



Vetenskapsrådet

Bibliometric survey of polar research in Sweden

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Introduction

Publications of Swedish polar research have been identified and compared with other countries. There is no clear definition of polar research. This study uses keywords that characterize polar research in order to find related publications in the publication database at the Swedish Research Council. Other bibliometric surveys of polar research may obtain different results in terms of publication volumes due to a different set of keywords¹.

In this report we analyze the performance of polar research, measured through bibliometric statistics, in research production, research impact, international collaboration and research funding organizations. Results are presented at country level for a number of top producing countries and also at institutional level for Sweden, Denmark, Norway and Finland.

Method

Polar research spans most scientific disciplines as it can be defined as research in or about the Polar regions. In this report the sub-polar regions are not included. However, if an article deals with both polar and sub-polar matters it is included. Polar research does not have a specific classification in the bibliometric databases, so in practice a set of mostly geographical keywords were used to match the definition of polar research. These are listed in Appendix 1.

With this procedure it is not expected that the set of keywords captures all articles that falls within the definition of polar research and, vice versa, the keyword search will also capture articles that are not polar research. In an iterative procedure the original keyword search was limited by exclusions using other keywords. For instance the keyword “Arctic” needed to be limited by exclusion (Boolean operator NOT) using the keyword nectarine to avoid horticultural articles on a specific type of fruit.

Publications are categorized into three areas/regions;

- Arctic – research/publications related to the Arctic region
- Antarctica – research/publications related to the Antarctic region
- Bipolar – research/publications related to both regions (Arctic and Antarctica)

where each area/region is defined by a set of keywords developed in cooperation with the Swedish Polar Research Secretariat.

The data used comes from the bibliometric database at The Swedish Research Council, which except for the Conference Proceedings Citation Index and the Book Citation Index, have the same content as Web of Science². Keyword searches are done against the following fields in the database:

- In the publication title
- In the publication abstract
- Among the keywords assigned by the authors of a publication.

The proposed set of keywords are used for search in all three records. An article is only counted once and is categorized to only one of the categories: Arctic, Antarctic or Bipolar. Publications including matching keywords in both Arctic and Antarctic are categorized as Bipolar.

¹ E.g. Polar research in the Kingdom of Denmark 2013, NIFU Report 18/2014.

² Certain data included herein are derived from the Science Citation Index Expanded, Social Science Citation Index and Arts & Humanities Citation Index, prepared by Thomson Reuters®, Philadelphia, Pennsylvania, USA, © Copyright Thomson Reuters® 2015. All rights reserved.

In the final keyword search result 500 articles with Swedish affiliations were manually, by reading title and abstract, classified into one of three categories 1) Obvious polar research (89 % of the articles) 2) Related to Polar research (6 %) 3) Not polar research (5 %).

To get an indication of the percentage of polar research captured by the keyword search the number of generated hits for polar specific journals were compared with the total number of hits for these journals in web of science (see Table 1).

Journal	Number of articles in WoS 2000-2013	Share of articles by keyword search
Antarctic Science	808	91%
Arctic	474	78%
Polar Biology	1748	82%
Polar record	247	75%
Polar research	350	77%
Polish Polar research	140	87%

Table 1. Number of articles in selected polar research specific journals and share of these captured by keyword search. (Data from Science Citation Index – Thomson Reuters).

In the database, every issue of a journal is classified by Thomson Reuters as belonging to between one and six of around 250 Web of Science Categories. Every publication in an issue gets the same Web of Science categories as the issue it comes from. These categories can in turn be classified and aggregated into larger research areas/fields.

Publication volumes are counted fractionalized. Every publication is fractionalized with respect to the number of author addresses and the number of Web of Science categories the publication belongs to. In some tables and sections non fractionalized publication volumes are used (Full counts), e.g. proportions of publications that involve international collaboration are better represented by using full counts statistics.

The citations in the report are calculated using a three year window, meaning that if an article is published in 2009, we will count citations to this article made by articles published in 2009, 2010 and 2011. Furthermore the citations are field normalized. This means that the number of citations to a publication is divided by the mean citation value for all publications in the same Web of Science Category, from the same year, of the same publication type. In this report we only consider publications of the type *Article* and *Review*.

If a publication has the same number of citations as the average publication of the same type, from the same year, in the same Web of Science Category, it will get a field normalized citation rate equal to 1. Citation averages are calculated as weighted averages based on fractionalized counting.

Highly cited is defined as the publications cited more than a certain percentile limit, in this paper the 90th percentile. An advantage with this indicator is that it is unaffected by single extremely highly cited papers that may strongly effect the average i.e. the *mean field normalized citation rate*.

When a name with the exact same spelling is found among the authors to the cited and citing publication the citation is considered to be a *self citation* and is removed from the calculations.³

³ See *Guidelines for using bibliometrics at the Swedish Research Council* at www.vr.se for a more thorough description and discussion of the concepts in this section.

Publication volume - global comparison

Figure 1 shows the global production of publications within polar research from 2000 – 2013. The total annual mean growth of all polar research publications is about 4.8 %. However the database content have changed markedly over these years where the total number of publications indexed in the database has increased with an annual mean growth of 4.1 %. This means that the overall publication production for polar research has increased about the same as the world average of science. About 60 % of all identified publications are related to the Arctic region, about 37 % are related to the Antarctica region, and 3 % are “Bipolar”. The total Swedish production of publications in polar research shows a similar increase as the world in general, but in Sweden the proportion of publications related to the Arctic region is somewhat higher (about 73%).

