

Responsible Development of the Arctic: Opportunities and Challenges - Pathways to Action Annual Reporting of Nordic Centres of Excellence

General information

Name of the Nordic Centre of Excellence:	REXSAC Resource Extraction and Sustainable Arctic Communities
Name of the responsible leader of the NCoE:	Sverker Sörlin
Reporting period	2019

1. Progress and research results

REXSAC is a Center of Excellence bringing together 15 partners in all the Nordic countries, and close collaborators also in Russia and Canada. Its research activities are organized in different Research Tasks (RTs), involving scholars from different disciplines in the partner universities and institutes, working on specific but interrelated research problems. In addition, there is special task force coordinating outreach and stakeholder interaction. The work in the RTs have progressed through 2019, as have the outreach and stakeholder interaction activities. This annual report will present this work – the activities and the insights – as well as specific outputs that are listed in the appendices.

The report has been composed in light of the recommendations adopted by the Programme Committee in 2019.

1.1. Unique research achievements

The objective of REXSAC is to contribute to practices and processes that ensure the sustainability of Arctic communities in a rapidly changing social, political, cultural, and ecological environment. A key research problem for REXSAC is to understand under which circumstances extractive industries can contribute to sustainable communities in the Arctic. Since we began our work in 2016, we have addressed this problem in our eight research tasks¹. In 2018, as advised by NordForsk program committee, we also stepped up our work with synthesis. We devoted our 2018 program wide meeting to this topic, including developing draft key insights and discussing new publication projects, as reported in the 2018 annual report. In 2019, building on this work, we launched what we termed the REXSAC synthesis process. This work has involved efforts to a) further develop our key insights, b)

¹ REXSAC originally had ten RTs. RTs 1 and 9 have been combined as have RTs 6 and 7. This annual report is therefore organized around eight RTs.

define a number of key publications for presenting these insights to the broader community of scholars and stakeholders, c) identify a number of conferences for presenting these findings, d) define outreach and communication activities, and finally e) plan for major panels at conferences.

As in the previous year, our work to develop our key insights in 2019 takes its point of departure in our three overarching research questions: How and why does resource extraction commence? What consequences does resource extraction have for communities and environments in the Arctic and beyond? What opportunities exist for transitions to post-extractive futures? In the below we have placed our key insights in relation to those questions. In addition we have noted which research tasks that have conducted the research which those insights build on:

How and why does resource extraction commence?

Insight: Investments in Arctic extractive industries are often linked to emotionally loaded expectations about the future.

Several factors have been driving the rise and decline of industrial resource extraction in the Arctic – global and national demands for minerals, occasionally coupled with geo-political interests, institutional frameworks, new technologies, investment costs, the quality of ores, political stability and social acceptance. In other words, investments in extractive industries have been seen as dependent on purely rational considerations. Opposition to mining, to the contrary, are often discussed as “emotional”. However, our research shows that not only local perceptions of extraction is linked to emotions, but also political decision making and indeed decisions to invest. Such emotions can be related to wishes for national independence, such as in Greenland, hopes for local job opportunities in communities with declining population, as well as to fears that environmental impacts will destroy livelihoods that depend on undisturbed land- and seascapes. Narrating the future becomes a tool not only to gain local acceptance but also to attract investment and convince decision makers.

Research Task 5 investigates the role emotions play in cases across the European Arctic. **Research Task 8** explores how the prospect of extractive expansion triggers local controversies and contested visions of the future, focusing on Northern Scandinavia.

Insight: Negotiations about ‘Sustainable Development’ are at the heart of decisions about extractive industries.

What sustainability means for local communities is usually defined from global or national perspectives. At the local levels, different ways of knowing and of using the landscape affect what people view as sustainable and thus how resources are valued and whether resource extraction is desirable or not.

Research tasks 3, 4, 5 and 8 highlights that state and corporate perspectives commonly take precedence over local concerns within political sustainability discourses. Work in **Research tasks 1/9** investigates local notions of sustainability (see the report Nilsson, A.,E., 2020, “Gruvor och hållbar utveckling – går de tatt förena?”).

Insight: Engaging with local communities in co-production of knowledge can improve the quality of impact assessments.

Current impact assessment practices rarely account for all potential consequences and impacts of mining. The varieties of local perceptions of mining impacts and sustainability are rarely considered in assessment processes for

extraction. A greater involvement of local communities in assessment processes is necessary to avoid outcomes that are considered as unjust and illegitimate, and therefore lead to tensions and conflicts.

Research task 4 is showing that high quality assessments that take all relevant knowledge into account require investment of resources to Indigenous groups and local communities. **Research task 1/9** uses input from interviews and workshops with local actors to investigate how the global Sustainable Development Goals could be adapted to the Arctic and potentially used as a tool for improved impact assessment (Nilsson and Larsen 2020).

What consequences does resource extraction have for communities and environments in the Arctic and beyond?

Insight: Improving assessments of effects of extractive activities demand a holistic understanding of such activities in the context of climate change.

