard is included in the figures. Within the Higher Education sector, UiT the Arctic University of Norway is the largest contributor with almost 50 R&D work years, followed by the University of Oslo with approximately 40. The Norwegian Polar Institute has a key role when it comes to research in Svalbard. This institute is classified under “other research institutes” and contributes to the majority of the research efforts of this group.

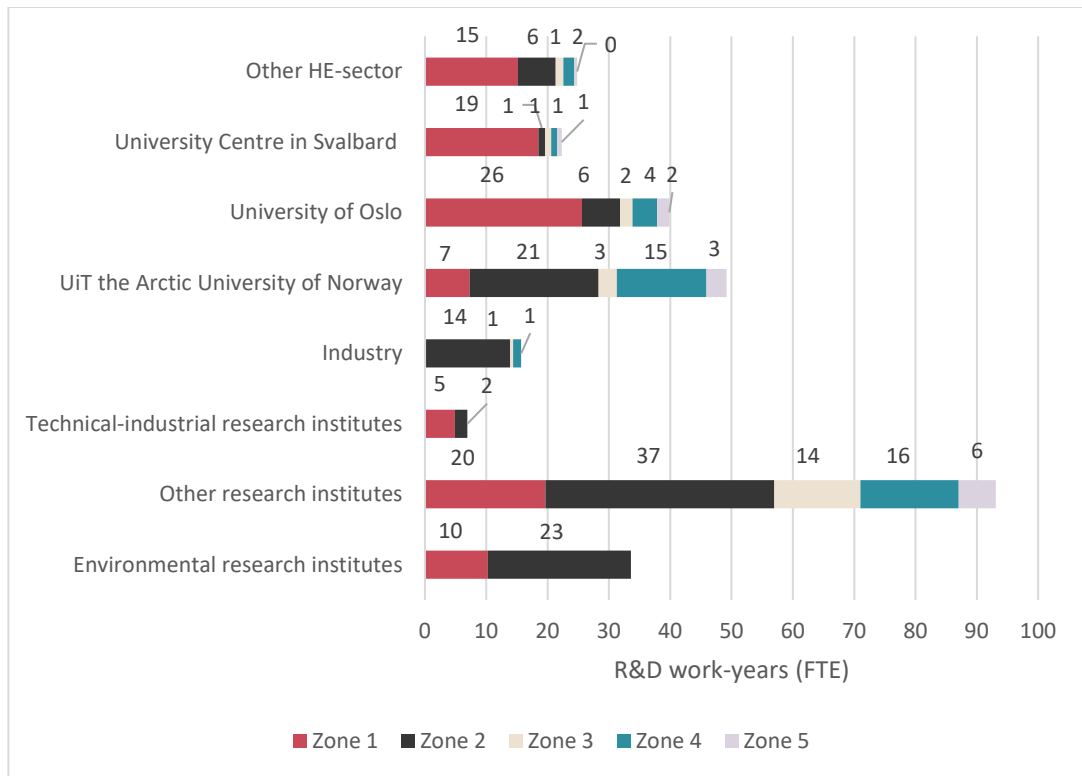


Figure 5.6 Norwegian research in/related to Svalbard 2018. Number of R&D work years (FTE) by geographical zones and institution/institute groups

Source: NIFU

5.3 Researcher days in Svalbard

In order to provide a quantitative measure of the extent of the different countries' research activities on the archipelago, *researcher days* have been used as an indicator (see Chapter 2). The indicator includes the number of days that researchers spend on Svalbard to conduct research (researcher days in this context also include PhD-students, technicians, research assistants etc., but not master's/bachelor's students). By counting how many days researchers from different countries and institutions have spent on the archipelago, we are able to provide an indicator of the extent of the countries' research efforts.

The indicator reflects physical presence on Svalbard, but not the extent of "Svalbard research" carried out at the home institutions in the various countries. For Norway, however, we also have figures for the latter activity, and section 5.2 above includes figures of the volume of Svalbard related research carried out in Svalbard as well as on the Norwegian mainland. When presenting figures of researcher days below, it is important to emphasize that these only will include days spent in Svalbard.

5.3.1 Main findings

The survey showed that researchers from Norway and other countries spent a total of 40,400 days in Svalbard in 2018. If this figure is converted to full time equivalent work-years, using a proxy where 1 full-time equivalents = 240 days, this corresponds to about 168 work years. These figures thus include the time that researchers spend on Svalbard to perform research, corrected for teaching and other activities that fall outside the research (for example, for UNIS teaching activities are not included).

To a large extent, the research stays will provide data and observations that are further processed at the home institutions. This means that the overall research related to Svalbard would be much higher. For example, fully or semi-automatic measurement stations can provide large amounts of data and thus form the basis for much research, but would contribute to few researcher days. For Norway, we have calculated that the number of Norwegian researcher days at Svalbard converted to full-time equivalents would amount to about 70 R&D work-years or 28 per cent of the total research related to Svalbard (273 work-years, cf. Chapter 5.2). Similar patterns, perhaps to an even larger extent, would probably apply for other countries as well.

Researchers from Norwegian institutions accounted for 42 percent of the researcher days in 2018, while researchers from foreign institutions accounted for the remaining 58 percent. The figures include UNIS for Norway, both field activity and presence in the offices in Longyearbyen (corrected for teaching activity). If only UNIS's field activity had been included, the Norwegian share would have dropped to 34 per cent (this factor is discussed in more detail below).

Based on data from the similar surveys previously carried out by NIFU, Figure 5.7 shows the development in number of researcher days for the period 2002-2018 and the Norwegian and foreign proportions of the researcher days. During the period 2002-2014 the number of researcher days increased significantly, this holds for both Norway and other countries. In 2018, we for the first time observe a decrease in the research activity measured by researcher days and the number is significantly lower than in 2014. However, compared with the previous years, the activity in 2014 was exceptionally high, and the number of researcher days in 2018 is still larger than in 2002, 2006 and 2010.

From 2014 to 2018 there is a decline for both Norway and other countries, but the reduction is largest for Norway which means that the Norwegian proportion drops from 53 per cent in 2014 to 42 per cent in 2018. The Norwegian proportion is now in the order of magnitude with the first two years figures are available (48 per cent in 2002 and 46 per cent in 2006).

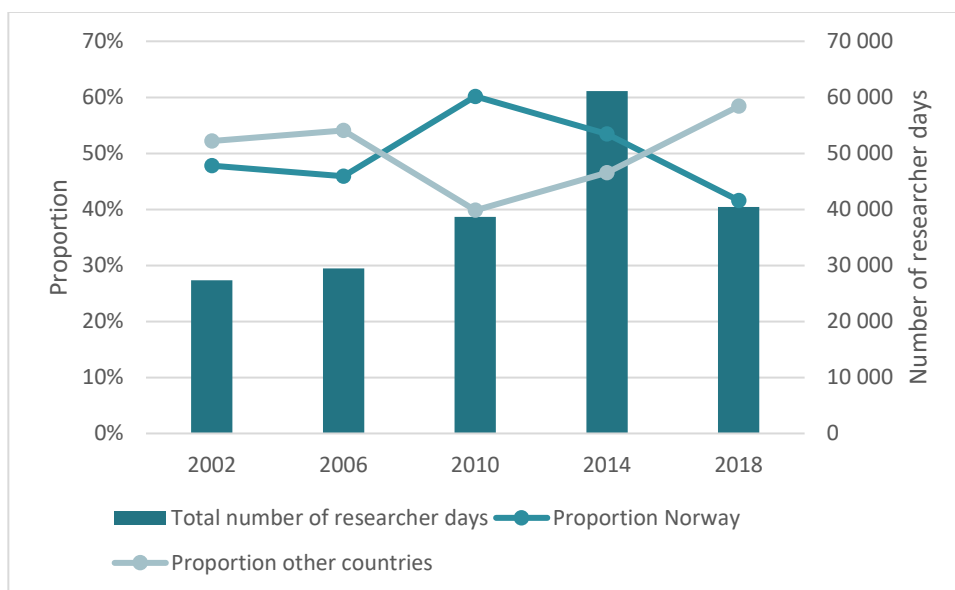


Figure 5.7 Number and proportion of researcher days in Svalbard, 2002-2018, Norway and other countries.

Source: NIFU

Many factors have contributed to the decrease from 2014 to 2018. One important factor is a reduction in the marine research from research vessels. In 2014, many cruises were carried out in Svalbard coastal areas which resulted in many researcher days. The survey for 2018 shows much less such activity, this particularly affects the Norwegian numbers. According to the reports, cruises starting in Svalbard in 2018 were mainly heading for waters outside the territorial border. Moreover, the research vessel *Lance* of the Norwegian Polar Institute which often were used in the Svalbard area, was sold in 2017. It should be noted that the marine research activity involving research vessels naturally will show large annual variations depending on the particular cruise plans for the year in consideration. Thus, this needs to be taken into consideration when interpreting the figures.

There is also a large reduction for UNIS. As described in Chapter 2, the number of R&D work years reported in the R&D mapping survey has been converted to researcher days. We have also obtained data on the field activity of UNIS. According to the annual reports of UNIS for 2014 and 2018, the number of permanent scientific positions (professors and associate professors) were almost identical in 2014 and 2018. However, the number of PhD candidates decreased from 28 in 2014 to 13 in 2018 and number of post docs was reduced from nine to four. As the latter positions have high proportions of research, this naturally lead to a significant reduction in both R&D work-years and researcher days.

From 2014 to 2018 we also find a large decrease in the Russian number of researcher days reported for Barentsburg. However, there are considerable elements of uncertainty related to the previous figures for Barentsburg. Thus, the reduction may not necessarily mean that there has been a real decrease in the research activity.³ This issue illustrates that the mapping involves uncertainty and should be regarded as a rough rather than precise quantification of the volume of research in Svalbard measured through researcher days.

Among other factors contributing to the decrease from 2014 to 2018 is a reduction in the research activities in Svea measured in researcher days. There was also reduction in the total number of researcher days in Ny-Ålesund.

The figures above represent the direct volume of the research activity in Svalbard measured through researcher days. In addition, the research activities require various types of support. For example, approx. 45 work years were carried out by Kings Bay employees in 2018 for operating the research station. Similarly, research in other parts of Svalbard require administrative support and services. This contributes to a significant number of work-years. At UNIS, the technical and administrative staff comprised 43 full time equivalent work years (FTEs) in 2018, in addition to a scientific staff of 13 professors, 15 associate professors, five researchers, four post docs, 13 PhD candidates and 39 staff with adjunct professor/associate professor positions. Moreover, a total of 218 student-labour years was produced at UNIS in 2018. In addition to the research activity, the Norwegian Polar Institute has adjacent activities (administration and logistics service, environmental monitoring, topographic mapping, operation of vessels etc.). At the Governor of Svalbard's office, management functions and administration are carried out in relation to the research at Svalbard, and the Svalbard Science Forum Secretariat of the Research Council of Norway has three employees. In other main research sites such as in Barentsburg and Hornsund there also are support functions related to the research activity. As a rough estimate, it is reasonable to assume that the research sector in a broad sense, that is, including teaching, student labour years, and support functions, accounts for more than 500 man-years in Svalbard. In addition, this activity generates secondary employment effects, for example in terms of public services, transport, trade and business. In comparison, according to figures from Statistics Norway, the total population in Svalbard (including all settlements) was 2787 people by the end of 2018.⁴ Research and higher education thus represent a central part and fundament for the Svalbard settlement.

³ Russia accounts for 16 per cent of the decrease in total number of Svalbard researcher days from 2014 to 2018. Excluding this decrease in the calculations, the Norwegian proportion of researcher days in 2014 would have been even higher.

⁴ Source: <https://www.ssb.no/befolkning/statistikker/befsvvalbard>

The research activity measured in researcher days is not evenly distributed throughout the year. The summer season is the most intense, but there is also a lot of activity during the spring and autumn. During the winter, the activity is more limited, and many stations are closed or have minimal staffing. Exceptions are activities such as northern lights research, and operation of continuous measurement and monitoring programs. The employees at UNIS are permanently based in Longyearbyen throughout the year.

5.3.2 Distribution by country

As described in chapter 5.3.1 researchers from Norwegian institutions accounted for 42 per cent of the researcher days in Svalbard in 2018. The second largest nation was Poland with a proportion of 15 per cent, followed by Russia with 13 per cent (Figure 5.8). Most of the Russian research is carried out in Barentsburg, while the Hornsund station accounts for the majority of the researcher days for Poland. In total, these three countries accounted for more than two-thirds of the total research efforts in Svalbard measured by researcher days.