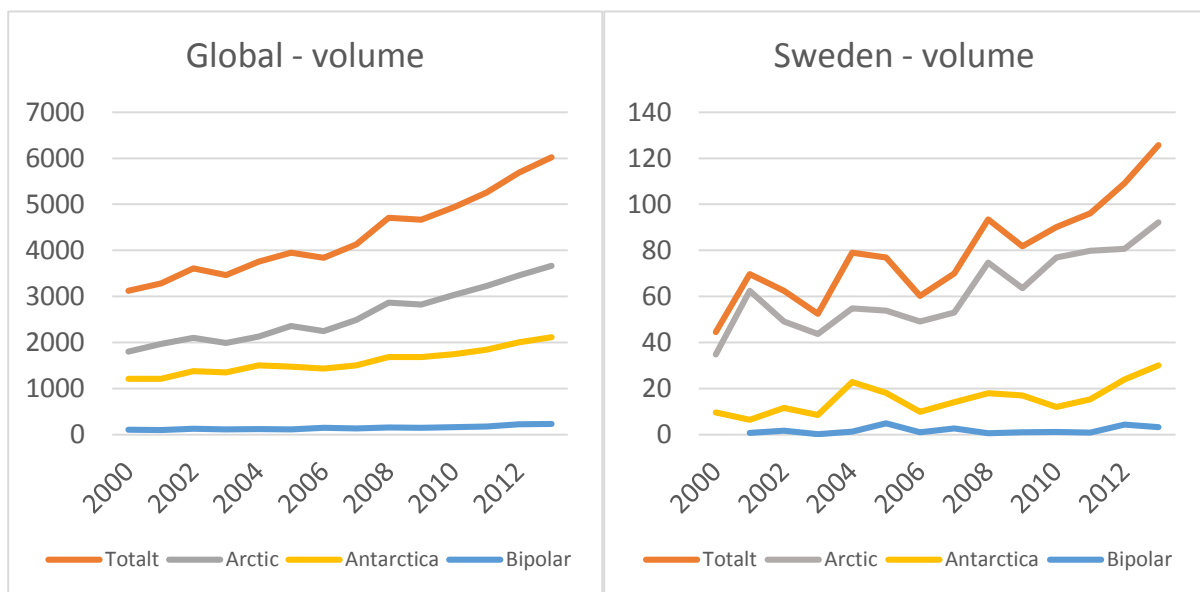


Figure 1. Number of fractionalized publications from 2000-2013 on polar research; Total, Arctic, Antarctic and Bipolar area. (Data from Science Citation Index – Thomson Reuters).

Table 2 shows the main contributing countries to publications in polar research, ordered by the number of fractionalized publications. United States is the largest producer with 32 % of the entire polar research production. Canada (10 %) and The United Kingdom (8%) respectively both represent a large share of the production. Of the Nordic countries is Norway the fifth largest producer with 2915 publications mainly in the Arctic area. Denmark is at number 9, Sweden at number 13 and Finland at nr. 19 (Iceland is found at place nr 29). Characteristic of Norway and Denmark (as well as Iceland and many other northern countries) is a high proportion of Arctic publications (over 90 %). Among the Nordic countries Sweden has largest number and proportion of publications in the Antarctic category.

Country	Arctic	Antarctica	Bipolar	Total	Rank	Share	Publ./100K pop.
United States	5 382	2 257	265	7 904	1	31,3%	0,58
Canada	2 476	165	44	2 685	2	10,6%	7,71
United Kingdom	886	933	111	1 930	3	7,6%	3,00
Germany	748	597	64	1 408	4	5,6%	1,74
Norway	1 133	81	25	1 239	5	4,9%	24,06
Russian Federation	1 005	169	30	1 204	6	4,8%	0,85
Australia	135	703	36	874	7	3,5%	3,88
France	324	456	40	820	8	3,2%	1,23
Denmark	673	29	13	715	9	2,8%	12,60
China	303	355	35	693	10	2,7%	0,05
Japan	298	330	26	654	11	2,6%	0,51
Italy	103	459	27	589	12	2,3%	0,95
Sweden	376	86	8	471	13	1,9%	4,84
Spain	119	232	11	362	14	1,4%	0,76
New Zealand	34	309	11	354	15	1,4%	8,02
Netherlands	180	119	19	318	17	1,3%	1,85
Finland	196	31	6	233	21	0,9%	4,43
Switzerland	130	75	20	225	22	0,9%	2,79
Belgium	62	109	11	182	23	0,7%	1,74
Austria	48	24	5	77	28	0,3%	0,94
Iceland	57	3	1	61	29	0,2%	19,21

Table 2. Number of fractionalized publications from 2008-2012 by country, Arctic, Antarctic and Bipolar. Rank is based on the total number of publications. The table also shows the share of total volume of polar research publications and the number of publications per 100k population (2014 Wiki). (Data from Science Citation Index – Thomson Reuters).

Polar research in different subject fields

As mentioned, articles in Web of Science are categorized as belonging to between one and six of about 250 journal subject areas. This section will present statistics based on publications from the period 2008-2012 for different subject fields, where the (250) journal subject areas have been aggregated into 14 subject fields (s.c. SPRU14 fields). The total volume of polar research publications per subject field is presented in table 3. Geosciences is the largest subject field (48% share) followed by Biology (18%) and Agriculture (11%). The medical fields (10% in publication share): Biomedicine and Clinical medicine, has shown a larger increase in publication production over the period. Physics has shown the largest increase over the period, apart from the very small areas. The increase in Physics is mainly due to activities in the Antarctic area, where the number of published articles has almost doubled over the period. About 50% of the publications within the subject field *Agriculture* are classified as *Environmental Sciences*. Research areas as *Plant Sciences* (16%) and *Fisheries* (13%) are also larger subareas, whereas more traditional agricultural areas, as *Agronomy* and *Horticulture*, are negligible in this context.