Extractive industries are not only production sites, but make up large systems of linked technological, societal and environmental components stretching over vast geographies and long timespans. REXSAC defines them as socio-technical-ecological systems. Increasing resource interests in the Arctic, as well as the legacies of systems constructed in the past, result in a multitude of such systems, which together with the impacts of climate change result in multiple pressures on communities and environments in the region. These pressures include:

- Expanding socio-technical-ecological systems for mining, forestry and energy production
- Legacies of past activities
- Changing weather and snow conditions due to climate change

Research Task 2 is studying multiple pressures from extractive industries but also from other societal activities and climate change and assess the system dynamics that influence long-term development in mining regions. **Research task 6/7** explores enduring impacts of past extraction.

What opportunities exist for transitions to post-extractive futures?

Insight: The post-extraction afterlife of settlements and regions built around extractive industries receives too little consideration when planning for new mining projects and assessing their impacts.

All mines eventually come to an end. This is a great challenge in the Arctic, where alternative incomes are fewer, distances to alternative employment long, and where the environmental footprint of mines are often long-lasting. Former mines leave behind communities that have grown to depend on incomes from the extraction, uncertainties about the future and related social stress, and in cases wounds from perceived historical injustices. Therefore planning for and assessing impacts of resource extraction requires a long time perspective, which considers a wide array of challenges beyond the end of extraction; diversification, transitions to new livelihoods and multi-faceted approaches to the decommissioning of systems for extraction, ensuring responsible treatment of toxic waste while seizing opportunities to build new futures from legacies of the past.

Research task 6/7 explores the afterlives of communities and regions built around resource extraction in the Arctic, with a focus on the role of environmental remediation, re-economization and heritagization in the making of sustainable post-extraction futures. The work is carried out in close collaboration with **Research task 1/9** on

scenarios and **2** on multiple pressures. As a joint activity, visions of post- mining futures were explored in a scenario workshop in Kiruna in November [2019](#).

Insight: Innovative research on extractive industries benefits from interdisciplinary training and exchange of highly qualified personnel, such as PhD students and postdoctoral fellows.

This training is offered to PhD students in REXSAC, who will in turn contribute new perspectives and methods to the study of Arctic communities and resources.

PhD students are primarily contributing to the work in **Research tasks 2, 4, 6 and 7**.

The key insights of REXSAC that are elaborated here will be further developed in the coming year as we progress with the syntheses process.

In parallel to the syntheses process, the work in the research tasks has continued in a highly intensive manner over 2019. In the following we report on the activities in each RT:

Research task 1/9: The main data collection work in RT 1/9 took place within the framework of a REXSAC field based workshop, which we conducted in southern Greenland in August 2019 and a scenario workshop we held in Kiruna in November 2019. The field work in Greenland included interviews with local residents, students and politicians. Immediate reflections from these interviews were published online as a blog post on the REXSAC web site. The scenario workshop in Kiruna was on the theme *Gruvor och hållbar utveckling i norra Sverige – går det att förena?* (Can mining and sustainable development in northern Sweden be reconciled?). A workshop report (in Swedish) has been published on REXSAC's website. The data from this and earlier fieldwork has informed an analysis of the global SDGs from an Arctic perspective, published in the journal *Sustainability* in January 2020: Making Regional Sense of Global Sustainable Development Indicators for the Arctic. RT 1/9 researchers have also published a journal article in *Polar Geography*, based on a REXSAC workshop on participatory scenario methodology held in 2018: Towards improved participatory scenario methodologies in the Arctic. The special Issue of *Polar Geography* (Guest Editor: Joan Nyman Larsen) features an editorial and 4 journal articles by authors who participated in the Stockholm REXSAC workshop on scenario exercises and arctic social indicators.

Findings: a key finding from RT 1/9 in 2019 is that engagements with local actors, including the use of participatory methods, provide important complementary perspectives on sustainable development compared to those expressed in the global SDGs. At the same time, the global SDGs put the spotlights on issues that are important also in the Arctic but have not yet received major attention. A preliminary conclusion is that further work on grounding the SDG framework in Arctic local contexts could serve as a base for developing better impact assessment in decisions about extractive industries in the Nordic north. Experiences up to now will also be important for REXSAC's engagement in a new project funded by the Norwegian Research Council and led by Nordland Research Institute: Field of Goals: Co-production of Knowledge and Implementation of the Sustainable Development Goals in Local and Regional Planning (FOG).

Research task 2: The research in RT2 has progressed on several fronts in 2019, parts of it closely connected with the fourth PhD course within the REXSAC PhD school, which we conducted in Finnish Lapland in October 2019 (reported more extensively in the section on researcher training). The course was dealing with the heart of the

research problem of RT2 – Cumulative impacts from resource extraction and climate change. Over 2019 ethnographic research in RT2 has allowed the REXSAC team at Anthropology, University of Oulu, to focus on perspectives that have previously received less attention, including women’s perspectives on how to deal with the impacts and benefits of mining. Among other things, this has revealed that in order to understand the impacts and benefits of mining in the arctic, one needs to zoom in on family dynamics, education opportunities and cultural changes – and especially into if and how the timing and pace of mining developments takes into consideration these matters.