Researchers from German institutions do also have extensive research activities in Svalbard. Germany is the fourth largest nation with a proportion of 6.0 per cent of the researcher days in Svalbard in 2018. Much of this activity is based from the French-German AWIPEV facilities in Ny-Ålesund. Then follow six countries with proportions the order of 2-3 per cent: USA (3.3 %), India (3.2 %), Italy (3.0 %), Czech Republic (2.7 %), France (2.6 %) and China (2.4 %). In addition, researchers from institutions in a number of other countries have been involved in research activities on the archipelago in 2018. According to our registrations, these researchers are affiliated with institutions in 20 different countries.

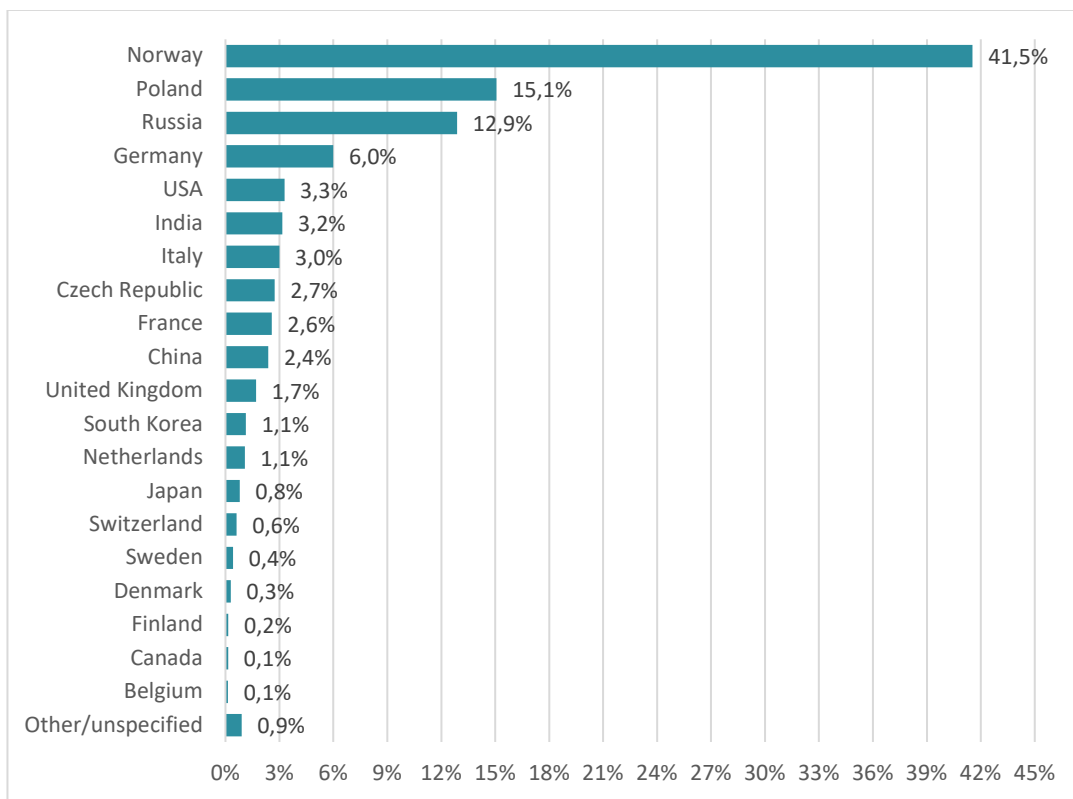


Figure 5.8 Researcher days in Svalbard 2018, relative distribution by country.

Source: NIFU

It may seem surprising that the Norwegian proportion is this high. One factor that should be taken into account is that Norway has a relatively large number of researchers residing in Svalbard, and this generates many days, while foreign researchers to a greater extent are present on the archipelago for shorter periods and where the research material is processed and analysed at the home institutions. For Norway, UNIS in particular increases the number of researcher days significantly. UNIS accounted for almost half of the Norwegian researcher days in Svalbard in 2018. From UNIS we have also received figures for the extent of the field activity measured in researcher days. If only the field activity was included for UNIS, the total Norwegian share of research days in Svalbard would have decreased from 42 per cent to 34 per cent. The latter figure is probably a better estimate of the Norwegian contribution to the actual Svalbard research, while the former figure reflects the human presence in Svalbard in a research context. In the previous NIFU reports we have also analysed the scientific publications relating to Svalbard. In the period 2012-2014 the Norwegian proportion of the total Svalbard related publication output was 29 per cent (Aksnes & Rørstad, 2015).

Based on data from the previous NIFU-mappings, Figure 5.9 shows the development over time for selected of countries. It should be noted that due to uncertainties concerning the previous Russian figures, Russia has not been included in this overview. As can be seen, for many of the countries there are quite large annual variations in the numbers. For the largest country, Poland, there has been a significant increase in the number of researcher days over this period, however with a reduction from 2014 to 2018. Germany shows a mixed picture with an increase during the 2002-2010 period and a reduction in the years 2014 and 2018. From 2014 to 2018 the number of researcher days has increased for USA, India and Italy, while there is a reduction for the Czech Republic and a modest reduction for France, China, the Netherlands and Japan. However, again it should be emphasised that the figures are associated with uncertainties. Moreover, some of the fluctuations may be interpreted as random in the way that they are influenced by the annual implementation of larger research programs.

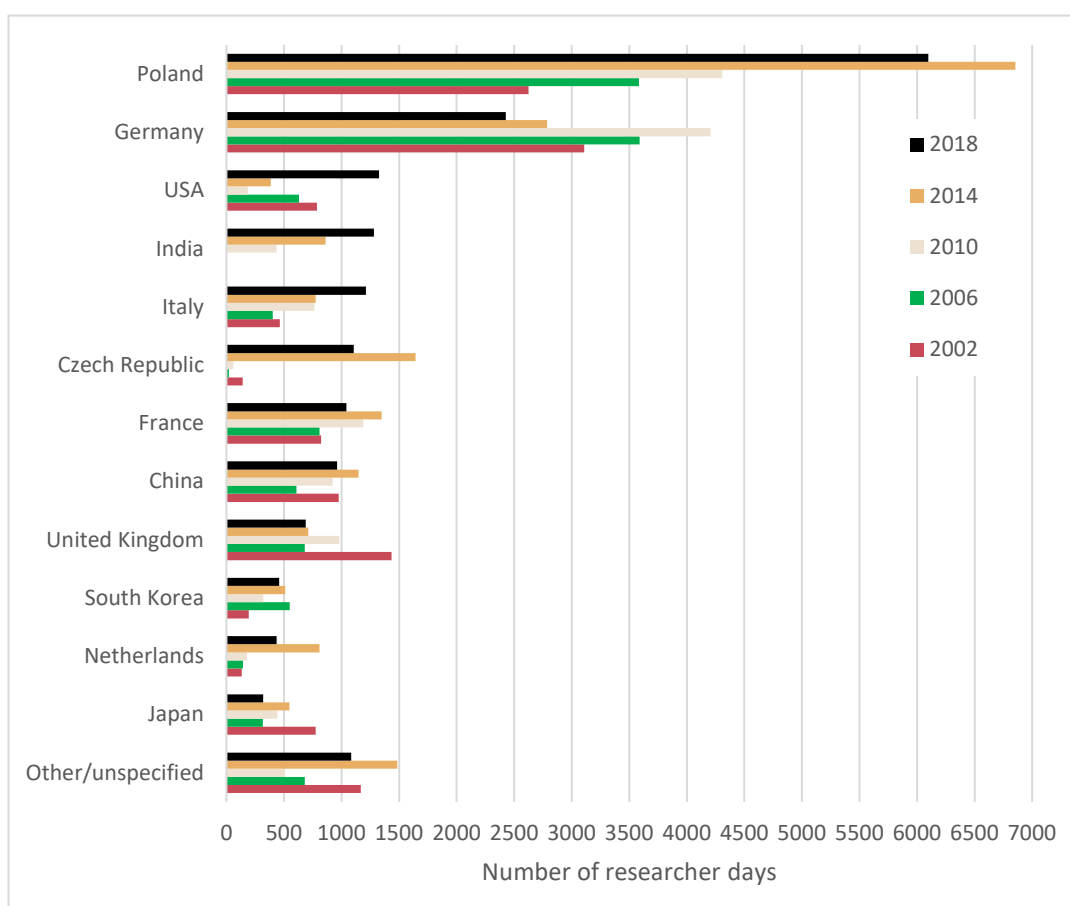


Figure 5.9 Number of researcher days in Svalbard 2002-2018 for selected countries*.

Source: NIFU.

*) Due to uncertainties concerning the previous figures, Russia has not been included in this figure.

5.3.3 Distribution by geographical area

In the analyses the researcher days have been distributed according to geographical Svalbard zones. The results are shown in Figure 5.10. Zone 1, which includes Longyearbyen, Barentsburg, Pyramiden, Isfjorden and Svea, accounts for the largest number of researcher days, approximately 17,000, or 42 per cent of the total. An important factor here is that UNIS is located in Longyearbyen. If excluding UNIS' researcher day in the offices in Longyearbyen (highlighted in shaded colour), the number and proportion would drop significantly.

The research activity in Zone 2 (Ny-Ålesund, Kongsfjorden and adjacent areas) accounted for just over 15,000 days or 37 per cent of the total activity in Svalbard in 2018. Approximately 6,000 researcher days were spent in Zone 5, south Svalbard (15 %), of which the Hornsund station is the major contributor. The research activities in the other parts of Svalbard are much more limited and less than 1,000 researcher days were carried out in Zone 3 (North West Svalbard) and Zone 4 (East Svalbard). Each zone accounted for approximately 2 per cent of the total.

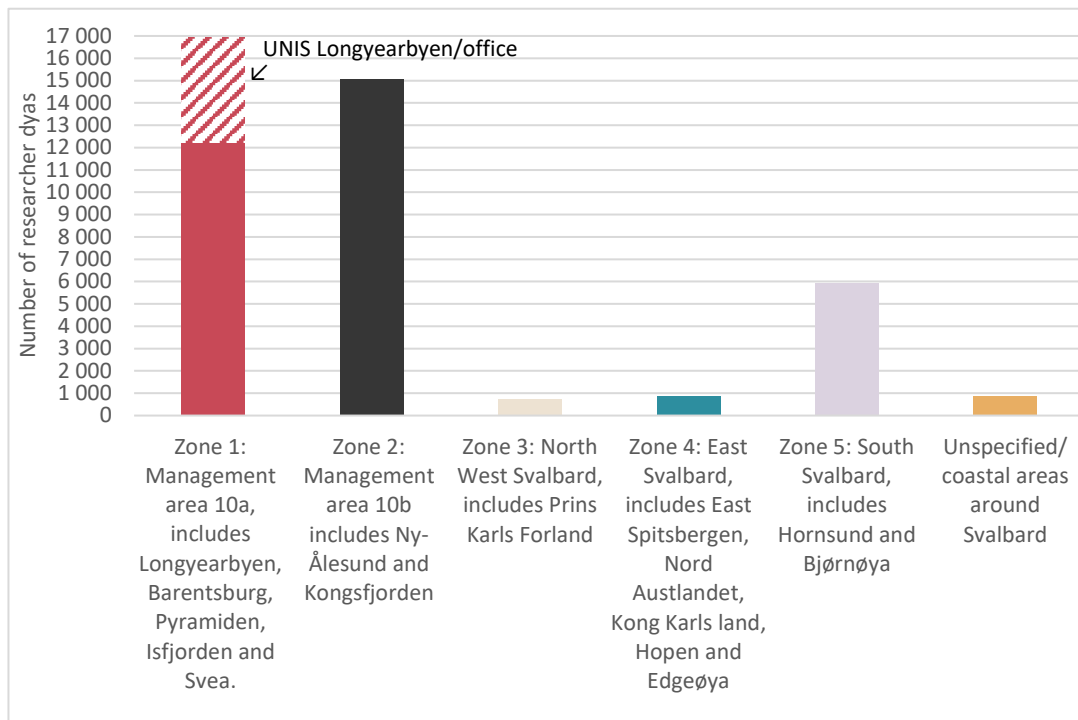


Figure 5.10 Number of researcher days in Svalbard 2018 by geographical zones.*

Source: NIFU.

*) UNIS' researcher days in Longyearbyen, which is not field-based, are shown in shaded color. See Figure 5.4 for a map of the zones.

5.3.4 Ny-Ålesund

In 2018, Kings Bay registered 25,828 overnight stays in Ny-Ålesund. Of these, 13,339 were researcher days, including days in the field. Figure 5.11 shows the number of researcher days in Ny-Ålesund, dating all the way back to 1996. The number increased significantly during the period 2006-2009, possibly due to the International Polar Year (IPY). Then the volume dropped somewhat, but from 2013 to 2014 there was again a marked growth. The recent years the number of researcher days has been in the order of 13-14,000 with some annual fluctuations.