	Number of publ.	Share	Mean Avg. Growth	Share Sweden
AGRICULTURE	2 836	11,0%	1,7%	12,3%
BIOLOGY	4 628	18,1%	3,1%	16,9%
BIOMEDICINE	1 344	5,3%	7,5%	3,2%
CHEMISTRY	255	1,0%	-1,0%	0,8%
CLINICAL MEDICINE	1 176	4,8%	5,8%	4,6%
ENGINEERING	484	1,8%	2,6%	2,3%
GEOSCIENCES	12 065	47,9%	3,3%	50,9%
HUMANITIES	256	1,0%	4,8%	1,2%
ICT	412	1,7%	9,2%	1,4%
MATERIALS SCIENCE	31	0,1%	6,1%	-
MATHEMATICS	45	0,2%	-2,9%	0,2%
OTHER	12	0,1%	11,8%	-
PHYSICS	1 061	4,3%	10,6%	4,6%
SOCIAL SCIENCES	660	2,6%	7,8%	1,5%
TOTAL	25 264	100%	3,9%	100%

Table 3. Polar research per subject area 2008-2012 fractionalized count. Web of Science areas aggregated into the SPRU14 fields. (Data from Science Citation Index – Thomson Reuters).

Figure 2 show the proportion of the national output of publications found in a particular field relative to the world proportion of polar research publications. A value of 1 indicates that a country has the same proportion as expected from the world average and 1.5 means that the country has 50% greater proportion in that field than expected from the world average. The distribution of the Swedish publications in different subject fields is similar to the world average, whereas the other three Nordic countries seems more specialized in the sense that they deviates more from the world average. Although, smaller subject fields have been grouped here to obtain better statistics some subject fields still contain few publications (especially Chemistry).

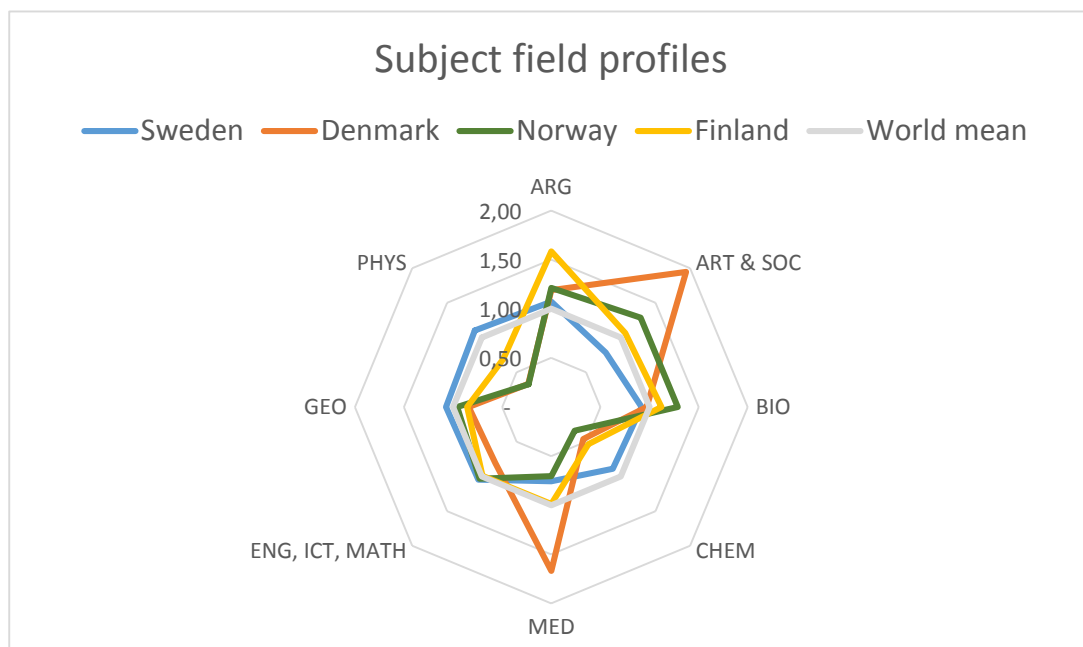


Figure 2. Subject field specialization profiles of Sweden, Denmark, Norway and Finland normalized to the World mean (= 1.0). (Data from Science Citation Index – Thomson Reuters).

International collaboration

Table 4 show the level and share of international collaboration for publications from 2008-2012. The numbers are based on author affiliations, and about 40 % of all scientific publications in polar research were produced in collaboration between more than one country⁴.

	World	Sweden	Denmark	Norway	Finland
Arctic	37%	82%	76%	68%	77%
Antarctica	43%	89%	97%	90%	75%
Bipolar	46%	92%	93%	79%	91%
Total	40%	84%	78%	71%	77%

Table 4. International collaboration 2008-2012 in % per polar region; total output (World), Sweden, Denmark, Norway and Finland. (Data from Science Citation Index – Thomson Reuters).

The share of International collaboration varies from country to country and is somewhat correlated to the size of the country. The world average in Table 4 are very much depending on how the large producing countries collaborate with other countries, especially US. Smaller countries (in size), like the Nordic countries, have a much larger share of international collaboration. Notably, Sweden has the largest share of publications with international collaboration among the four Nordic countries, although, in total numbers Norway and Denmark still produce more international publications than Sweden.