A major output from RT2 in 2019 is an article based on the field research conducted by REXSAC at Nautanen, Norrbotten, in the Swedish Arctic: Fischer, S., Rosqvist, G., Chalov, S. R., & Jarsjö, J. (2020). Disproportionate Water Quality Impacts from the Century-Old Nautanen Copper Mines, Northern Sweden. *Sustainability*, 12(4), 1394). The article targets an often neglected part in mining impact assessments, namely the long-term environmental impact of abandoned mining sites, in particular with respect to metal loading of surface water systems. Not least in the mining-intense country of Sweden, existing environmental monitoring programs are most commonly focused on principal mining areas, and is not designed to capture potential impacts of smaller sites. Their impact is therefore poorly known, despite being far more numerous than large sites.

Scholars in RT2 has also submitted a manuscript entitled “Impacts of climate warming on reindeer husbandry demand new land use strategies” to the journal *Ambio* (Gunhild Rosqvist, Niila Inga and Pia Eriksson). The paper presents results from our collaboration with Sami reindeer herders. In this article we have determined the impact of recent and rapidly changing weather and snow conditions on reindeer behavior and herding strategies in Laevas Sámi community, northern Sweden.

As the Nautanen publication show, where Sandra Fischer is the main author, PhD students in RT2 have conducted substantial parts of the work in RT 2 in 2019. Another example is Carl Österlin, who was in charge of drone based photogrammetric documentation of abandoned mines in south-western Greenland in the REXSAC fieldwork in August 2019 (reported in more detail below). A third example is the work of Chris Fohringer at SLU, who has applied and evaluated novel biomolecular approaches to samples of free-ranging moose in northern Sweden. These include genetics to quantify relative telomere length as a proxy for chronic stress detection when moose are exposed to different degrees of land-use intensity. Another experiment links serum metabolomics and DNA-metabarcoding to examine how moose adapt to changing environmental conditions. This is the first application of two genomics approaches covering maximum taxonomic diversity as well as maximum functional diversity of the samples provided.

Insights: A key result from the Nautanen case study – a smaller mine abandoned already in 1908 after only a few years of operation – is that the metal loads on the site as well as downstream were unexpectedly high relative to the (small) amount of tailings, waste rock and slag produced. This example raises the general question of whether or not (and to which extent) the neglect of small, abandoned mines in environmental impact assessments may result in erroneous estimates of regional-scale pollution pressures, including those of sensitive Arctic environments. This has important implications e.g. for policies regarding mineral extraction and decisions on the possible re-opening of smaller abandoned mines, which is on the agenda in many parts of the Arctic.

Another insight is that moose exhibit high flexibility regarding their winter diets, which reflects a high adaptive potential to changing environmental conditions. However, in limited or extreme habitats moose are facing constraints regarding their energy metabolism. In such habitats, moose are found to deplete deposits, accumulated over the growing season, before over their conspecifics in less limited habitats.

An insight from the research conducted in collaboration with Sami reindeer herders is that the integration of reindeer herder's knowledge in cumulative impact assessments is essential to understand ecosystem vulnerability. Historical data and participatory mapping add substantial value to determine where and when traditional grazing grounds and other ecosystem services are threatened.

Another batch of insights is based on the above mentioned ethnographic work in Finnish Lapland

- Public discussions around mining in Lapland are polarised but at the local level the various parties of land use conflicts also share a common pursuit to secure the possibility for a good life in the North
- Actions of a single livelihood group during local land use conflicts may be guided by not only a need to secure the continuity of one's livelihood but also by an aspiration to maintain good relations to other members of one's community. The various parties to local land use conflicts live as members of larger social communities and thus their actions should be understood against this background.
- The research results challenge the assumption that a lack of open resistance against a planned land use project, such as a mining project, equals local acceptance of a said project. Depending on their circumstances, local people may refuse to resist projects they deem harmful for themselves.
- Behind the polarised discussions around mining in northern Fennoscandia are in part on the one hand the dependency of nature-based tourism on the image of Lapland as an untouched wilderness and on the other hand long-term dreams of prosperity and a better tomorrow attached to northern mining projects.

Research task 4: The achievements of RT4 in 2019 consists of an intensive effort by PhD student Jean-Sebastien Boutet and research Peder Roberts to analyze great volumes of documents in Canadian and Greenlandic archives, developing a research output on the changing role of Greenland as a model for development for Canada (with particular respect to mining) and how that shifted over the years.

Findings: Their key findings include that Canadians looked to Greenland as a model largely because of the scale of Danish investment and a more general sense that Denmark showed commitment to northern development. This shifted from the late 1960s as a) Indigenous Greenlanders began to problematize the value of development, b) there were visible examples like Qullissat that undermined the Danish state's claim to success and c) Canadian firms began to bring capital and expertise to Greenlandic mining.

Research task 5: RT 5 contributed a focus on mining activities as deeply entangled in human affects. The general consensus seems to be that where economics is involved, emotions should yield to rational arguments. Yet, this is a false dichotomy. Whether to mine or not depends on different visions of the future, different hopes, different ideas of what might be "the good life" – all of which is deeply embedded in emotion. A more analytical approach to the role of emotions in debates and decision-making processes related to mineral extraction is thus sorely needed.