AWIPEV had the largest activity in 2018 with just over 3,000 researcher days. Next follows the Sverdrup building by the Norwegian Polar Institute (NPI), accounting for approximately 2,700 days (including institutions hosted by NPI). Together, AWIPEV and Sverdrup accounted for 43 per cent of the total Ny-Ålesund researcher days.

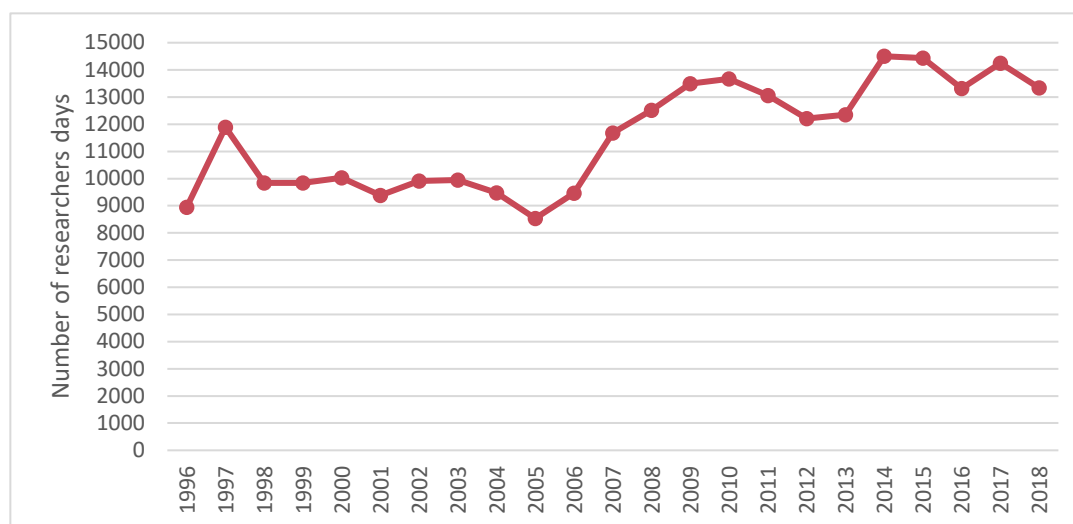


Figure 5.11 Number of researcher days in Ny-Ålesund, 1996-2018.

Source: Kings Bay AS.

Figure 5.12 shows how the research activity in 2014, 2017 and 2018 was distributed throughout the year. The number of researcher days is clearly highest in the summer season (June-August), and especially in July and August the number is high. In both 2017 and 2018, approximately 40 per cent of the researcher days came during these three summer months. In 2014 the summer peak was even higher than in 2017 and 2018. There has been less activity during the winter, particularly in 2014 and 2017. However, Ny-Ålesund has increasingly been used for research throughout the year compared with the situation some years ago.



Figure 5.12 Number of researcher days in Ny-Ålesund per month, 2014, 2017 and 2018.

Source: Kings Bay AS.

5.4 Research sites and installations

As part of the project, a survey of Norwegian and foreign research sites and installations in Svalbard was carried out. This survey was sent to the owners of the various sites and research installations on the archipelago, where also questions concerning researcher days were included. In 2015, a similar survey was carried out, and the present survey is an update where much of the previous information has been retained.

The aim of this survey has been to get more detailed information on the research being carried out, capacity, staffing and further plans (see Appendix 3). Chapter 5.4 describe the results of the study in a descriptive format, mainly reproducing the information we received through the survey. Some respondents did not return much information, other provided extensive reports. Therefore, the extent of the description of each site varies in terms of content and details.

5.4.1 Ny-Ålesund

This section provides an overview of the main research institutions and installations located in Ny-Ålesund. Initially, in Figure 5.13 we present an overview of how the researcher days collected by Kings Bay were distributed per main institution in 2018.

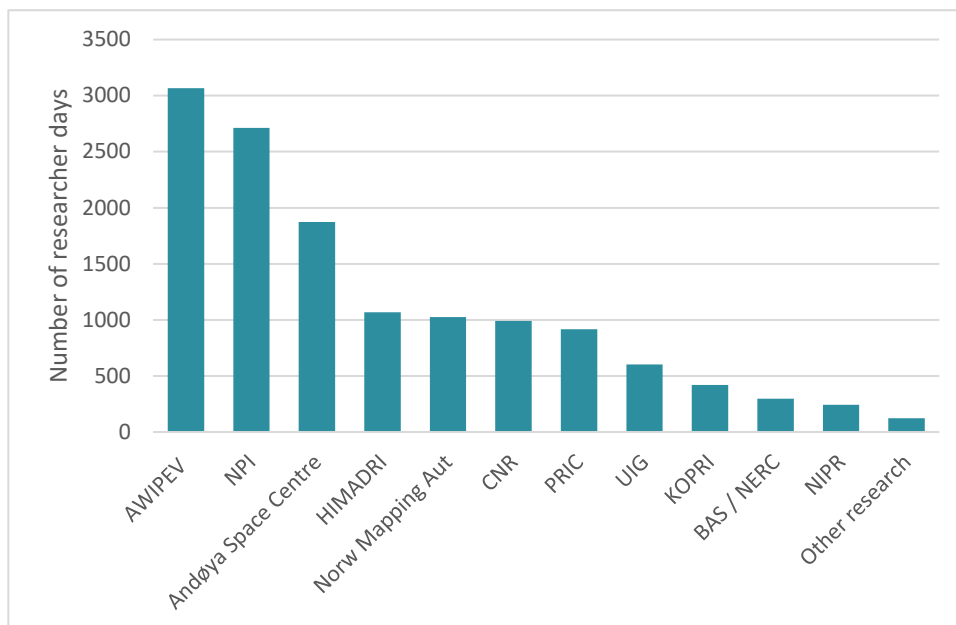


Figure 5.13 Number of researcher days in Ny-Ålesund per institution 2018.

Source: Kings Bay AS.

Sverdrup

Sverdrup is the Norwegian Polar Institute's (NPI) building in Ny-Ålesund. NPI has been present in locations in Ny-Ålesund all-year-round since 1968 and a new building was opened in 1999. The Sverdrup building hosts both NPI's own researchers and other researchers. The building is 800 square meters and contains offices, logistic warehouses, a preparation platform, lecture rooms and an observation platform. The observations and research carried out include climate and atmospheric research, biological research (both terrestrial and marine), as well as cryospheric and oceanographic research.

On the Zeppelin mountain just above Ny-Ålesund there is an observatory for atmospheric research. The Norwegian Polar Institute owns and operates the station, but the Norwegian Institute for Air Research (NILU) has the scientific responsibility for the operation. The observatory was put into operation in 1989 and was replaced by a new one in the year 2000.

The NPI personnel in Ny-Ålesund carry out technical maintenance of instruments, both at Sverdrup and at the Zeppelin Observatory. Furthermore, they offer logistical services to researchers from institutions in Norway and other countries which do not have their own facilities in Ny-Ålesund. Key tasks include routine measurements at Sverdrup, the Zeppelin Observatory, the areas around Ny-Ålesund as well as in the sea/Kongsfjorden.

Infrastructure / instruments and data

NPI maintains the permanent instrumentation present, in total over 100 different instruments. In addition, NPI offers office space for renting and mechanical and electronical working rooms. NPI also provides other logistical services, including field equipment, boats, snow mobiles and other equipment for hire.

The measurement programs include more than 100 different time series of data, the longest going back to the 1950s and -60s. The time series include a number of different parameters from the atmosphere as well as terrestrial and marine areas. Some of the measurements are seasonal.

Staff

Sverdrup has permanent staffing with engineers and technicians, and staffing increases in the summer. According to the report provided by NPI, the institute has a staff of 14 people with technical/administrative duties, who carried out 13.5 work years in 2018. In addition comes a scientific personnel of 3 researchers accounting for 3 work years.

Kings Bay's laboratories

Kings Bay is responsible for the operation of the marine laboratory in Ny-Ålesund, which opened in 2005, as well as the Kings Bay Vaskerilab. The marinelab is designed for experimental research in marine ecology, physiology, biochemistry and some disciplines with geosciences, such as oceanography, marine geology and ice physics. The laboratory has equipment for various types of research, including control systems for experiments with variable temperatures and lighting conditions, and there is a separate diving lab. Kings Bay Vaskerilab has two laboratory rooms that are used for both terrestrial and marine research. Kings Bay Veksthus (Terrestrial laboratory) was opened in 2019 and will be ready for use summer 2020.

The use of the laboratories is concentrated in the summer months (May-September), but it also used during the winter season. According to the annual report of Kings Bay, there was a significant decrease in the use of the laboratories in 2018 compared with 2017. In order to provide service and assistance to visiting

scientists, Kings Bay hired a person in a temporary position for the period April to September in 2018.

According to statistics provided by Kings Bay for the main part of 2019 (up to October 2019), the Alfred Wegener Institute (AWI) was by far the most frequent user of the laboratories accounting for 38 per cent of the researcher days, followed by the Indian National Centre for Polar and Ocean Research (NCPOR) with 23 per cent.

Staff

Kings Bay has 26 employees (December 2018), but the staffing is considerably higher during the summer season, and a total of 45 work-years were carried out in 2018.

The Geodetic Observatory

The geodetic observatory in Ny-Ålesund of the Norwegian Mapping Authority maps movements in the earth's surface, the rotation of the earth and its exact location in space. The main installation on the observatory is the VLBI (Very Long Baseline Interferometry) antenna, which has been in operation since 1993. It is part of a worldwide network that is essential for all types of satellites to function with sufficient precision. The observatory in Ny-Ålesund is the northernmost in international VLBI cooperation and the only one north of 60 degrees north. The Mapping Authority operates the observatory, and in return receives precise satellite navigation and the opportunity for participation in basic geodetic research.

The construction of a new facility began in 2013, and the new observatory was officially opened in 2018. The new observatory will gradually be phased in, replacing the old facilities at Hamnerabben. The observatory has an estimated cost of about 300 million NOK.

Infrastructure / instruments and data

The VLBI antenna uses quasars (distant celestial bodies) as measuring points; several VLBI antennas placed in other part of the Earth provide simultaneously measurements against the sources (quasars). Raw data from the observations is then transmitted to a joint data center that compiles data. This makes it possible to trace movements in the Earth's surface, how fast the Earth rotates and the exact location of the Earth in space. This infrastructure necessitates radio silence in Ny-Ålesund.

In addition, other types of instrumentation have been installed at the observatory. This includes GNSS receivers that observe satellite data and provide continuous observation of the Earth's crust, superconducting gravimeters that

measure changes in the Earth's gravity and contribute in the determination of sea level change as well as tide and water level meters (one of 24 permanent tide and water level measurement installations in Norway). In addition, some foreign institutions have deployed instruments at the observatory, including scintillation receivers.

The new observatory consists of cutting-edge technology, including next-generation VGOS (VLBI Global Observing System), twin telescopes with fast-slewing antennas and a broadband (2-14 GHz) signal acquisition chain.

Staff

The observatory has a permanent staff of 4 people who together perform 3 work-years. The primary task of the personnel is to operate infrastructure and maintain buildings and instruments. According to statistics from Kings Bay, a total of 1,024 researcher days were reported for the observatory in Ny-Ålesund in 2018.

Further plans

The Norwegian Mapping Authority has signed a contract with NASA concerning building of a state-of-the-art Satellite Laser Ranging facility (SLR) at the new Earth observatory in Brandal. This work is ongoing. The current goal is to have all systems up and running in Ny-Ålesund by 2022.

Svalbard Rocket Range

Andøya Space Center operates two sounding rocket launch bases, one is located in Ny-Ålesund, the other at Andøya. These sites offer a variety of rocket trajectories and access to all layers of the atmosphere. The launch base at Ny-Ålesund has a unique location for polar cusp studies. The cusp is the only place where the solar wind directly influences the Earth's atmosphere and Ny-Ålesund is the only place on Earth where sounding rockets can be launched directly into the solar wind.

Infrastructure / instruments and data

The installation in Ny-Ålesund consists of a launching ramp for scientific rockets, preparation hall for rockets and payloads, as well as other facilities and systems that allow rocket launches.

Staff and utilization

Andøya Space Center does not have permanent personnel in Ny-Ålesund. The installations are only manned in relation with the execution of rocket campaigns. Andøya Space Center's customers and partners include ESA, NASA, JAXA, CNES, DLR, IAP and Airbus, as well as a numerous of universities and research institutions worldwide. In some years, this has resulted in significant additional activities in Ny-Ålesund during the winter.

The AWIPEV Base

The German Alfred Wegener Institute for Polar and Marine Research (AWI) and the French Polar Institute Paul Emile Victor (IPEV) run joint research infrastructure in Ny-Ålesund. This serves as a platform for German and French researchers as well as researchers from collaborating countries. The AWIPEV facilities includes the Koldewey building, the Rabot base and the French Corbel camp, 5 kilometers east of Ny-Ålesund. AWI established the Koldewey base in 1991, and IPEV has had a permanent base at the Rabot station since 1991. Since 2003, AWI and IPEV have collaborated on operations, logistics and administration.