Most frequent collaboration countries of Sweden are United States, United Kingdom and Germany, as can be seen in the network plot in Figure 3, and are the same three countries as for Sweden in general. Next after these, we find Norway and Denmark who are almost as frequent as Germany in terms of international collaboration. Ties between other countries, in the network plot, indicates collaborations involving more than one country.

Figure 4 shows national collaboration in Sweden by organization. Most links go to Stockholm University who is also the largest producer in Sweden (See also Table 6 in next chapter).

⁴ About 40 % international collaboration is also what is observed at the world level for all publications in the database. The corresponding number for all Swedish publications is about 60 %; *The Swedish Production of Highly Cited Papers, Report Vetenskapsrådet 5:2012*

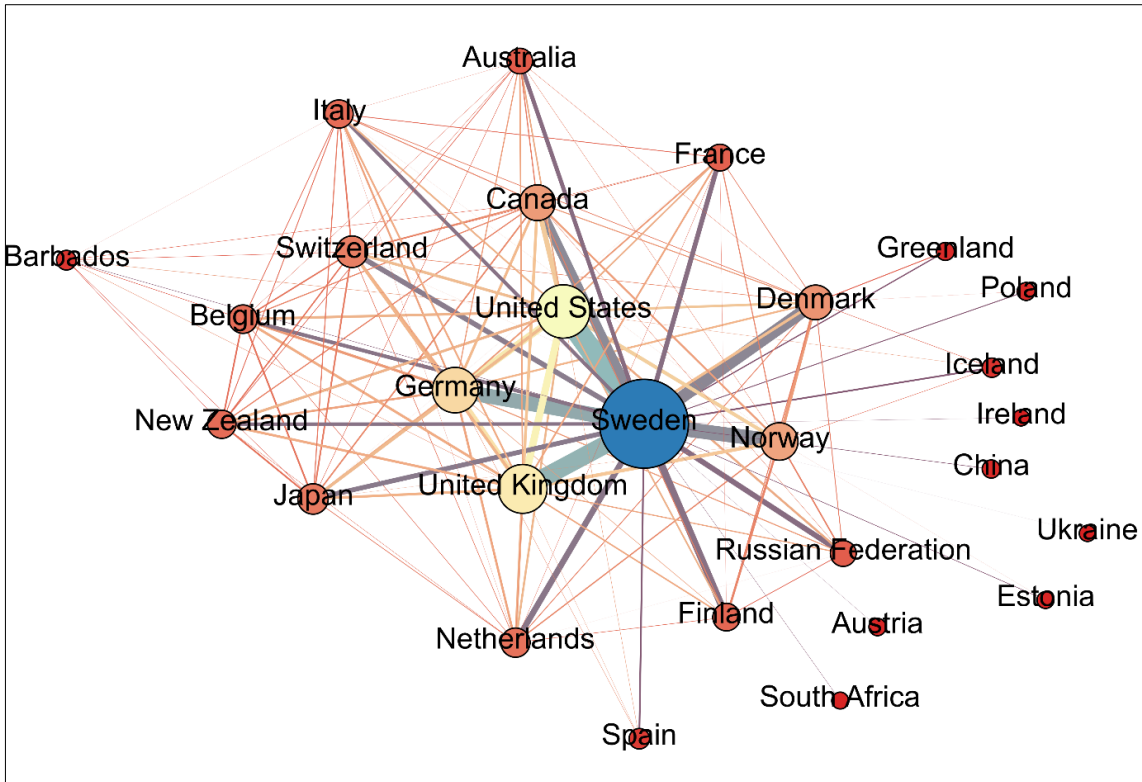


Figure 3. Network of international collaboration in Swedish polar research. Publications including at least one Swedish affiliation (author addresses) and countries with at least 20 publications co-published with Swedish researchers (Swedish affiliations). Thickness of Nodes and Edges relate to the number of publications/coo-publications ($20 < \text{Edge-thickness} < 694$). (Data from Science Citation Index – Thomson Reuters).