Based on studies and field work in Greenland and Sápmi in Northern Scandinavia, researchers in RT5 have investigated how affects and emotions as cultural practices empower discourses that connect (or disconnect) resource extraction with community making and nation building. Their research demonstrate how mining not only relies upon the mobilization of emotions but also fosters emotions, which support certain discourses and narratives while silencing other. Drawing on critical cultural studies, critical human geography, relational ontology, social psychology and anthropological approaches to affect and emotion, they have continued to explore how humanities can be applied to the field of mining and extraction studies. By doing so, they have tended to cast new light on the issues, which are normally in focus when researching and understanding mining: questions linked to development (e.g. economic), trade-offs (e.g. environmental), barriers (e.g. infrastructural), requirements (e.g. technical), community relations (e.g. stakeholder participation), control (e.g. legislation) and opportunities (e.g. employment).

Research task 6/7: RT 6/7 aim to explore and explain the afterlife of large-scale resource extraction projects. During 2019, REXSAC researchers and PhD students have worked on five main fronts: 1) publishing on the results of field research conducted in 2016 and 2017 from the REXSAC case study area at Svalbard, 2) working on PhD theses chapters on heritagization, environmental remediation and re-economization of abandoned mines in Gällivare municipality, Norrbotten, Arctic Sweden, 3) gathering data from the REXSAC case study areas at Greenland (reported in section 4 of this report) and Arctic Sweden, 4) gathering data at case study areas identified for comparisons in north-eastern Canada, in Quebec and Labrador, and 5) writing field work reports from said case study areas.

An article based on the fieldwork at Greenland is in the making, entitled “Sustainability after extraction: lessons from abandoned mining settlements in southern Greenland”, co-authored by Avango, Jarsjö, Nilsson, Pashkevich, Rastad-Bjørst, Rosqvist and Österlin. The objective of the article is to discuss the challenges for sustainable development of mining dependent communities beyond the end of extraction.

In Norrbotten, Arctic Sweden, research in RT 6/7 gathered data at the abandoned settlement and mining site Laver, using drone based photogrammetric mapping and archaeological survey. We also conducted interviews with various stakeholders in the Älvsbyn municipality. We will publish the fieldwork report in 2020. The research will result in an article entitled “Legacies of the past in mines of the future”, with the aim to explain the role of mining legacies – material and immaterial – in conflicts regarding mining futures.

Both articles are based on theoretical development within REXSAC, entitled socio-technological-ecological systems theory. This theoretical framework has also guided the data gathering described in the above.

Key findings: just like the cases of Nautanen described under RT2, preliminary results from Greenland and Laver indicate that substantial amounts of toxic substances remain at the sites. While various actors have taken measures to remediate these environmental impacts and to create new values at the sites, their scale and benefits have been limited compared to post-extraction communities such as Longyearbyen and Pyramiden at Svalbard, where interested actors have invested heavily in re-economization and heritage making. These results indicate that it is difficult to ascribe new values to mining sites where the built environments pertaining to the mines have been destroyed, leaving only the toxic legacies behind. This should inform long-term planning processes aiming for sustainable development in natural resource rich Arctic regions.

Research task 8: The activities in RT 8 in 2019 has first and foremost been devoted to the publication of a thematic issue of the journal *Polar Record* on the theme of Uchronotopia, with contributors from research tasks 4, 5, 6, 7 and 8, co-authoring articles pertaining to the relation between notions of the past and competing visions of the future in Arctic mining region regions. Scholars in the RT has also published chapters in edited volumes on place branding and competing perceptions and representations of the north.

Research task 10: The work of RT 10 consists of synthesis, involving most researchers active in the center. The synthesis process is described elsewhere in this report.

1.2. Nordic added value

Scientifically the Nordic added value lies in the unique ability of our NCoE to conduct comparisons and comparative analyses across the Nordic Arctic, pertaining to all of our three overarching research problems. This has enabled us to gain deeper insights on how different institutional frameworks, as well as different historic, social, cultural, climatic and geographical context influence start up processes of resource extraction, the impacts of extractive industries and climate change and post-extractive transitions. Furthermore, the Nordic context has provided opportunities to be competitive in applying for funding for new scientific research (see RT1/9 for an example).

For the consortium, in addition to the above, the Nordic added value lies in our ability to organize a PhD school building on the knowledge and multi-disciplinary teaching abilities of top-notch scholars in the Nordic countries, who under normal circumstances would not be available in the PhD courses of the individual consortium members. As we have stated in previous reports, the PhD training together with the field-based workshops bring together PhD students and early career researchers with senior scholars. In these activities, at our conference sessions and workshops, as well as in our everyday research activities, we build a new generation of specialists in the Nordic countries, experts on the Arctic and the challenges this region is facing.

For stakeholders the main added Nordic value is similar to the scientific. REXSAC stimulates stakeholders to consider the challenges they are facing and their strategies to cope, by comparing and evaluating comparable processes across the Nordic borders. In the year ahead, as part of the REXSAC syntheses process, we will develop this aspect of Nordic added value for stakeholders. Though not yet fully developed, we also see the possibility of using our Nordic research network for creating contacts among stakeholders in the different Nordic countries, for example in relation to the implementation of the SDGs.