The research includes biology, chemistry, geology, climate research and atmospheric physics. Important areas of activities are the operation of three long term climate observatories (the atmosphere, the permafrost ground, and the Kongsfjord Under Water Observatory). In addition, long term glaciological observations are carried out at the Lovénbreen glacier. Other research includes terrestrial biology, ornithology, and research of the marine ecosystem of Kongsfjorden. The climate change research conducted builds on the long-term observation of key parameters of climate change, at the surface, in the ground, and in the atmosphere, as well as of glaciers around Ny-Ålesund.

Infrastructure / instruments and data

The AWIPEV facilities can accommodate up to 16 guests and includes offices and various laboratories. Boats, snowmobiles, cars and bicycles are available for transport and access to remote locations. In addition to the buildings, the facilities include an atmospheric observatory and a balloon house which is used for the release of, among other, meteorology balloons. The laboratories and observatories are equipped with state-of-the-art instrumentation for their various purposes.

Staff

The AWIPEV facilities is staffed with three people all year round. The personnel operate the infrastructure and carry out the measurements and provide logistical support to visiting researchers. In addition, staff at the home institutions in Germany and France are involved in the operation of the station part-time or full-time. It is reported that in 2018, there were 18 people in technical-administrative positions and 12 people in scientific positions involved in the operation of the station. The personnel performed 12 and 6 work-years respectively.

Further plans

It is reported that the observatory installations are upgraded regularly on an instrument basis, but there are no plans to extend the all year observatory program. There has for several years been a discussion with Kings Bay AS to build a new, three-nation building, but this is still uncertain.

UK Arctic Research Station

The British Antarctic Survey operates facilities in Ny-Ålesund, funded by the National Environment Research Council (NERC). The research site, located in the Harland House, has been in operation since 1991 and carries out research in terrestrial ecology, glaciology, biology, marine research and atmospheric research.

Infrastructure / instruments and data

Facilities include laboratory space and computer rooms, lab equipment store, project equipment store, field clothing and safety equipment store. The laboratories contain instruments such as microscopes, centrifuges, pH meters, refrigerators and freezers. Various equipment is also available for field work, such as boats and equipment for glaciological research.

Staff

The research site has a staff of one-person accounting for 0.21 work-years in 2018. In addition, it is visited by scientists for short or long stays.

NIPR Rabben

The National Institute for Polar Research (NIPR) from Japan has been permanently established in Ny-Ålesund since 1990. The research carried out covers atmospheric observations of compounds such as greenhouse gases, aerosols and clouds, upper-middle atmospheric observations including energetic electron precipitation, and biological field works of the study of tundra ecosystem and its response to climate change.

Since April 2019, NIPR's facilities have been relocated in the new research building in the center of Ny-Ålesund. NIPR's research activities will be continued in the new building.

Infrastructure / instruments and data

Instruments for e.g. aerosol, cloud and greenhouse gas observations are installed at Rabben, near the airport. However, there are no common instruments for other researchers.

Further plans

Further plans include to start observations of atmospheric Argon concentrations in the near future. In addition, considerations are made concerning a new common aerosol inlet at Gruvebadet to proceed with further aerosol observations.

The Arctic Centre of the University of Groningen (UiG)

The Arctic Center at the University of Groningen (UiG) has research facilities in Ny-Ålesund, dating back to 1995. Primarily research in terrestrial biological research, including ecology and ornithology is carried out. There is also research in archaeology and environmental pollution.

Infrastructure / instruments and data

Various types of research infrastructure and instruments are provided, including equipment for ornithological studies, reversed microscopes and wildlife cameras.

Staff

There is no permanent staff, but 14 scientists visited the facilities in 2018, accounting for 1.6 work years.

Further plans

The Dutch Research Council (NWO) has made an agreement with the German-French AWIPEV for joint use of each other's infrastructure and to invest in new housing facilities and laboratories. Further plans include investments in GPS loggers on birds, DGPS, an adapted drone and soil scanning devices. There are also plans for a small extension in social science research.

CNR – Dirigibile Italia

The National Research Council of Italy (CNR) has been in Ny-Ålesund since 1997. The facilities also include the so-called "Amundsen-Nobile Climate Change Tower" which was opened in 2009. Atmospheric studies have a key role, but the research also includes oceanography, marine and terrestrial biology, glaciology, geology and aurora research.

Infrastructure / instruments and data

The facilities of CNR include about 330 square meters with four laboratories and six rooms, capable to host up to seven people. The research facilities also include the Climate Change Tower equipped with sensor to measure the physical parameters of the atmosphere, the Gruvebadet Atmospheric Laboratory that host several aerosol samplers. The facilities are offered (based on bilateral agreement) to support integrated and complementary measurement. Logistics support, snowmobiles, clothing, field and safety equipment are also available to visiting scientists.

Staff

CNR has now permanent staff located. Researchers typically visit and stay for 1-2 months.

Further plans

Further plans include installation of an optical fiber for high resolution measurements of temperature and humidity profiles, a reference for air and soil temperature at different levels.

PRIC - Yellow River

The Chinese Arctic and Antarctic Administration (CAA) has been present in Ny-Ålesund since 2004. The research includes meteorology, atmospheric studies, glaciology and marine biology. The Polar Research Institute of China (PRIC) took over administration and management of the facilities in 2017. There are no permanent staff, but many scientists have visits during large parts of the year. No further information as we did not receive a response to the mapping survey.

KOPRI - Dasan

The Korean Polar Research Institute (KOPRI) has been present with research facilities in Ny-Ålesund since 2002. Various types of research are carried out, including Arctic sea ice research, environmental change survey on upper atmosphere and space, geology and geophysics, marine and terrestrial ecosystems, as well as microbiology.

Infrastructure / instruments and data

Various types of scientific equipment and logistics equipment have been installed such as upper atmosphere monitoring systems, basic laboratory equipment, GPS and radio systems, portable CTD and diving instrument. Studies of the upper atmosphere are carried out at Gruvebadet and the Zeppelin Observatory.

Staff

There is no permanent staffing. The activity is seasonally based and scientists visit the facilities for shorter or longer stays.

Further plans

It is reported that KOPRI is planning rental of additional research space in Ny-Ålesund.

NCPOR - Himadri

The Indian National Centre for Polar and Ocean Research (NCPOR) formerly known as the National Center for Antarctic and Ocean Research (NCOAR), established research facilities in Ny-Ålesund in 2008. The research includes biochemistry, genetics, geology, glaciology, oceanography atmospheric research and studies of long-range pollution. More specifically the following research issues are addressed: (i) Long-term monitoring of the physicochemical and biogeochemical aspects of Arctic fjords and adjoining ocean for climate change studies. (ii) Research on the dynamics and mass budget of Arctic glaciers. (iii) Research on Atmospheric Aerosols and Precipitation in Arctic: Aerosol, black carbon and snow sampling, precipitation measurements. (iv) Assessments of the flora and fauna of the Arctic vis-à-vis their response to anthropogenic activities. (v) Comparative study of the life forms under extreme environment from both the Polar Regions- Arctic and Antarctic –bacterial, algal and plankton sampling.

Infrastructure / instruments and data

Many types of scientific instruments are available, including portable CTD (equipped with fluorescence, DO, turbidity, and PAR sensors), van-veen Grab sampler, plankton net, Niskin water sampler, portable meteorology kit, Bucket thermometer, spectrophotometer, dosimat, weighing balance, and computer systems. In addition various types of instruments are installed at the Gruvebadet lab.

Staff

There is no permanent staff at Himadri. Scientists visit the facilities in four to five batches each year.

5.4.2 Longyearbyen

EISCAT Svalbard radar

The EISCAT-Svalbard radar is located a few kilometres outside Longyearbyen and has been operated since 1996. In 1999 a second antenna was built. EISCAT (abbreviation for European Incoherent Scatter) is an international organization and was established in 1975 involving collaboration between six European countries, including Norway. Later, Japan and China have joined the organization. EISCAT also has antennas located in Tromsø, Kiruna in Sweden and Sodankylä in Finland. EISCAT is registered in Sweden and is owned by its members. In 2018, Norway represented by the Norwegian Research Council has a share of 23.39% of the foundation. The member countries as of 2018 include Norway, Sweden,

Finland, the UK, Japan, and China. In addition, France, South Korea and Ukraine are associated partners.

The Eiscat Svalbard Radar is the most powerful instrument on Svalbard for studies of the interactions between the Sun and Earth; the Earth's upper atmosphere, the ionosphere and the magnetosphere, and the aurora. The radar is ground based tool for studies of the cusp/cleft region of the magnetosphere. It allows new scientific research of the geo-space coupling to the ionosphere and related plasma- physical processes, and investigations of the Arctic stratosphere and troposphere, which are essential in view of global change and environmental research.

Infrastructure / instruments and data

The EISCAT Svalbard Radar is a high-power radar that is using the incoherent scatter technique. The Radar operates in the 500 MHz band with a transmitter peak power of 1000 kW. There are two antennas, a 32 meter mechanically fully steerable parabolic dish antenna, and a 42 meter fixed parabolic antenna aligned along the direction of the local geomagnetic field.

The high latitude location of this facility is particularly aimed at studies of the cusp and polar cap region. The data are pre-processed in signal processors, displayed and analyzed in real-time and can be recorded to mass storage media both locally and at a main storage facility.

The EISCAT Svalbard Radar can also be operated together with the other EISCATs radars on the mainland, which give scientists unique research opportunities. EISCAT has played a role in supporting research in many areas including solar-terrestrial relationships, solar system physics, geospace studies, space weather, and global change. Access to the facilities is provided to all scientists in the associated countries. Distribution of time is divided by membership.

The Radar can be run locally by scientists from all of the member countries/institutes, with support from the local staff. In addition, the radar can be run by the local staff, and remotely monitored by scientists located anywhere in the world.

Staff and utilization

The EISCAT Svalbard facility has a local staff of two people on permanent basis, 2.2 work-years were conducted in 2018. The number of local staff has been reduced compared with the situation previously. This is due to the fact that the facility has been less in use in terms of radar hours. In 2017, the running time was only half of the time in 2006. According to the report from EISCAT, this is because it is more costly to operate the Svalbard radar compared with the radars on the mainland. This means that fewer running hours can be offered. The running cost

per radar hour has increased dramatically, mainly due to increased electricity cost the recent decade.

Further plans

At the moment, all plans for further extending the infrastructure have been put on hold. There is an ongoing process concerning the possible inclusion of new affiliates into the organization, as well as letting scientists from non-member/non-affiliates countries gaining access to the radar facility.

Kjell Henriksen observatory

The Kjell Henriksen Observatory (KHO) is owned and operated by the University Center at Svalbard (UNIS) and is used for aurora research. KHO is part of The Birkeland Centre for Space Science (BCSS). The observatory was inaugurated in 2007 and is built on Breinosa, just above the EISCAT antennas at Longyearbyen. The station replaced the old aurora station in Adventdalen. KHO serves as a platform for ground-based observations of the dayside and night side aurora in the polar cap. The two months of astronomical darkness in Svalbard makes the location the most ideal places for ground-based observations of the daytime aurora.

The optical instruments at KHO are used to study a variety of questions / processes related to dayside and night side aurora, airglow, and dynamics of the thermosphere and mesosphere. One goal is to provide an overview of the Sun-Earth interaction in the magnetosphere to obtain a better understanding of the upper atmospheric weather and how it connects to the lower atmosphere, and vice versa. KHO also serves as a laboratory for training and teaching students in space physics at UNIS.

Infrastructure / instruments and data

The observatory mainly includes passive low light sensitive optical instruments and radio instruments. The staff of KHO provide help with installation and transport up to the observatory and assist in the yearly tuning, calibration and daily operations of the instruments on request from the owners. Calibrations are carried out in the Optical laboratory at UNIS. Moreover, KHO provides power and internet connection is part of their services.

The observatory contains various types of optical instruments and radio instrumentation. In 2018, there were 26 optical instruments operating 24 hours a day during the auroral winter season from November to the end of February and 17 non-optical instruments which run all-year-round 24 hours a day. The instruments are owned by a number of different institutions, where UNIS accounts for the highest number. In total 24 different institutions from 14 nations are

present at KHO. KHO has time series for a number of different parameters related to aurora, the longest time series going back to 1978.

Staff and utilization

There is currently a research group of 10 scientists at UNIS affiliated with KHO, accounting for 5 work-years in 2018. In addition, comes 2 people in technical/administrative positions accounting for 1.5 work years. In addition, the observatory is regularly visited by external researchers, these are personnel from the institutions that have instruments at KHO and other researchers.