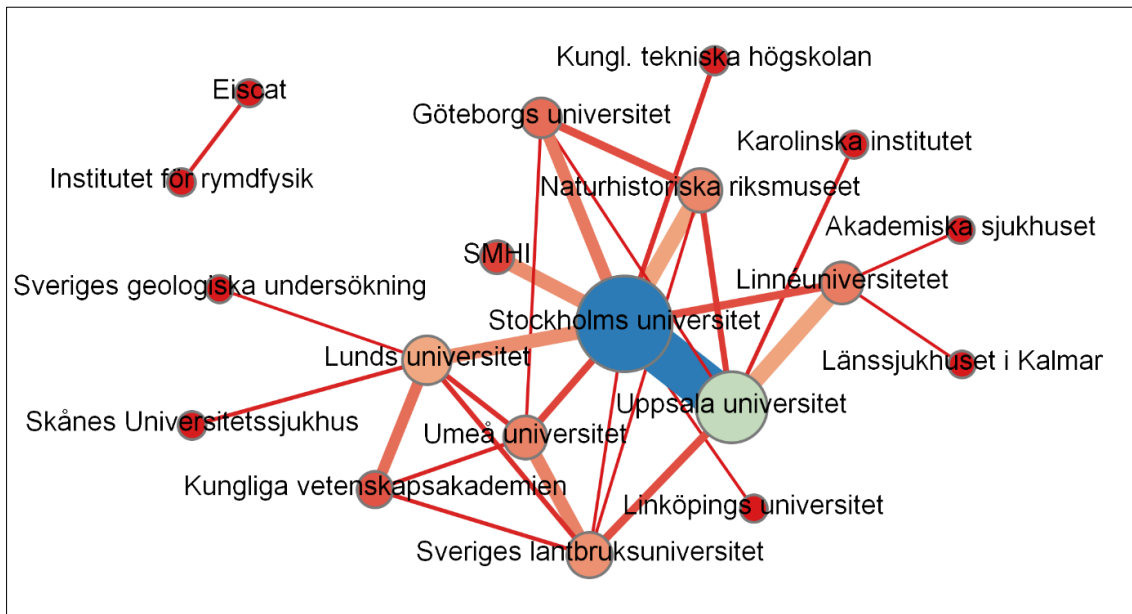


Figure 4. Network plot, publications based on national collaboration. Only the Swedish affiliations/organizations are shown. Thickness of Nodes and Edges relate to the number of publications/coo-publications 2008-2012 ($3 < \text{Edge-thickness} < 46$). (Data from Science Citation Index – Thomson Reuters).

Citation impact

In Figure 5, the global trend in mean citation rate and share of highly cited publications over the last 10 years is shown for Polar research (all countries). Both indicators show numbers that are well above world average for all sciences over the period. Overall citation impact has slightly improved from 2007 to 2012. The values for 2012 are still a bit uncertain due to overall low citation statistics. Corresponding data for Sweden basically show the same trend.

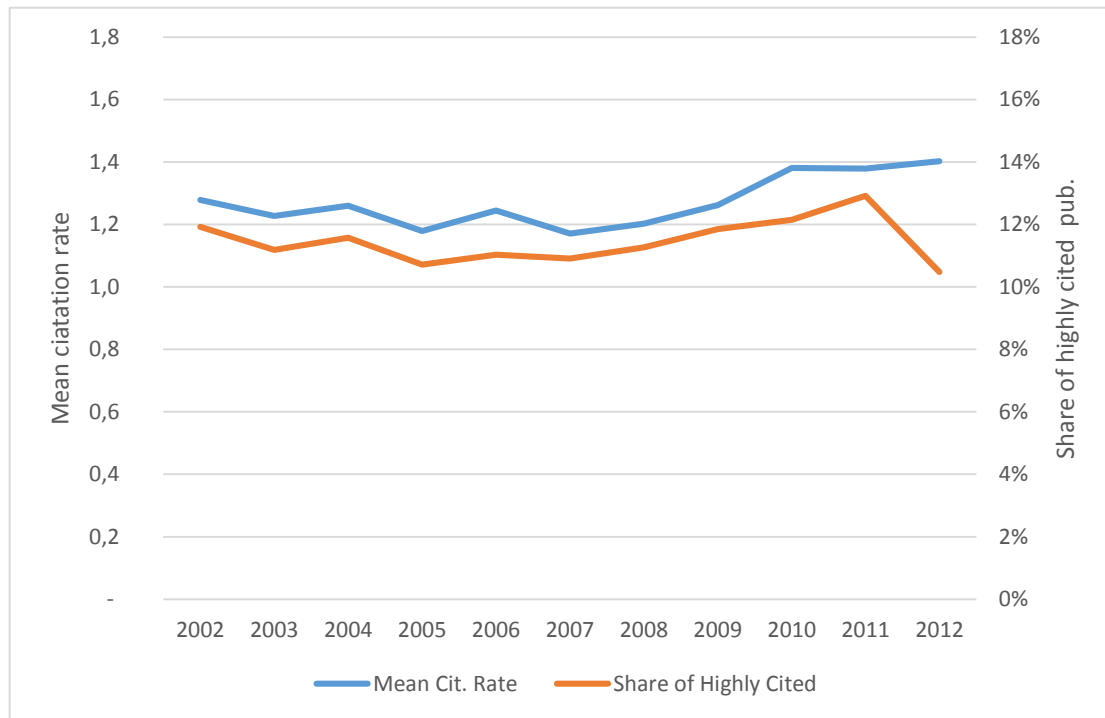


Figure 5. Global trend of mean (field normalized) citation rate and share of highly cited publications between 2002 and 2012 for all publications in Polar research. (Data from Science Citation Index – Thomson Reuters).

Broken down by country, Figure 6 shows four leading nations in terms of citation impact; Switzerland, Netherlands, United Kingdom and United States. Here we show averaged data over the last five years (2008-2012) to obtain better statistics. Sweden is performing just below the world average in polar research (mean of all countries), but slightly better than large producing countries like Canada, Norway and Denmark. The selected countries are sorted in order of *share of highly cited publications* (left table). The corresponding mean (field normalized) citation rate, seen in the right table, show a similar pattern and order but not exactly the same. The mean citation rate indicator is more sensitive to individual highly cited publications, here especially for countries with a relatively low number of publications.

Per polar region, the Bipolar category is the most highly cited where 22.2 % of all publications being highly cited (mean citation rate at 2.16) and Arctic and Antarctica at 11.5% (1.32) and 11.1% (1.26), respectively. For Sweden the corresponding numbers are; Bipolar 27.8%/3.12⁵, Arctic 11.7%/1.33, and Antarctica 8.7%/1.06.

⁵ Note: citation impact is based on few publications.