1.3. Gender perspectives

The gender balance in REXSAC in 2019 remains unchanged within the consortium since the year before. The gender balance has also been maintained in activities such as the field-based workshops and the PhD training in northern Finland. Similar to previous years, the research in REXSAC include gender perspectives, particularly in research tasks 1/9 on scenarios and indicators, in RT 8 on transitions in Arctic communities and in RT5 on affective economies. As reported in detail under RT2, one of the PhD projects focuses on the impact of mining on women in Arctic communities.

1.4. Difficulties encountered

The difficulties in finding funding to finance the field based workshops in REXSAC remained in the beginning of 2019 but were solved, partly by re-allocating funding that remained unspent under other budget posts for travel costs, partly by applying for and receiving funds from the government of Quebec and the Nordic Council of Ministers for Nordic-Quebec collaborations. These funding sources paid the expenses for the field-based workshops in Quebec and Labrador in May-June 2019 and in southwestern Greenland in August 2019.

1.5. Changes introduced or envisaged in the research objectives or design

The changes in research design which we envisioned in 2017 and implemented in 2018 are now in place. With most of the planned data collection done in REXSAC and a number of core publications published or in late stage of production, the consortium as a whole is directing its efforts to synthesis.

1.6. Specific efforts undertaken to encourage synergetic collaboration across academic fields and disciplines in research and outreach

REXSAC works with five main tools to achieve synergetic collaborations across disciplines. The first is in the organization of the research into crossdisciplinary research tasks, in which scholars from different disciplines and REXSAC partners work together on specific research problems. The second is the center-wide focus of the research on cases study areas, where researchers from the different RTs work together at specific sites or regions. The third is the REXSAC PhD school, to which teachers from all disciplines have contributed in each course, making their empirical, theoretical and methodological content both multi- and cross-disciplinary. A fourth tool is our field-based workshops, two of which we have conducted this year (see under 4 meetings and networking). A fifth and indeed central tool is the publication of REXSAC research in co-authored articles on the main research problems of REXSAC, described also in the REXSAC annual reports of 2017 and 2018. We see these dimensions as interacting, mutually reinforcing in an evolutionary understanding. So, inter- and multidisciplinary in REXSAC is not a steady state but a creative force of growing co-production of knowledge.

2. Researcher mobility

The researcher mobility in REXSAC that extends beyond two weeks can be divided into three categories: a) rotations by PhD students, b) field-based workshops in Canada and Greenland, where several REXSAC researchers from most Nordic countries have participated, and c) guest or adjunct research positions where senior research spend time away from their home institution. For the sake of saving space, we have not listed the b category in the table below, instead listing them as follows:

Field based workshop and PhD training in Canada:

Gender, title, organisation: Élise Lépy (U of Oulu), Dag Avango (LTU), Albina Pashkevich (U of Dalarna), Lill Rastad Bjørst (U of Aalborg), Arn Keeling (U of Newfoundland), Sandra Fischer (U of Stockholm), Chris Fohringer (SLU) and Jean-Sébastien Boutet (KTH). 1 full professor (male), 3 associate professors (2 female, 1 male), 3 PhD students (1 female, 2 male). *The sites of work* was mining towns in Quebec and Labrador. *The purpose* was to conduct research and work on joint multidisciplinary publications. The duration was all in all two weeks. *Output:* REXSAC has

reported on the event on our web site and has secured a special issue in Extractive industries and society for the resulting publications.

Fieldwork and travelling workshop in Greenland:

Gender, title, organisation: Albina Pashkevich (U of Dalarna), Annika Nilsson (KTH), Calle Österlin (U of Stockholm), Dag Avango (LTU), Hannu Heikkinen (U of Oulu), Joan Nymand (Stefansson Arctic Inst), Lill Rastad Bjørst (U of Aalborg), Gunhild Ninis Rosqvist (U of Stockholm), Lene Kielsen Holm (GINR) and Jerker Jarsjö (U of Stockholm). 4 full professors (2 female, 2 male), 3 associate professors (2 female, 1 male), 2 researchers (female), 1 PhD student (male). *The sites of work* was mining towns in western Greenland. *The purpose* was to conduct research and work on joint multidisciplinary publications. The duration was two weeks. *Output:* REXSAC has reported on the event on our web site and work is ongoing with publications based on the activity.