Further plans

The SuperDARN (Super Dual Auroral Radar Network) radar at Breinosa crashed due to extreme icing conditions after providing almost two year of operation real time data to the rest of the world. There are ongoing plans for rebuilding the radar. Further plans include to upgrade, develop and compare instruments as novel technology and knowledge emerge. In this respect the KHO aims to strengthen the collaboration with the current uses and invite new ones, as well as being We an attractive partner to large scale rocket and satellite campaigns both on the instrumental and observational side.

NORSAR's measurement installations

NORSAR is the owner and operator of two permanent installations in Svalbard: a seismic site at Janssonhaugen in Advent Valley and a radionuclide installation at Platåberget near Longyearbyen. The installations are in permanent operation. The seismic installation is part of a global network of stations to monitor compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT) with the main purpose to detect nuclear test explosions. The measurements can also be used to monitor seismic activity, primarily earthquakes, all over the globe. Examples of other sources of seismic waves observed are industrial explosions and icequakes. The radionuclide station located is used for measurement of airborne radioactivity. Also for this installation, the main purpose is monitoring of the CTBT. The installations of NORSAR are not specifically research installations, but the data provided can also be used for research purposes.

Infrastructure / instruments and data

The seismic installation is equipped with seismometers for measurement of ground vibrations from seismic signals propagating through the interior of the earth, and equipment to convert these signals to digital form. The radionuclide station comprises two systems: One for detection of radioactive, airborne particles, and one for radioactive, airborne noble gases.

The data from the installations are transferred in real time to NORSAR's operating center at Kjeller. The data are openly accessible to the national and international seismological research community.

Staff and utilization

The daily, technical operation of the radionuclide monitoring installation on Platåberget is handled by a Longyearbyen-subcontractor to NORSAR. The seismic installation is fully automated and unmanned and only needs occasional visits for repair and maintenance. Part of this is handled by a subcontractor in Longyearbyen, but the yearly work-time is negligible.

Further plans

Both installations are operated as part of an international network of stations to monitor for compliance with the CTBT. In the future the installations will be operated, maintained and upgraded to comply with the requirements and specifications for this international network of stations. Data provided will also continue to be applied for civil and scientific purposes.

Tromsø Geophysical Observatory's installations

Tromsø Geophysical Observatory at the Arctic University of Norway has installations and conduct magnetic field measurements at four locations in Svalbard; Bjørnøya, Hopen, Longyearbyen and Ny-Ålesund. The Norwegian Meteorological Institute hosts the installations on Bjørnøya and Hopen, while UNIS and the Norwegian Polar Institute have this function for the installations in Longyearbyen and Ny-Ålesund, respectively.

The scientific objective of the measurements is three-fold: long-term measurements to study the Earth's magnetic field change over decades, studies of short variations in the Earth's magnetic field caused by the interaction between the solar wind and the magnetosphere and the effect of such changes on modern infrastructure (space weather).

Infrastructure / instruments and data

The installations include a Flux-gate magnetometer with associated data logs (PC) located at the stations run by the Norwegian Meteorological Institute (Hopen, Bjørnøya), UNIS (Longyearbyen) and the Norwegian Polar Institute (Ny-Ålesund). At Hopen and Bjørnøya, Tromsø Geophysical Observatory and the Norwegian Meteorological Institute share internet connection for real-time transmission of data.

Further plans

Ongoing plans include purchase of a new calibrating instrument for the station in Bjørnøya.

Sousy Svalbard Radar

SOUSY Svalbard Radar is a radar system for atmospheric research to study weather, wind, waves and turbulence in the polar regions. The facility was established in 1998 by the Max-Planck-Institut für Aeronomie but is now operated by the Tromsø Geophysical Observatory at the Arctic University of Norway. It is a so-called "mesosphere-stratosphere-troposphere" (MST) radar, located in the Advent Valley about 10 kilometers from Longyearbyen.

Infrastructure / instruments and data

The installation consists of three containers and outdoor area that make up the field station and is intended for daytime stays. There is room for guest instruments. Different radar observations of the troposphere and the mesosphere are carried out. Furthermore, measurements include the cosmic noise of monitors, GPS scintillation measurements and magnetometer measurements.

Svalbard Satellite Ground Station (KSAT Svalbard)

Svalbard Satellite Station was officially inaugurated in 1999 and is located on Platåfjellet outside of Longyearbyen. KSAT downloads data for civilian purposes from satellites in polar orbits. The facilities have a unique northern location and provides access to every orbit. Kongsberg Satellite Services AS owns the infrastructure and is responsible for the operation. Since the facilities primarily are operated for commercial purposes, they are not included in our registration of research in Svalbard.

5.4.3 Other locations

SINTEF's field laboratory

Since 1984, SINTEF has conducted research from field laboratories in Svea, as well as in other areas in Svalbard. An important research issue has been studies of oil spills in Arctic environments with government agencies and oil companies as clients. In recent years, Arctic technology (geotechnics, erosion control, ice mechanics, ice and permafrost constructions, geophysical studies) has also

become a major area of research. The Svea community has been decided to be decommissioned and the laboratories will be closed down during 2020/2021.

Infrastructure / instruments and data

Svea has been used as a field laboratory. Equipment includes laboratory facilities and a drilling rig that has been used to sample ground conditions. In Svea there is also a rub-hall with suitable field equipment for work on ice and at the shore, communication instruments and a pick-up car for transport in the area. Other equipment and instruments are brought up from the mainland or from Longyearbyen on a project basis.

The stations of the Norwegian Meteorological Institute

The Norwegian Meteorological Institute has meteorological stations on Bjørnøya and Hopen (and on Jan Mayen). The stations primarily make regular meteorological measurements and are not research stations. There are thus no scientific personnel at the stations, but they are occasionally visited by scientists for research purposes. In this respect, the Meteorological Institute provides logistics assistance. In addition, the institute has more than 20 automatic weather stations all over the Svalbard archipelago.

Russian Research - Barentsburg

Russian research in Barentsburg has long traditions dating back to 1962. A number of Russian institutions and institutes have been established and conduct research based in Barentsburg, these primarily include: Arctic and Antarctic Research Institute, North-West Branch of "Typhoon" Research Center, Polar Geophysical Institute, Polar Marine Geological Expedition and Research Institute "VNIIOkeangeologia", Research Center for Medical and Biological Issues in Polar Regions of Kola Scientific Center RAS, Geophysical Survey of Russia Academy of Sciences (RAS), Polar Alpine Botanical Garden of Kola Scientific Center RAS, Institute of Archaeology of RAS, Murmansk Marine Biological Institute, Institute of Geography of RAS, and Institute of Atmosphere Physics of RAS.

The research includes archeology, biology, geology, glaciology, hydrology, atmospheric research, oceanography and geophysics. More specifically examples of observations and research include the following: Standard meteorological observations, turbulent fluxes, atmospheric composition (aerosol, BC, gases), oceanographic observations in fjords (incl. moorings), hydrological monitoring (incl. snow cover estimations), glaciology (mass-balance, dynamics, surface albedo), permafrost (CALM site, borehole temperature, pingo structure), sedimentation in fjords and lakes, paleoecological studies, marine biology,

ornithology, environmental pollution, ecotoxicology, soil studies (gas fluxes, decay processes, contamination), vascular plants and mosses adaptation, geology, archeology, medicine (physiological response to high Arctic conditions), geophysics (seismology, auroral activity, magnetic field etc.), satellite imaging.

Infrastructure / instruments and data

The Kola Science Center offers premises and logistical support to the institutes of the Russian Academy of Sciences and other institutes. It comprises a building of approximately 900 square meters with 30 rooms, 11 of which are designed as laboratories. There are available warehouses, cars, boats, snowmobiles etc. The building stock has recently been refurbished. There are field stations at various locations along the Grønfjord and in Pyramiden. On the mountain above Barentsburg there are disks for downloading satellite data. Murmansk Marine Biological Institute's vessel R/V Dalnie Zelentsy conducts research in the coastal zone around Svalbard.

Examples of equipment include analytical lab facility (hydrochemistry, GC, LC, LC-MS, AAS, microscopy, sample preparation); satellite receiving station; meteorological site, equipped with stationary automated and automatic instruments; Meteo and weather stations, aerosol and bc measuring station, trace gases measuring stations, instrumental tower 2 and 10 m; CALM site and temperature monitoring boreholes, drilling rig, Kovacs ice drilling equipment, GPR equipment, thermistor strings; ctd-profilers SBE & RBR, wave and tide recorders SBE, ADCP, rosette, level loggers; sediment samplers; level loggers, stream gauges, snow gauges, portable analyzers. The Geophysical observatory is operated by Polar Geophysical Institute RAS while the biogeochemical laboratory is operated by Murmansk Marine Biological Institute.

Staff

There are two people in technical/administrative position employed by the Kola Science Center who run the research facilities. In addition, Arctic and Antarctic Research Institute has a staff of 6 people and the Meteorological Observatory seven. In total the technical/administrative personnel carried out 15 work years in 2018. In addition comes a scientific staff of the Arctic and Antarctic Research Institute of 3 scientists carrying out 3 work-years.

Further plans

There are tentative plans for further development of social infrastructure. No substantial investments in new research infrastructure are currently planned.

The Polish station - Hornsund

The Polish Polar Station (The Stanisław Siedlecki Polish Polar Station) is located in the Isbjørnhamna of the Hornsund fjord. The station is operated by the Institute of Geophysics at the Polish Academy of Sciences based in Warsaw. The history of the station dates back to the late 1950s, and since 1978 there has been permanent staffing at the station.

The station functions as an interdisciplinary research platform, where monitoring and research projects is carried out aiming at improving the understanding of the functioning and change of the Arctic nature. The station is a part of an international network of research observatories. Monitoring programmes that are carried out include climatology, glaciology, hydrology, oceanography, seismology, geomagnetism, physics of the atmosphere, permafrost and geomorphic processes.

Infrastructure / instruments and data

The station offers access to accommodation and research facilities, including well-equipped laboratories, satellite communication and various scientific equipment such as liquid ion chromatography, DGPS, geodetic surveying equipment and an automatic weather station. There is also a well-equipped workshop, a boathouse, and storage warehouse available. The Station's lounge can be used for scientific seminars and conferences.

In total the station covers buildings of area approx. 1500 sq m. The infrastructure and equipment provide living and working conditions for 40 people at a time. The Station offers full room and board services. Logistic infrastructure (workshop, warehouse, snowmobiles, boats, etc.) and the laboratories make it possible to develop projects in various fields of research throughout the year. Various types of scientific instrumentation have been installed. Equipment for transport includes boats and snowmobiles.

Over the years a number of different data series have been established, the longest dating back to 1978. The data series include meteorological data, glaciological measurements, atmospheric measurements, environmental chemistry and oceanographic data.

Staff

The station has a staff of 10 people in technical/administrative positions accounting for 10 work-years in 2018. In addition, the station is used by guest researchers from various, primarily Polish institutions. A large number of scientists visit the station each year.

Adam Mickiewicz University Polar Station – Petunia Bay

Adam Mickiewicz University from Poznan, Poland, has been conducting research in the area of Petunia Bay since 1984. Up to 2009, 14 polar research expeditions were carried out, based in the so-called Scottish cabin on the east coast of Petunia Bay in the Billefjord. In 2011, two new smaller cabins were built about 400 meters from the Scottish cabin.

The research at the station covers various types of environmental observations, including meteorology, glaciology, permafrost, hydrology, contemporary geomorphic processes and plant habitats monitoring. In addition geological and paleo-geographical research related to the Billefjorden basin are conducted.

Infrastructure / instruments and data

The station consists of a total area of approximately 40 square meters accommodation area which is fully equipped for stays and research activities for up to 10 people during the summer season and 4-6 people during the spring. Transportation is provided by rubber boats in the inner-fjord area. All security equipment for field works is available at the station. There is time series data including ice measurements and permafrost thickness, which goes back to the year 2000.

Staff

The station has no permanent staff. The station manager is coming from Poland during the period of station operation from the end of June to the end of September. There are in addition two scientists permanently employed as the station personnel, also coming on Svalbard for expeditions.

Further plans

Considerations are made concerning possibilities for building a new magazine (storeroom/lab) container. Measures have been taken for international cooperation within INTERACT Transnational Access programme.

Nicolaus Copernicus University Polar Station – Kaffiøyra

The polar research station of Nicolaus Copernicus University (NCU) in Poland is located on Kaffiøyra in the western part of the Oscar II Land on Spitsbergen. The research carried out at the station includes various types of studies of the geographical environment such as glaciology, glacial geomorphology, permafrost and periglacial processes, as well as climatologic and botanical studies. Since 1995 glaciological research and the studies of permafrost of various ground types and their seasonal thawing, as well as meteorological observations have been the major issues on the research agenda. Several research aspects, such as geometry

of glaciers have been investigated for more than 30 years, since first NCU Polar Expedition in 1975.