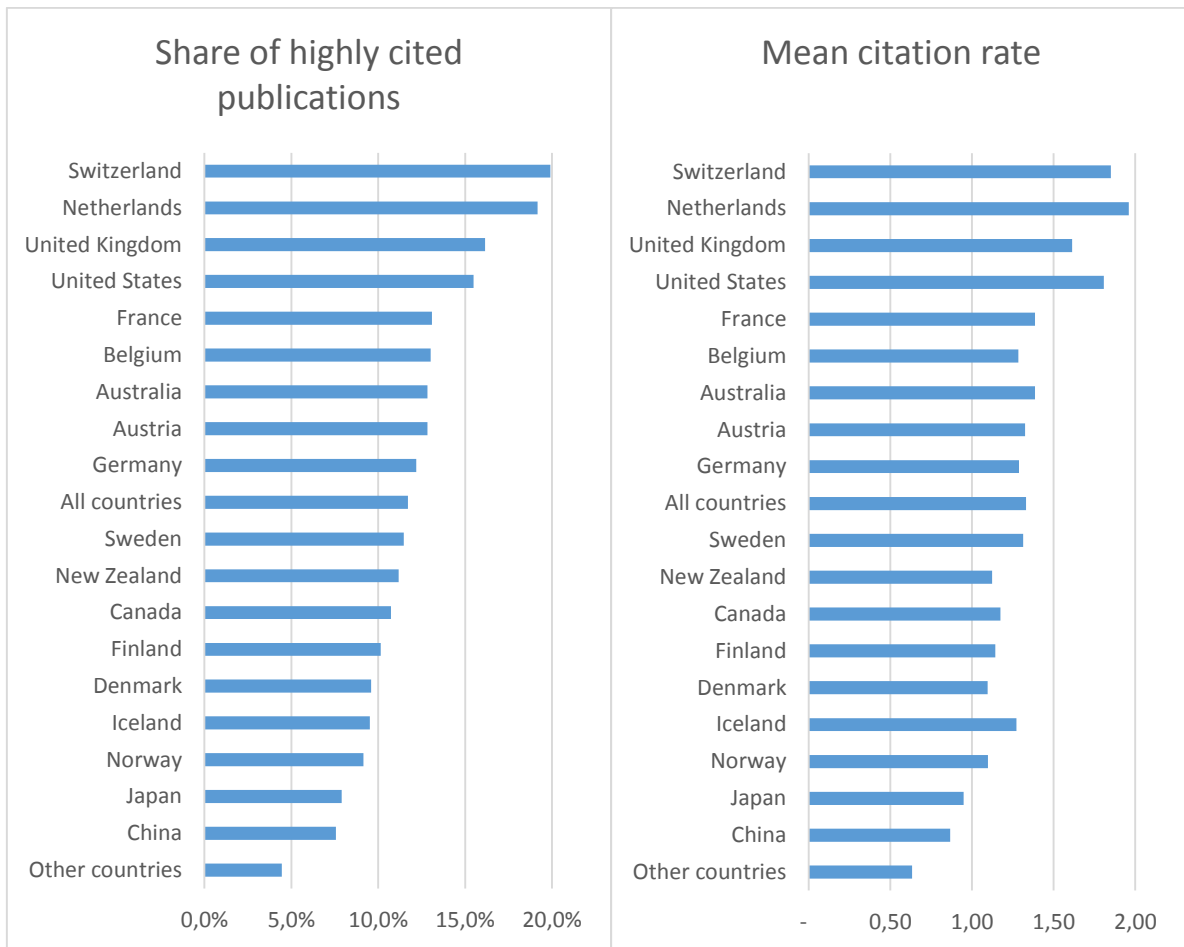


Figure 6. Polar research citation impact of selected countries for publications from 2008-2012, sorted by share of highly cited publications. (Data from Science Citation Index – Thomson Reuters).

Table 5 lists the top 20 producing research organizations within the Nordic countries, including number of publications and citation impact. Four Swedish universities are among the 20 top Nordic producers. In terms of citation impact, Stockholm University has the largest share of highly cited publications and Uppsala University has the greatest mean citation rate among the 20 top Nordic research organizations.

	Country	Full Counts	Number of frac. Pub.	Mean citation rate	Share highly cited
University of Copenhagen	Denmark	543	206	1,00	7,9%
University of Tromsø	Norway	486	202	1,08	9,3%
University of Bergen	Norway	432	177	1,16	9,2%
University of Oslo	Norway	396	163	1,21	10,7%
Aarhus University	Denmark	419	153	1,32	12,7%
Stockholm University	Sweden	385	137	1,56	14,3%
Norwegian Polar Res Inst.	Norway	288	83	1,18	10,9%
Geol Survey Denmark & Greenland	Denmark	174	79	0,77	5,8%
Finnish Sector Research Inst.	Finland	227	74	0,98	9,2%
Inst. Marine Res.	Norway	164	71	1,31	12,7%
Uppsala University	Sweden	207	69	1,71	12,5%
University of Helsinki	Finland	173	59	1,44	12,2%
Norwegian Univ. of Sci. and Tech.	Norway	155	57	1,05	9,5%
Univ Ctr Svalbard	Norway	190	57	0,84	6,3%
Lund University	Sweden	158	49	1,33	11,9%
Göteborg University	Sweden	128	46	1,11	13,4%
Technical University of Denmark	Denmark	131	45	1,20	13,8%
Greenland Inst. Nat. Resources	Denmark	133	38	1,39	10,8%
University of Iceland	Iceland	104	37	1,37	12,1%
University of Oulu	Finland	91	34	1,02	10,0%

Table 5. Top 20 organizations (number of fractionalized publications) in Sweden, Denmark, Norway and Finland (2008-2012). (Data from Science Citation Index – Thomson Reuters).

A list of the top 10 producing research organizations in Sweden is shown in Table 6. These ten organizations contribute to about 87 percent of the total production of Swedish polar research publications.