Gender, job title, organisation	Site of work	Purpose of visit	Duration of visit	Comments, output of the visit
Chris Fohringer, Male, PhD student, Swedish University of Agricultural Sciences	Department of Bioscience - Arctic Ecosystem Ecology, Aarhus University, Denmark	Working on thesis manuscripts; Collaboration with colleagues and partaking in department culture	26.08.2019-14.02.2020	https://bios.au.dk/en/about-bioscience/organisation/arctic-ecosystem-ecology/
Chris Fohringer, Male, PhD student, Swedish University of Agricultural Sciences	Department of Life Sciences, GloCEE Global Change Ecology and Evolution Research Group, University of Alcalá, Spain]	Working on thesis manuscripts; Collaboration with colleagues; Extending research network	26.02.2020-19.03.2020	https://www.uah.es/en/conoce-la-uah/campus-centros-y-departamentos/departamentos/Life-Sciences/
Hannu I. Heikkinen, Male, Full Professor, University of Oulu	University of Cologne, Global South Study Center	Visiting scholar/ Arctic – South comparison	1.8 – 31.12.2019, 5 months	Networking, familiarizing to mining dilemmas in western Germany
Jasmiini Fransala (née Pylkkänen), female, PhD student, University of Oulu	University of Alberta, Department of Sociology & Rankin Inlet, Nunavut, Canada	Visiting PhD student (research): fieldwork	1.1.-3.2.2019, 1 month (the UAlberta research visit started on) Fieldwork in Nunavut from May 31 in 2018 until early 2019)	Collecting primary data for PhD thesis, receiving supervision
Varnajot A.; male, doctoral researcher, University of Oulu	World Leisure Centre of Excellence, Vancouver Island University, Nanaimo, Canada	Visiting researcher	8 Nov – 9 Dec 2019 (1 month)	Networking; IPTRN collaboration; experience another university

Juha Saunavaara, male, Hokkaido University Arctic Research Center	University of Oulu, Faculty of Humanities	Research and teaching	3 months	Article writing, teaching
Annika Nilsson, Female, Researcher, KTH	Nordland Research Institute, Bodø, Norway	Establish new collaboration and support applications for new projects as adjunct professor	8 visits from Mar 2019- Feb 2020, 3 days each=total 24 days	Nordland Research Institute enrolled as partner in REXSAC, adding competence on sustainability discourses in relation to extractive industries and on SDG implementation
			Female	Male
Number of visiting months by gender (table only)			1	16
Number of visiting researchers by gender (table only)			2	4

3. Researcher training and education

	Female	Male
Number of Nordic PhD students recruited	4	
Number of non-Nordic PhD students recruited		2
Number of Nordic Post Docs recruited	1	
Number of non-Nordic Post Docs recruited	1	
Number of PhD degree achieved	0	0

The REXSAC PhD school worked according to plan in 2019. Between October 20-25 we conducted the course Cumulative impacts on Arctic environments and societies, in Arctic Finland. In addition, we also co-organized a second PhD course entitled Northern mining towns in transition, May 25 to June 6 in Quebec and Labrador in Canada.

Northern mining towns in transition (Quebec, Labrador) was organized in close collaboration with MinErAL – a network on Mining Encounters and Indigenous Sustainable Livelihood, funded by the Canadian Social Sciences and Humanities Research Council, which REXSAC has collaborated with for the last three years. MinErAL was the main organizer, REXSAC the co-organizer. Back to back to back with the course, and also involving the PhD students, Northern mining towns in transition was also a field based workshop with senior scholars from REXSAC and MinErAL.

Northern mining towns in transition started out from the coastal town Sept-Îles and as a travelling workshop / PhD course moved by railroad and bus to the inland mining settlements Schefferville, Fermont, Labrador West and Wabush, in Quebec and Labrador. These towns were established as part of giant socio-technical-ecological systems for iron ore extraction in the post-world war 2 period. The four towns have developed differently over the second half of the 20th century, making them useful lenses for comparing processes of change and their impacts in mineral rich areas in the north. Our focus was on transitions in connection with booms and busts in mining towns, and the particular challenges the business cycle of mining poses to communities Arctic, where distances are great, alternative economies fewer and where the environmental and social imprints of mining often are significant. We explored how these communities dealt with abrupt change, which is a key research problem both for REXSAC and MinErAL. The workshop/PhD course allowed us to not only gain new knowledge on the variety of ways northern mining communities has dealt with change, but also new insights on how differences between the Canadian and Nordic historical and institutional contexts play out in periods of change.

The PhD course consisted of lectures carried out on the train rides, literature discussions, site visits, and interactions with local actors who in different ways related to the ongoing changes in the mining settlements we visited, and to north Canadian mining in general. The course addressed topics such as Indigenous rights, the design of built environments in mining settlements, the evolution of labour arrangements from company towns to modern fly-in fly-out camps, mining governance, environmental assessments, as well as impact and benefit agreements. They also dealt with closure, environmental remediation and heritage making.

Northern mining towns in transition is an example of the way REXSAC and MinErAL work to build interdisciplinary collaboration through field based workshops. By bringing together scholars from different Research Tasks, work packages and different disciplinary backgrounds, focusing on joint research problems at the same sites, we are able to learn from each other and reach understandings we wouldn't have if working separately.

Cumulative impacts on Arctic environments and societies (Finland) was the fourth and final of the core components of the REXSAC PhD school. Its aim was for PhD students to gain knowledge of the challenges of assessing the cumulative effects of climate change and various forms of land uses, past and present, which affect environments and communities in the Arctic. The course explored to what extent current practices in planning and permission giving processes for extractive industries take multiple pressures into account and how assessment processes can be improved. In the course the PhD students studied concrete examples of cumulative impacts and local complexities through different site visits in northernmost Finland and Sweden and by analysing documents from EIA processes of different large scale extraction projects in different countries in the Arctic. The learning goals was for student to gain ability to identify cumulative impacts from various land uses, present and past, that can occur in the Arctic in the context of climate change; possess knowledge on theoretical and methodological approaches for identifying cumulative impacts; know how current EIA and SIA processes for extractive industries work in the Nordic countries (actors, methods, content); have the ability to critically assess contents and methods for EIA and SIA's; be able to identify relevant stakeholders in planned extraction projects; and gain an understanding of varying contexts and needs to engage with local communities when assessing the possible impacts of extractive industries.