Infrastructure / instruments and data

The station offers facilities for polar research. The station has previously been expanded and now covers about 100 square meters. The station includes living room, bedroom, storage room and laboratory. It is equipped with the necessary technical facilities, generators, solar panels, motor boats and snowmobiles. The scientific equipment includes instruments related to glaciological, hydrological and permafrost research as well as a weather station. Main variables collected includes summer mass balance, changes in glaciers geometry (both, geodetic in-situ and remote sensing methods), surge of glaciers, thermal structure of glaciers (direct measurements and indirect features, e.g. icings formation monitoring), bathymetry of glaciers bays, active layer key features.

Staff

The station is used 3 to 4 months annually, but it is possible to stay there for as long as a whole year. The station can accommodate 10-15 people at a time.

Further plans

Currently there are plans for investing in a new sleeping room and storages. Moreover, in terms of research collaboration these plans include intensifying current international contacts, as well as initiating new cooperation projects in the Kaffiøyra region. In the coming years next polar expeditions of the UMK are being planned.

Josef Svoboda Research Station

Josef Svoboda Station in Svalbard consists of several facilities located in central Svalbard. The infrastructure includes a base station and laboratories in Longyearbyen and a field station in Petunia Bay, as well as a research vessel, motorboats, snow scooters and an off-road car providing logistic support. The station in the Petunia Bay is operated by the University of South Bohemia in the Czech Republic. Since the early 1980s, Czech scientists have been conducting research on Svalbard, especially in the south-western and central parts, near the Russian mining towns of Barentsburg and Pyramiden. Today's field station in the Petunia Bay (Nostoc field station) was established in 2007 and includes containers and a cabin 6 kilometers north of the Pyramiden. The station is used during the summer season. In 2014, a station was also established in Longyearbyen (Julius Payer House). The research includes studies interdisciplinary research in microbiology-phycology, botany-plant ecophysiology, zoology-parasitology, climatology-glaciology, geology-geomorphology, limnology-hydrology.

Infrastructure / instruments and data

The base station located in Longyearbyen provides housing for 10 people (up to 20 for short-term accommodation). There are two life science laboratories equipped with state-of-the-art optical microscopes, sterile space (laminar flow cabinet, dry heat and IR sterilizers), centrifuges, etc. The Julius Payer House also provides storage space, technical workshop with basic tools, and scuba diving equipment.

The Nostoc field station consists of four modular houses connected by a large tent. It accommodates up to 12 people and includes kitchen, laboratory, technical facility (energy generators, basic workshop tools), and scuba diving equipment. There are also two additional containers close to Pyramiden harbour. RV Clione, a motorsailer, is also available for transport and research, as well as rubber boats cars and snow mobiles.

Further plans

There are plans for increasing the collaboration with institutions involved in Arctic research.

References

- Aksnes, Dag W. & Kirsten Wille Maus (2003). Norsk polarforskning – forskning på Svalbard. Ressursomfang og vitenskapelige publisering – indikatorer 2002. Norsk institutt for studier av forskning og utdanning (NIFU), Rapport 8/2003.
- Aksnes, Dag W. & Kristoffer Rørstad (2008). Norsk polarforskning - forskning på Svalbard. Ressursinnsats og vitenskapelig publisering - indikatorer 2006. NIFU STEP, Rapport 8 / 2008.
- Aksnes, Dag W. & Dag O. Hessen (2009). The structure and development of polar research (1981-2007): A publication-based approach. *Arctic, Antarctic and Alpine Research*, 41(2), 155-163.
- Aksnes, Dag W., Inge Ramberg, Liv Langfeldt & Vera Schwach (2010). Nordområdeforskningen 2009. Kartlegging av ressursinnsats, resultater og merverdi. NIFU STEP, Rapport 31/2010.
- Aksnes, Dag W., Kristoffer Rørstad & Trude Røsdal (2012). Norsk polarforskning – forskning på Svalbard. Ressursomfang og vitenskapelig publisering – indikatorer 2010. NIFU, Rapport 3/2012.
- Aksnes, Dag W. & Kristoffer Rørstad (2015). Norsk polarforskning – forskning på Svalbard. Ressursomfang og vitenskapelig publisering – indikatorer 2014. NIFU, Rapport 37/2015.
- Arlov, Thor B. (1996). Svalbards historie. Aschehoug, Oslo.
- Clas, Dag Harald, Alf Håkon Hoel, Arnfinn Jørgensen-Dahl & Lars Lothe (1987). Norsk arktisforskning i perspektiv. Fridtjof Nansens institutt, Oslo.
- Departementene (2017). Nordområdestrategi – mellom geopolitikk og samfunnsutvikling. Oslo.
- Norges forskningsråd (1997). Organisering av forskningen på Svalbard. Oslo.
- Norges Forskningsråd (2011). Det norske bidraget. Polaråret 2007-2008.
- Norges forskningsråd (2018). Det norske forsknings- og innovasjonssystemet – statistikk og indikatorer 2018. Oslo.
- Norges forskningsråd (2019). Forskning og innovasjon i og for nord. Forskningsrådets strategi for nordområdeforskning. Revidert 2019. Oslo.
- NOU (1989). Norsk polarforskning (NOU:9). Oslo.

Riksrevisjonen (2014). Riksrevisjonens undersøkelse om utnyttelse av infrastruktur til forskning i norske områder i Arktis. Dokument 3:13 (2013-2014).

Schild, Ingrid (1996). The politics of international collaboration in polar research. PhD avhandling, University of Sussex.

St.meld. nr. 42 (1992-93). Norsk polarforskning. Miljøverndepartementet, Oslo.

St.meld. nr. 9 (1999-2000). Svalbard. Justis- og politidepartementet, Oslo.

Appendix 1 Questionnaire

NIFU

Kartlegging av polarforskning og nordområdeforskning (FoU) i Norge i 2018

Det bes om at spørreskjemaet besvares innen 31. mai 2019.

Opplysningene du taster inn lagres når du går frem og tilbake i skjemaet. Det er mulig å gå ut av skjemaet for så å komme tilbake senere uten at inntastede data forsvinner. På skjemaets siste side kan man oppgi sin e-postadresse og få tilsendt en kopi av besvarelsen.

Ved spørsmål, kontakt Kristoffer Rørstad, telefon: 92 81 97 22, e-post: kristoffer.rorstad@nifu.no

1. Vennligst oppgi kontaktopplysninger

Institutt	<input type="text"/>
Lærested	<input type="text"/>
Kontaktperson	<input type="text"/>
Tlf	<input type="text"/>
E-post	<input type="text"/>

2. Utførte instituttet polar- og/eller nordområdeforskning i 2018?

Definisjon av polarforskning (FoU): Forskning (FoU) som drives med grunnlag i materiale fra polarområdene (Arktis og Antarktis), omkring fenomener med lokalisering i polarområdene, eller som tar direkte sikte på anvendelse i polarområdene. Alle fagområder er omfattet.

Arktiske områder: Den polare delen av Arktis inkludert bl.a. Svalbard, Jan Mayen, det nordlige Norskehavet, Barentshavet, Grønlandshavet og Polhavet.

Antarktiske områder: Området sør for den antarktiske konvergensen hvor de varme vannmassene nordfra møte de kalde vannmassene fra Sørishavet (polarfronten). Polarfrontens posisjon varierer, men befinner seg vanligvis mellom 50 og 60 grader sør. Også de sub-arktiske øyene, slik som Bouvetøya og Sør-Georgia, som tidvis kan ligge nord for konvergensen er inkludert.

Definisjon av nordområdeforskning (FoU):

Forskning (FoU) som har tematisk relevans og/eller henter sitt materiale og/eller sikter mot anvendelse av FoU-resultater i nordområdene. Alle fagområder er omfattet (også medisinsk forskning når den er basert på biologisk-/klinisk/helse- materiale eller data innhentet i nordområdene). FoU-arbeidet kan utføres ved enheter som har sin institusjonsadresse i nordområdene eller utenfor.

Nordområdene: Nordområdene omfatter området innenfor den svarte linjen (de tre nordligste fylkene med fjord- og kystområdene, nordlige deler av Norskehavet, Barentshavet og Svalbard). I tillegg inngår nord-Sverige, nord-Finland og nordvest-Russland, markert med gråskravering i kartet.

[Gå her for ytterligere veiledning og kart.](#)

I denne kartleggingen er det noe overlapp mellom de geografiske områdene for Arktis og nordområdene ved at Svalbard og deler av Barentshavet og Polhavet inngår i begge. Forskning instituttet utfører innenfor dette geografiske området må i skjemaet rapporteres både under "Arktisk polarforskning" og "Nordområdeforskning". Dette er viktig for at vi skal kunne utarbeide totaltall for henholdsvis polarforskning og nordområdeforskning.

Merk at det i internasjonal kontekst kan benyttes andre definisjoner av Arktis enn den som er brukt her. Definisjonen i undersøkelse er basert på tidligere nasjonale definisjoner og Forskningsrådets strategi for nordområdeforskning.

Ja

Nei

Start

Contact form for Companies

1. Vennligst oppgi kontaktopplysninger

Bedrift/foretak	<input type="text"/>
Org.nr.	<input type="text"/>
Kontaktperson	<input type="text"/>
Stilling	<input type="text"/>
Tlf	<input type="text"/>
E-post	<input type="text"/>

Question to all sectors

3. Vennligst oppgi antall FoU-årsverk innen arktisk polarforskning, antarktisk polarforskning og nordområde forskning som instituttet utførte i 2018.

Se for øvrig neste spørsmål der den geografiske fordelingen skal oppgis, tallene her skal samsvare med totaltallene i dette spørsmålet.

Område	Antall FoU-årsverk
Arktis polarforskning	<input type="text"/>
Nordområdeforskning	<input type="text"/>
Antarktisk polarforskning	<input type="text"/>

Tilbake

Neste

Question to all sectors

4. Geografiske områder

Instituttets totale FoU aktivitet innenfor polar/nordområdeforskning 2018 bes fordelt på geografiske områder. Anslå skjønnsmessig antall årsverk etter området forskningen var konsentrert om (hvilket område data var innhentet/forskningen omhandlet)

Antarktis	Arktis	Nordområde	Geografisk område	Antall FoU-årsverk
Antarktis			Antarktis - landområder	<input type="text"/>
Antarktis			Antarktis - havområder	<input type="text"/>
	Arktis		<u>Arktiske landområder utenom Svalbard</u>	<input type="text"/>
	Arktis		Polhavet	<input type="text"/>
	Arktis		Grønlandshavet	<input type="text"/>
	Arktis		Øvrige havområder i Arktis	<input type="text"/>
	Arktis	Nordområde	<u>Svalbard (sone 1)</u>	<input type="text"/>
	Arktis	Nordområde	<u>Svalbard (sone 2)</u>	<input type="text"/>
	Arktis	Nordområde	<u>Svalbard (sone 3)</u>	<input type="text"/>
	Arktis	Nordområde	<u>Svalbard (sone 4)</u>	<input type="text"/>
	Arktis	Nordområde	<u>Svalbard (sone 5)</u>	<input type="text"/>
	Arktis	Nordområde	Barentshavet og nordlige del av Norskehavet	<input type="text"/>
		Nordområde	Hav- og kystområder utenfor Nord-Norge	<input type="text"/>
		Nordområde	Nordland	<input type="text"/>
		Nordområde	Troms	<input type="text"/>
		Nordområde	Finnmark	<input type="text"/>
		Nordområde	Nord-Sverige, nord-Finland og nordvest-Russland	<input type="text"/>
		Nordområde	Uspesifisert/generell nordområde	<input type="text"/>
	Arktis		Uspesifisert/generell polar	<input type="text"/>
Sum Antarktis				<input type="text" value="0"/>
Sum Arktis				<input type="text" value="0"/>
Sum Nordområder				<input type="text" value="0"/>

Tilbake

Neste

Question to HE-institutions

5. Finansieringskilder/kostnadstyper

Vennligst anslå hvordan instituttets polar- og nordområdeforskning ble finansiert i 2018, fordel prosentvis

Finansiering	Antarktisk polarforskning	Arktisk polarforskning	Nordområdeforskning
Grunnbevilgning (gjelder fast personale, stipendiater, postdoc og andre lønnet av lærestedenes grunnbudsjett)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Norges forskningsråd	<input type="text"/>	<input type="text"/>	<input type="text"/>
Departementer og direktorater	<input type="text"/>	<input type="text"/>	<input type="text"/>
Fylker og kommuner	<input type="text"/>	<input type="text"/>	<input type="text"/>
Næringsliv	<input type="text"/>	<input type="text"/>	<input type="text"/>
EU-kommisjonen	<input type="text"/>	<input type="text"/>	<input type="text"/>
Utlandet (utenom EU)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Andre kilder (fond, private, egne inntekter)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Totalt (skal summeres til 100 %)	0	0	0