	Full Counts	Number of frac. Pub.	Mean citation rate	Share highly cited
Stockholm University	385	137	1,56	14,3%
Uppsala University	207	69	1,71	12,5%
Lund University	158	49	1,33	11,9%
Göteborg University	128	46	1,11	13,4%
Naturhistoriska riksmuseet	82	31	1,08	9,5%
Umeå University	68	25	1,00	10,3%
Swedish Univ. of Agricultural Sci.	55	19	1,23	10,7%
Swedish Meteorological and Hydrological Inst.	32	12	-	-
Royal Inst. of Technology	27	11	-	-
Swedish Inst. of Space Physics	32	11	-	-

Table 6. Top 10 organizations (number of fractionalized publications) in Sweden (2008-2012). Note, impact indicators are not shown for units with few publications. (Data from Science Citation Index – Thomson Reuters).

Funding of Swedish Polar Research

The analysis is based on funding organizations found in the acknowledgement of publications.

Acknowledgement records are found from publication year 2008 and onward in the database. However, the database is not entirely complete and for this specific analysis 306 (out of 1109 Swedish publications) lack information about acknowledgements and funding source. Here we list the largest Swedish funding organizations and EU-funding acknowledged in publications with author affiliations from Sweden. A publication may acknowledge more than one funding organization. Table 7 show the percentage of how many publications (full count) acknowledge each funding organization. In total 803 Swedish publications had at least one named funding organization, of these almost 40 % (317 publications) acknowledge the Swedish Research Council (VR) and about 10 % (82 publications) acknowledge the Polar Research Secretariat (see figure 7). Publications with more than one funding source tend to receive better citation impact. This might be an effect of collaboration, as the number of funding sources correlate with the number coauthors (number of author addresses). Citation impact tend to correlate with collaboration. In general publications from international collaboration receive more citations (higher impact).

	Arctic	Antarctica	Total	Full Count	Mean citation rate	Share highly cit.
Swe. Res. Council (VR)	37%	49%	39%	317	1,14	9,8%
EU-funding	21%	26%	22%	177	1,27	12,0%
Knut and Alice Wallenberg Found.	9%	24%	12%	100	1,48	15,6%
Swe. Polar Res. Secretariat	5%	24%	10%	82	1,18	13,9%
Swe. Res. Council - FORMAS	11%	4%	10%	77	1,50	17,4%

Table 7. Percentage of publications per Swedish funding organization 2008-2012. In total 803 Swedish publications including a record of at least one funding organization were found. Citation impact for publications with no record of funding (missing in the database) are 1.58/14.2% (mean citation rate/share of highly cited papers). (Data from Science Citation Index – Thomson Reuters).

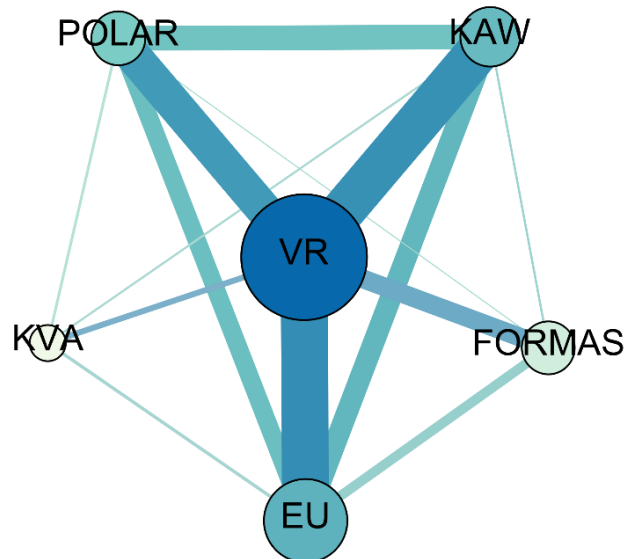


Figure 7. Funding of Polar research in Sweden. Network based on listed funding organizations in acknowledgement in Swedish publications. Size of Nodes and Edges are related to number of acknowledged publications, e.g. 80 % of all publications that acknowledge Swedish Polar Research Secretariat (POLAR) also acknowledge the Swedish Research Council (VR). This plot also includes the funding from Royal Academy of Sciences (KVA). (Data from Science Citation Index – Thomson Reuters).

Journals and citation impact

Table 8 list the most common journals (number of publications) for Swedish polar research 2008-2012 and the citation impact of those publications.