Instructors consisted of lecturers from within the REXSAC NCoE, external experts from organizations involved in EIA and SIA processes, environmental licensing administrations, and people from local communities where extraction takes place.

In the course we familiarized the REXSAC PhD students with interdisciplinary approaches for studying the complexities of resource extraction in the arctic – cultural contexts, social systems, history, economics and ecology. Furthermore, we took the PhD students to field sites and communities in multiple northern jurisdictions, beyond their home countries and their possible key case study areas, in order to kindle abilities for and interest in conducting comparative arctic research. These were in themselves already unique achievements for a research consortium. However, it will take time to reap the benefits, as the PhD students have perhaps had more things to process than many students who are working in a more ‘standard’ type of research projects and environments. Patience and trust in the long-term benefits of this kind of approach are needed, especially since the PhD students have, simultaneously with all the interdisciplinary rhetoric of today, discovered that most of academia is still operating according to disciplinary silos. It is essential to train PhD students early in their research careers to observe and contest disciplinary boundaries.

4. Meetings and Networking

In 2019, REXSAC undertook two major field based workshop – in Quebec and Labrador in May-June and in southwestern Greenland in late August.

The objective of the field based workshop in Quebec and Labrador was to define, plan and start the work on comparative analyses of mining towns and mining regions in transition in the Canadian and Nordic Arctic. The workshop took place back to back with the PhD course Northern mining towns in transition. The activity was co-organized by MinErAL and REXSAC. Five senior researchers and three PhD students from REXSAC participated. The objectives and activities we describe in more detail under section 3, researcher training.

The objective of the Greenland field based workshop was threefold: a) to enable researchers in REXSAC to collaborate in collecting data for research in this case study area of our NCoE, b) to conduct a travelling seminar for discussing how we can use what we learn from the field work in publications on the core research problems of REXSAC and c) to communicate our research and learn from local communities at the sites we visited. Ten researchers, from REXSAC partners in most of the Nordic countries, participated (details in section 2). They gathered Copenhagen on August 13 and spent an intensive period of seven days together, moving by boat along the south-western coast of Greenland, visiting the following communities; two former military bases, Narsarsuaq and Kangillinnuit / Grønnedal; two former mining towns, Ivittuut (cryolite, 1857-1987) and Josva (copper, 1905-1914); and three settlements impacted by mining, Narsaq (uranium, 1960s and present) and Arsuk near Ivittuut. The group collected data using UAV based photogrammetry, systematic archaeological survey and soil sampling. They also conducted interviews at Grønnedal and Arsuk. An activity of central importance was a town hall meeting the group conducted in Narsaq, where the REXSAC researchers and local residents discussed mining pasts and future challenges for several hours. The report from the field work will be published in 2020. The data will be used for reconstructing and explaining the afterlife of the resource extraction projects in the area, as well as on how

residents and other local stakeholders view the future. The group is also working on several co-authored publications, envisioned and planned during our workshop sessions in the field.

Of central importance for meeting and networking was the International Association for Impact Assessment (IAIA) conference in Brisbane in May 2019, entitled "Evolution or Revolution: Where Next for Impact Assessment?" <https://conferences.iaia.org/2019/index.php> A multidisciplinary group from REXSAC participated; Anna-Maria Fjellström, Rebecca Lawrence, Gunhild Ninis Rosqvist, Kaisa Raitio and presenting indigenous collaborator Niila Inga. Rebecca Lawrence co-organized and co-chaired the session 'Integrating indigenous rights and knowledges into impact assessment'; with Christina Allard (LTU), Anders Ehrling Fjällås, Semisjaur Njarg Sami community, and Jenny Wik Karlsson (Svenska Samernas Riksförbund). This session explores different ways of doing impact assessment, where impacted indigenous communities, and their rights and knowledges, took center stage. Rosqvist presented a paper in the session; 'The cumulative dimensions of resource regions'. Rebecca Lawrence organised a two week post-conference study tour, which included a delegation of Sami Swedish Indigenous representatives. The group travelled from Minjerrabah in Queensland down to Darug Country to meet with local Indigenous leaders.

Another important workshop organized by REXSAC was a scenario workshop in Kiruna, Sweden, on November 6, 2019, entitled: 'Gruvor och hållbar utveckling i norra Sverige – går det att förena?'. A report from this workshop to be published early 2020.

REXSAC was also present at Arctic Frontiers 2020. This consisted of a plenary brief outlook by A.E. Nilsson in the session Powered by Knowledge (27 Jan); a scientific presentation by A-E. Nilsson and D. Avango 'Post extraction: Lessons for sustainability assessments' (29 Jan); and a REXSAC side event 'The post-petroleum transition: Implications for local sustainability' (29 Jan) with a panel of researchers and policy actors.