Tilbake

Neste

Question to research institutes

5. Finansieringskilder/kostnadstyper

Vennligst anslå hvordan instituttets polar- og nordområdeforskning ble finansiert i 2018, fordel prosentvis

Finansiering	Antarktis polarforskning	Arktis polarforskning	Nordområdeforskning
Grunnbevilgning (direkte over statsbudsjettet fra departement)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Norges forskningsråd (basisbevilgning, program- og prosjektbevilgninger)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Departementer og direktorater	<input type="text"/>	<input type="text"/>	<input type="text"/>
Fylker og kommuner	<input type="text"/>	<input type="text"/>	<input type="text"/>
Næringsliv	<input type="text"/>	<input type="text"/>	<input type="text"/>
EU-kommisjonen	<input type="text"/>	<input type="text"/>	<input type="text"/>
Utlandet (utenom EU)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Andre kilder (fond, private, egne inntekter)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Totalt (skal summeres til 100 %)	0	0	0

Tilbake

Neste

Question to companies

5. Vennligst oppgi bedriftens/foretakets totale utgifter til polar- og nordområdeforskning i 2018

	Beløp (mill. kr)
Antarktisk polarforskning	<input type="text"/>
Arktis polarforskning	<input type="text"/>
Nordområdeforskning	<input type="text"/>

6. Finansieringskilder/kostnadstyper

Vennligst anslå hvordan bedriftens/foretakets polar- og nordområdeforskning (FoU) ble finansiert i 2018, fordel prosentvis beløpene over på finansieringskildene under

Finansiering	Antarktis polarforskning	Arktis polarforskning	Nordområdeforskning
Egne midler og fra andre norske bedrifter	<input type="text"/>	<input type="text"/>	<input type="text"/>
Norges forskningsråd	<input type="text"/>	<input type="text"/>	<input type="text"/>
Departementer og direktorater	<input type="text"/>	<input type="text"/>	<input type="text"/>
Fylker og kommuner	<input type="text"/>	<input type="text"/>	<input type="text"/>
SkatteFUNN	<input type="text"/>	<input type="text"/>	<input type="text"/>
Innovasjon Norge	<input type="text"/>	<input type="text"/>	<input type="text"/>
EU-kommisjonen	<input type="text"/>	<input type="text"/>	<input type="text"/>
Utlandet (utenom EU)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Andre kilder (fond, stiftelser, forskningsinstitutter)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Totalt (skal summeres til 100 %)	0	0	0

Tilbake

Neste

Question to all sectors

6. Vennligst anslå antall FoU-årsverk polar- og nordområdeforskning som instituttet utførte i 2018 skjønnsmessig etter fagfelt

Fagfeltene er listet etter fagområder og omfatter både disipliner og tematiske områder.

Fagfelt	Antarktis polarforskning	Arktis polarforskning	Nordområdeforskning
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Velg fag	<input type="text"/>	<input type="text"/>	<input type="text"/>
Totalt	0	0	0

Tilbake

Neste

Question to all sectors

7. Hadde instituttet forskning knyttet til urfolk i 2018?

Hvis ja, vennligst oppgi antall FoU-årsverk etter tema

Tema	FoU-årsverk
Reindrift	<input type="text"/>
Språk	<input type="text"/>
Rettsvitenskap og rettighetsforhold	<input type="text"/>
Kultur og historie	<input type="text"/>
Helsefag	<input type="text"/>
Øvrige fag/tema	<input type="text"/>

Tilbake

Neste

Question to companies

9. Har bedriften/foretaket kjøpt FoU-tjenester knyttet til nordområdeforskning (FoU) i 2018?

	Ja	Nei
Innkjøpt FoU-tjenester fra institusjoner/institutter i de tre nordligste fylkene	<input type="radio"/>	<input type="radio"/>
Innkjøpt FoU-tjenester fra andre nasjonale institusjoner/institutter	<input type="radio"/>	<input type="radio"/>
Innkjøpt FoU-tjenester fra utenlandske institusjoner/institutter	<input type="radio"/>	<input type="radio"/>

10. Har bedriften/foretaket samarbeidet med utenlandske forskningsmiljøer knyttet til nordområdeforskning (FoU)?

Hvis ja, vennligst før opp fra hvilke land:

Tilbake

Neste

Questions to HE-institutions and research institutes

8. Vennligst oppgi antall personer som var involvert i polarforskning i 2018

Fordel personale etter stillingskategorier og kjønn

Stillingskategori	Kvinner	Menn	Totalt
Vitenskapelig/faglige	<input type="text"/>	<input type="text"/>	0
Herav stipendiater	<input type="text"/>	<input type="text"/>	0
herav postdoktorer	<input type="text"/>	<input type="text"/>	0
Teknisk/administrativ	<input type="text"/>	<input type="text"/>	0
Totalt	0	0	0

9. Venligst oppgi antall avlagte doktorgrader i 2018 innenfor polarforskning utført av stipendiater som instituttet hadde arbeidsgiveransvaret for.

Antall doktorgrader:

Tilbake

Neste

10. Vennligst oppgi antall personer som var involvert i nordområdeforskning i 2018

Fordel personale etter stillingskategorier og kjønn

Stillingskategori	Kvinner	Menn	Totalt
Vitenskapelig/faglige	<input type="text"/>	<input type="text"/>	0
Herav stipendiater	<input type="text"/>	<input type="text"/>	0
herav postdoktorer	<input type="text"/>	<input type="text"/>	0
Teknisk/administrativ	<input type="text"/>	<input type="text"/>	0
Totalt	0	0	0

11. Venligst oppgi antall avlagte doktorgrader i 2018 innenfor nordområdeforskning utført av stipendiater som instituttet hadde arbeidsgiveransvaret for

Antall doktorgrader:

Tilbake

Neste

Questions to companies

11. Vennligst oppgi antall personer ved bedriften/foretaket som var involvert i polar- og/eller nordområdeforskning i 2018

	Kvinner	Menn	Totalt
Polarforskning	<input type="text"/>	<input type="text"/>	0
Nordområdeforskning	<input type="text"/>	<input type="text"/>	0

Tilbake

Neste

12. Hadde bedriften/foretakets ansatte opphold på Svalbard i 2018 for å utføre forskning/FoU?

Vennligst oppgi i så fall det totale antall persondøgn tilbragt på øygruppen

Antall døgn:

Tilbake

Neste

Information to all sectors

12. Takk for besvarelsen av spørreskjemaet om polar- og nordområdeforskning 2018. Dette er skjemaets siste side. Trykk "send inn" om skjemaet er ferdig utfylt og klar for innlevering.

Om du ønsker kopi av besvarelsen, vennligst oppgi din epost-adresse

her:

Eventuelle tilleggskommentarer til oppgis her i feltet nedenfor.

Tilbake

Send inn

Appendix 2 Units included in the mapping

Units in the higher education sector

Institutions	Department	Polar	High North
Inland Norway University of Applied Sciences	Department of Forestry and Wildlife Management	yes	yes
Nord University	Faculty of Biosciences and Aquaculture	yes	yes
Nord University	Nord University Business School		yes
Norwegian University of Life Sciences	Faculty of Environmental Sciences and Natural Resource Management	yes	yes
Norwegian University of Life Sciences	Faculty of Science and Technology	yes	yes
Norwegian University of Science and Technology	Department of Biology	yes	yes
Norwegian University of Science and Technology	Department of Chemistry	yes	yes
Norwegian University of Science and Technology	Department of Geography	yes	yes
Norwegian University of Science and Technology	Department of Geoscience and Petroleum	yes	yes
Norwegian University of Science and Technology	Department of Marine Technology	yes	
Norwegian University of Science and Technology	Department of Natural History	yes	yes
Oslo Metropolitan University	Department of Nursing and Health Promotion		yes
Sami University of Applied Sciences	Department of Languages, Duodji, Reindeer herding and Social Sciences		yes
Sami University of Applied Sciences	Department of Sami teacher education and indigenous journalism		yes
The Arctic university of Norway	Centre for Sami Studies	yes	yes
The Arctic university of Norway	Department of Archaeology, History, Religious Studies and Theology		yes
The Arctic university of Norway	Department of Arctic and Marine Biology	yes	yes
The Arctic university of Norway	Department of Community Medicine		yes
The Arctic university of Norway	Department of Electrical Engineering	yes	yes
The Arctic university of Norway	Department of Geosciences	yes	yes
The Arctic university of Norway	Department of Health and Care Sciences		yes
The Arctic university of Norway	Department of Mathematics and Statistics	yes	
The Arctic university of Norway	Department of Medical Biology		yes
The Arctic university of Norway	Department of Psychology		yes
The Arctic university of Norway	Department of Social Sciences		yes
The Arctic university of Norway	Department of Tourism and Northern Studies		yes
The Arctic university of Norway	Faculty of Law	yes	yes

The Arctic university of Norway	Norwegian College of Fishery Science	yes	yes
The Arctic university of Norway	RKBU Nord		yes
The Arctic university of Norway	Tromsø Geophysical Observatory	yes	yes
The Arctic university of Norway	Tromsø University Business School	yes	yes
The Arctic university of Norway	Tromsø University Museum	yes	yes
University of Agder	Department of Global Development and Planning	yes	yes
University of Agder	Department of Natural Sciences	yes	yes
University of Bergen	Department of Biology	yes	yes
University of Bergen	Department of Comparative Politics		yes
University of Bergen	Department of Earth Science	yes	yes
University of Bergen	Department of Geography		yes
University of Bergen	Department of Linguistic, Literary and Aesthetic Studies		yes
University of Bergen	Department of Physics and Technology	yes	yes
University of Bergen	Geophysical Institute	yes	yes
University of Bergen	University Museum of Bergen	yes	yes
University of Oslo	Department of Biosciences	yes	yes
University of Oslo	Department of Geosciences	yes	yes
University of Oslo	Department of Mathematics	yes	yes
University of Oslo	Department of Media and Communication		yes
University of Oslo	Department of Physics	yes	yes
University of Oslo	Department of Political Science	yes	yes
University of Oslo	Department of Social Anthropology	yes	yes
University of Oslo	Museum of Cultural History	yes	yes
University of Oslo	Natural History Museum	yes	yes
University of Stavanger	Department of Petroleum Engineering	yes	
University of Stavanger	Dept. of Mechanical and Structural Engineering and Materials Science		yes
The University Centre in Svalbard	UNIS - Department of Arctic Biology	yes	yes
The University Centre in Svalbard	UNIS - Department of Arctic Geology	yes	yes
The University Centre in Svalbard	UNIS - Department of Arctic Geophysics	yes	yes
The University Centre in Svalbard	UNIS - Department of Arctic Technology	yes	yes
Number of units		40	54

Units in the institute sector

Research institutes	Area of research	Polar	High North
Center for International Climate Research	Environmental research institute	yes	yes
Geological survey of Norway	Environmental research institute	yes	yes
Nansen Environmental and Remote Sensing Center	Environmental research institute	yes	yes
NORCE	Environmental research institute	yes	yes

Norwegian Institute for Air Research	Environmental research institute	yes	yes
Norwegian Institute for Cultural Heritage Research	Environmental research institute	yes	yes
Norwegian Institute for Nature Research	Environmental research institute	yes	yes
The Norwegian Institute for Water Research	Environmental research institute	yes	yes
Akvaplan niva AS	Other research institute	yes	yes
Alta Museum World Heritage Rock Art Centre	Other research institute		yes
Finnmark Hospital	Other research institute		yes
GenØk – Centre for Biosafety	Other research institute	yes	yes
Institute of Occupational Health	Other research institute	yes	yes
Nordland Museum	Other research institute		yes
NORWEGIAN POLAR INSTITUTE	Other research institute	yes	yes
The Narvik War and Peace Centre	Other research institute		yes
The Norwegian Meteorological Institute	Other research institute	yes	yes
The Norwegian Water Resources and Energy Directorate	Other research institute	yes	yes
Institute of Marine Research	Primary research institute	yes	yes
Nofima	Primary research institute	yes	yes
Norwegian Institute of Bioeconomy Research	Primary research institute		yes
Norwegian Veterinary Institute	Primary research institute	yes	yes
Centre for Applied Research	Social sciences research institute		yes
Fridtjof Nansen institute	Social sciences research institute	yes	yes
Institute for Social Research	Social sciences research institute		yes
Møreforsking	Social sciences research institute	yes	yes
Nordland Research Institute	Social sciences research institute	yes	yes
Norwegian Institute of International Affairs	Social sciences research institute	yes	
Western Norway Research Institute	Social sciences research institute	yes	yes
Northern Research institute	Technical industrial research institute	yes	yes
SINTEF	Technical industrial research institute	yes	yes
IFE, Institute for Energy Technology	Technical industrial reserach institute	yes	yes
Northern Research institute Narvik	Technical industrial reserach institute	yes	yes
Norwegian Geotechnical Institute	Technical industrial reserach institute	yes	yes
Number of institutes		27	33

Appendix 3 Survey - research activities in Svalbard

Mapping survey – research activities in Svalbard

On behalf of the Norwegian Research Council, the Nordic Institute for Studies in Innovation, Research and Education (NIFU) carries out a mapping survey of research infrastructure in Svalbard.