Journal	Full counts publ.	Fract. number of publ.	Mean citation rate	Share of highly cited
QUATERNARY SCIENCE REVIEWS	36	13,60	2,28	19,9%
ATMOSPHERIC CHEMISTRY AND PHYSICS	32	14,90	1,03	5,2%
ENVIRONMENTAL SCIENCE & TECHNOLOGY	21	7,37	1,81	24,3%
JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES	21	7,84	0,64	0,0%
GEOPHYSICAL RESEARCH LETTERS	20	6,36	2,97	45,6%
AMBIO	20	8,34	0,77	3,2%
ANNALES GEOPHYSICAE	17	7,24	0,19	0,0%
POLAR BIOLOGY	17	8,20	0,47	4,1%
PHYSICAL REVIEW D	16	2,08	1,52	15,8%
JOURNAL OF GEOPHYSICAL RESEARCH-OCEANS	15	5,67	1,37	13,2%
GLOBAL CHANGE BIOLOGY	15	4,14	3,86	68,1%
BIOGEOSCIENCES	14	6,21	1,62	27,0%
PLOS ONE	14	7,21	0,91	0,0%
BOREAS	13	8,43	0,81	4,0%
CLIMATE DYNAMICS	13	5,23	1,72	22,3%
SCIENCE OF THE TOTAL ENVIRONMENT	13	5,92	3,24	24,0%
TELLUS SERIES B-CHEMICAL AND PHYSICAL METEOROLOGY	13	5,43	1,02	18,4%
SCIENCE	12	2,16	10,01	71,0%
POLAR RESEARCH	12	7,51	0,53	0,0%
PRECAMBRIAN RESEARCH	12	5,26	1,47	26,6%
PALAEO GEOGRAPHY PALAEOCLIMATOLOGY PALAEOECOLOGY	12	3,55	1,65	18,3%
JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS	11	3,31	0,25	0,0%
EPISODES	10	3,19	1,15	0,0%
GEOCHIMICA ET COSMOCHIMICA ACTA	10	3,99	0,93	7,8%
ASTROPHYSICAL JOURNAL	10	0,99	1,07	16,2%
GLOBAL AND PLANETARY CHANGE	9	3,19	1,25	5,2%
JOURNAL OF QUATERNARY SCIENCE	9	2,96	2,44	52,7%
PROGRESS IN OCEANOGRAPHY	8	2,14	0,38	0,0%
PALEOCEANOGRAPHY	8	2,40	2,77	38,7%
GLOBAL BIOGEOCHEMICAL CYCLES	8	4,50	1,11	13,3%
OTHER JOURNALS	668	366,56	1,21	9,4%

Table 8. Most common (top 30 of 343) journals for Swedish polar research, number of publications and citation impact in terms of mean citation rate and share of highly cited publications from 2008-2012.

Note, that mean citation rate is not the same as journal impact factor but the actual impact of the selected publications. Also note that citation statistics are based on few publications. (Data from Science Citation Index – Thomson Reuters)

APPENDIX 1. KEYWORDS POLAR RESEARCH

KEYWORDS ARCTIC

Arctic (NOT alzheimer* char* fox* skua* grayling* tern* warbler*
sub-arctic mutant oscillation nectarine)

Tundra (NOT alpine tundra)

Alaska	Eurasian Basin	Novaya Zemlya
Amund Ringnes Island	Fram Strait	Novosibirskije Ostrova
Amundsen Basin	Franz Josefs Land	Nunavik
Amundsen Gulf	Gakkel Ridge	Nunavut
Arctic Bay	Greenland	Nunivak Island
Aurora Borealis	Greenland Sea	Ny-Alesund
Axel Heiberg Island	Greenlander	Prince Charles Island
Baffin island	Gulf of Alaska	Prince Patrick Island
Banks Island	Hopen	Qaanaaq
Barents	Hornsund	Queen Elizabeth Island
Barents Sea	Hudson Bay	Repulse Bay
Barentsburg	Hudson Strait	Resolute Bay
Bathurst Island	Inuit	Seward Peninsula
Bear Island	Inupiat	Severnaja Zemlya
Beaufort Gyre	Jan Mayen	Siberian Sea
Beaufort Sea	Kara Sea	Somerset Island
Bering Strait	Karskoje Sea	Southampton Island
Bjornoya	King William Island	Spitsbergen
Bristol Bay	Kongsfjord	St Lawrence Island
Brooks Range	Labrador Sea	St Matthew Island
Bylot Island	Lancaster Sound	Svalbard
Cambridge Bay	Laptev Sea	Taymyr Peninsula
Canada Basin	Lomonosov Ridge	Thule
Chukchi	Longyearbyen	Tiksi
Chukchi Sea	Mendelev Ridge	Ungava
Cumberland Sound	Mendelev Rise	Victoria Island
Davis Strait	Nansen Basin	Wrangel Island
Denmark Strait	Nares strait	Yupik
Devon Island	North Magnetic pole	Koryaks
East Siberian Sea	North Pole	Nenets
Ellef Ringnes Island	Northern lights	Yukaghir
Ellesmere Island	Northwest Passage	
Eskimo	Northwest Territories	

KEYWORDS ANTARCTICA

Antarctic* AND NOT (Candida OR Sub-Antarctica)

Antarctica NEAR Sub-Antarctica

Abbot Ice Shelf	Oates Land
Alexander Island	Palmer Land
Amery Ice Shelf	Princess Elizabeth Land
Amundsen Sea	Queen Elizabeth Land
Antarctic Peninsula	Queen Mary Land
Aurora Australis	Riiser-Larsenisen
Bellinghausen Sea	Ronne Ice Shelf
Berkner Island	Ross Ice Shelf
Brunt Ice Shelf	Ross Sea
Coats Land	Shackleton Ice Shelf
Dronning Maud Land	South Pole
East Antarctic Ice Sheet	South Shetland Islands
East Antarctica	Southern lights
Ellsworth Land	Southern Ocean
Enderby Land	Terre Adelie
Filchner Ice Shelf	Thurston Island
Fimbulisen	Transantarctic Mountains
George V Land	Weddell Sea
George VI Ice Shelf	West Antarctic Ice Sheet
Getz Ice Shelf	West Antarctica
Graham Land	West Ice Shelf
IceCube	Victoria Land
Kemp Land	Wilhelm II Land
Larsen Ice Shelf	Wilkes Land
Mac.Robertson Land	Wilkins Ice Shelf
Marie Byrd Land	

ADDITIONAL KEYWORDS BIPOLAR

Polar mesospher%

Polar stratospher%

Polar ionospher%

international polar year

Ozone hole