We are sending this inquiry to the contact persons at research sites and installations in Svalbard. We kindly ask you to fill in the enclosed questionnaire. We are aware it may be difficult to provide exact answers to some question in the survey, in such cases we ask for discretionary estimates.

Please use the Word-form below and enter the answers directly under each question. A similar survey was conducted in 2015. In Question 1 we have included the previous answer from your research site/installation. You may revise this information with more up-to-date information if needed.

We ask you to return the questionnaire by e-mail to NIFU within the (13.06 2019).

The information will be used as basis for writing a report on the research in Svalbard, where the research activity at the various infrastructures will be described. The report will be available in English. If any of the information provided below should be treated confidentially, please let us know.

We hope for your kind cooperation.

For questions, please contact:

Dag W. Aksnes, Research Professor, NIFU

E-mail: dag@nifu.no

Tel .: (+ 47) 99 47 43 38

1. General information

Below, we have included the previous answer from your research site/installation (2015-survey). You may revise this information with more up-to-date information if needed.

- a) Please provide a brief description of what kind of observations and research that are being carried out at the research site/installation:

- b) What type of research infrastructure/instruments are available and (if any) what kind of services are offered (logistical support, etc.)?

2. Staff

Enter the number of people (permanent staffing located in Svalbard) responsible for the operation of the research site/ installation. Also enter the number of work-years (full-time equivalents) the permanent workforce performs:

	Number of people 2018	Number of work-years 2018
Technical/administrative personell		
Scientific personell		

3. Researcher days in 2018

As a measure of the extent of the presence and of the research activity in Svalbard, the number of researcher days is used as indicator.

Definition of researcher days: The total number of days that researchers were present at your site/installation in Svalbard in 2018. The purpose of the stay must be to carry out research and to collect data used primarily for research. Both scientists, PhD-students, technicians, research assistants, etc. should be included, but not master's/bachelor's students.

Activities such as regular topographic mapping and environmental monitoring (e.g. daily records of temperatures or of atmospheric pressure) should not be included unless this activity primarily is carried out for research purposes

- a) **Researcher Days:** Please enter an estimate of the total number of researcher days at the site/installation in 2018. Include both regular staff and users/guests in the

figure, but only days by persons who were present in Svalbard should be reported. We are aware that you may not have systematic records of this and we are requesting discretionary estimates, only

Total number of researcher days in 2018:

- b) **Research area:** Distribute the total number of researcher days in 2018 provided above according to the following geographical areas in Svalbard:*
For reporting to each zone include research of marine waters out to 12 nautical miles.

Geographical area	Number of researcher days 2018
Zone 1: Management area 10a, includes Longyearbyen, Barentsburg, Pyramiden, Isfjorden and Svea.	
Zone 2: Management area 10b includes Ny-Ålesund and Kongsfjorden	
Zone 3: North West Svalbard, includes Prins Karls Forland	
Zone 4: East Svalbard, includes East Spitsbergen, Nord Austlandet, Kong Karls land, Hopen and Edgeøya	
Zone 5: South Svalbard, includes Hornsund and Bjørnøya	
Total	

*) See the enclosed map.

- c) **Institution:** Please distribute the researcher days at the site/installation in 2018 according to the institution the researchers are affiliated with.

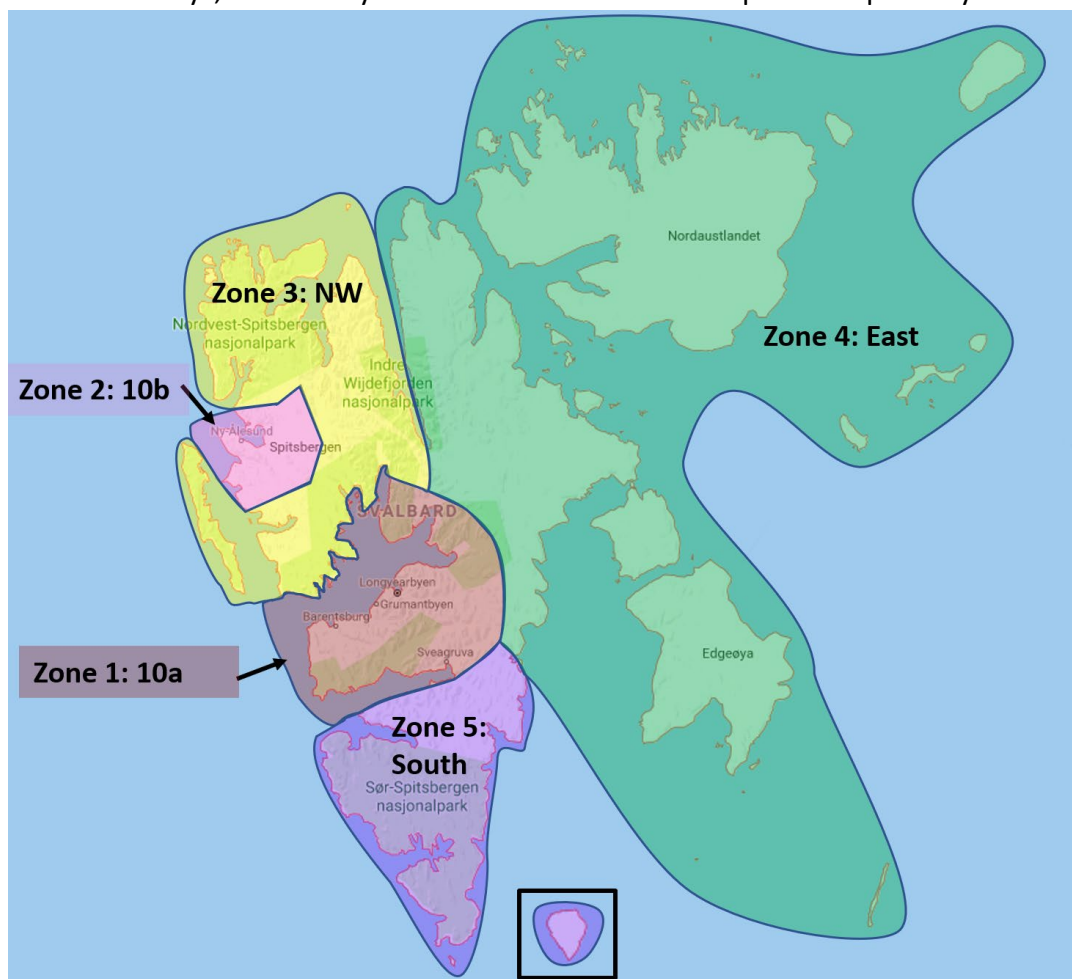
Institution, please specify	Number of researcher days 2018
Total	

6. Further plans for the site/installation

Are there plans for further development of the site/installation, investments in new infrastructure and future collaboration?

Appendix - map of areas in Svalbard

The map can be used as guidance for completing the geographical distribution of researcher days, where stays in these areas should be reported separately.



List of tables

Table 2.1 Overview of the numbers of units and response rates by sector of performance.....	25
Table 3.1 Current expenditures to research relating to the High North by source of funds and sector of performance in 2018. Mill NOK.	36
Table 3.2 Intramural and purchased R&D services related to High North research. Industrial sector 2018.....	36
Table 3.3 Distribution of companies in the industrial sector by size (number of employees) and volume of High North research (R&D) in 2018.....	40
Table 3.4 Distribution of companies in the industrial sector standard industrial classification (NACE), number of companies, number of total employees and R&D expenditures in 2018.	40
Table 3.5 FTEs High North research in 2018 by geographical areas and sector of performance.....	42
Table 3.6 FTEs of High North research in 2018 by fields and sector of performance.....	45
Table 3.7 FTEs of High North research in 2018 with specific themes related to indigenous people.....	46
Table 3.8 Personnel involved in High North research by sector of performance and type staff in 2018, number of people and share of women	47
Table 4.1 Numbers of entities reporting polar research by sector of performance in 2002, 2006, 2010, 2014 and 2018	50
Table 4.2 Share of polar research of total R&D FTEs in Norway, by sector of performance in 2002, 2006, 2010, 2014 and 2018.	51
Table 4.3 Current expenditures to polar research by source of funds and sector of performance in 2018. Mill NOK.....	53
Table 4.4 Current expenditures to Antarctic polar research by source of funds and sector of performance in 2018. Mill NOK.	55
Table 4.5 FTEs polar research in 2018 by geographical areas and sector of performance.....	60
Table 4.6 FTEs polar research by selected fields in 2014 and 2018.	63

Table 4.7 FTEs polar research by fields of subject and sector of performance in 2018.....	64
Table 4.8 Personnel involved in polar research by sector of performance and type of staff in 2018, number of people and share of women	65
Table 4.9 Number of awarded doctoral degrees with polar research as a main theme in different periods.....	66

List of figures

Figure 2.1 Map of Arctic and northern areas as delineated in the survey*	22
Figure 2.2 Map of Antarctica as delineated in the survey*	23
Figure 2.3 Map of Svalbard and zones used in the survey	30
Figure 3.1 Number of FTEs research relating to the High North, by sector of performance, 2018.....	34
Figure 3.2 Current expenditures to research relating to the High North, by sector of performance in 2018.....	35
Figure 3.3 FTEs of High North research by institutions, groups and sector of performance in 2018. Relative contributions in percentage.....	38
Figure 3.4 FTEs of High North research by institutions, groups and sector of performance in 2018.	39
Figure 3.5 FTEs High North research in 2018 by geographically area.....	41
Figure 3.6 FTEs of High North research by county of the institutions/institutes/companies and sector of performance in 2018.....	43
Figure 3.7 FTEs of High North research by field in 2018	44
Figure 4.1 FTEs in polar research 2018, by Arctic and Antarctic areas and sector of performance.....	49
Figure 4.2 FTE in polar research, by sector of performance in 2002, 2006, 2010, 2014 and 2018.....	50
Figure 4.3 Current expenditures to polar research, by sector of performance in 2002, 2006, 2010, 2014 and 2018, mill NOK.....	52
Figure 4.4 Current expenditures to polar research by source of in 2006, 2010, 2014 and 2018. Percentage of total.....	54
Figure 4.5 FTE in polar research by institutions, groups and sector for performance in 2018. Relative contributions in percentage.....	56
Figure 4.6 FTEs in polar research by institutions and sector for performance in 2018.....	57
Figure 4.7 FTEs in polar research by institutions and sector of performance in 2014 and 2018.....	58

Figure 4.8 FTEs polar research in 2018 by geographical area.....	59
Figure 4.9 Polar research by geographically areas in 2006, 2010, 2014 and 2018, FTEs.....	61
Figure 4.10 FTEs polar research by fields of subject in 2018.....	62
Figure 5.1 Norwegian Svalbard research by sector, number of R&D work-years, FTE. 2018.....	70
Figure 5.2 Norwegian Svalbard research by sector, number of R&D work-years, FTE. 2010-2018.	71
Figure 5.3 Distribution of Norwegian Svalbard research by geographical zones* (R&D work-years, FTE), 2018.....	72
Figure 5.4 Map of Svalbard and zones used in the survey.....	72
Figure 5.5 Distribution of Norwegian Svalbard research by geographical zones and sector (R&D work-years, FTE), 2018.	73
Figure 5.6 Norwegian research in/related to Svalbard 2018. Number of R&D work years (FTE) by geographical zones and institution/institute groups.....	74
Figure 5.7 Number and proportion of researcher days in Svalbard, 2002-2018, Norway and other countries.	76
Figure 5.8 Researcher days in Svalbard 2018, relative distribution by country.....	79
Figure 5.9 Number of researcher days in Svalbard 2002-2018 for selected countries*.....	80
Figure 5.10 Number of researcher days in Svalbard 2018 by geographical zones.*	81
Figure 5.11 Number of researcher days in Ny-Ålesund, 1996-2018.....	82
Figure 5.12 Number of researcher days in Ny-Ålesund per month, 2014, 2017 and 2018.....	83
Figure 5.13 Number of researcher days in Ny-Ålesund per institution 2018.....	84

Nordisk institutt for studier av
innovasjon, forskning og utdanning

Nordic institute for Studies in
Innovation, Research and Education

www.nifu.no