In addition to the cumulative impacts course, REXSAC scholars at the University of Oulu took part in Tools of consent or conflict? How mining law and institutional practices shape indigenous community consultations. Helsinki, Finland, May 27 - 29, 2019. Heikkinen co-convener. HS-NOS 2nd workshop on Extractive industries & indigenous livelihoods. A series of three workshops.

Other important workshops in which REXSAC has played an important role are the following:

- Peder Roberts: 'The Rise and Fall of Greenland as a Model for Administering the Canadian North', Canadian Historical Association annual meeting, Vancouver, June 2019.
- Carl Österlin: Participation and poster-presentation during Bolin-days at Geosciences building November 2018. Presentation of REXSAC fieldwork on Southwest Greenland August 2019 during the Bolin-days at Geosciences building November 2019.
- REXSAC participated in the NordForsk annual program meeting in Reykjavik, May 20-21, with networking meetings taking place also on the 19th and 22nd.

5. Infrastructure and data policy

As described in the annual report of 2018, REXSAC uses several infrastructures pertaining to data and data collection. It is diverse due to the multi-disciplinary character of the NCoE. The written data sources we use comes from archives, libraries and web deposits. We also use information available from public agencies such as geographical and geological surveys (GIS data), Masters of mines offices (mines, concessions) or national heritage boards (historical remains, protected heritage sites). We also collect environmental field data.

REXSAC also makes use of Arctic infrastructures when producing data. One example is INTERACT – International Network for Terrestrial Research and Monitoring in the Arctic, which provides access to research stations across the Arctic. REXSAC researchers also use laboratories at Stockholm University, University of Agricultural Sciences and Umeå University, for analysing water-, soil- and animal samples. REXSAC also produce new data using drone based photogrammetry and GPS techniques. We use archaeological survey techniques including measured drawings, photo documentation and text description. We perform interviews (e.g. semi-structured, participant observation), discuss in focus groups and host scenario workshops. In the latter data output is made up of notes and photographed ‘post-its’ and flip chart notes.

REXSACs data policy is built on the ambition to make the data collected within the NCoE framework publically available. This will be done at two levels. The first level consists of a list of meta data, available from the REXSAC home page. The second level is the data in itself, consisting of data, such as GIS files, images, drawings, descriptions in text and various samples. Such data will be made accessible through existing open data repositories, such as SND in Sweden. The work of building this data has already begun in 2019 in the form of a pilot at KTH-Royal Institute of Technology in Stockholm, consisting of archaeological data from Sorgfjorden, Svalbard.

The second level data will not include already publically available data (state agencies, archives, libraries). We In accordance with ethical and legal standards we will not make transcribed interviews nor related sound files publically available. This type of data will be listed in our meta data lists, with information about how to apply for permission to access data and the principles limiting access (GDPR, ethical recommendations).

6. Governance

The centre wide decision making body that takes strategic decisions regarding planning and coordination of the NCoE is the Coordination Board. It is made up of representatives from all the partner organisations in REXSAC and, if not overlapping, representatives from all research tasks and from the centers communication. Each partner names its own representative. The PI and co-PI chairs the board. The Coordination Board has an overseeing responsibility and serves as a forum for reviewing progress in relation to the NCoE goals and research and communication plans and advises the Director and Co-director on more significant adjustments as needs appear. The Coordination Board meets two time each year, either back to back with the NCoEs centre wide meetings or online. In 2019, as planned, REXSAC did not conduct a program wide meeting. Instead both coordination board meeting took place online, in March and October.

In the same manner as in previous years, the everyday activities of REXSAC was organized by an executive committee (ExCom) meeting once a month with exception of summer holidays. ExCom consists of Sverker Sörlin (KTH, PI), Ninis Rosqvist (SU, co-PI), Dag Avango (LTU/KTH, coordinator of the REXSAC PhD school), Annika Nilsson (KTH, strategic planning) and Andrea Norgren (SEI, communications coordinator). The ExCom coordinates matters such as the PhD school, upcoming meetings, financial issues as well as pro-active work on the larger strategic planning for the NCoE. The ExCom also have access to the administrative capacity of KTH. In 2019, the ExCom has devoted special attention to the syntheses process, which we develop further in the progress plan below.

7. Output and dissemination of research

Peer-reviewed Publications / of which Open Access	[Type text]
Non-peer-reviewed Publications / of which Open Access	[Type text]
Reports	[Type text]
Invited conference presentations	[Type text]
Conference presentations, oral / poster	[Type text]
Number of appearances in media	[Type text]
Outreach and dissemination to the public	[Type text]

8. Progress Plan for the coming year

The main aim with REXSAC research is to provide new knowledge that help answering the question How should resource extraction in the Arctic be planned and performed to ensure the sustainability of Arctic communities? The rationale is that the Arctic is subject to impacts of multiple global processes – i.e. climate change and increasing market demands for resources. There have been several resource booms in the north in the past and their legacies add to the current challenges to many aspects of sustainability. To support a societal transformation towards a more sustainable use of resources, innovations in planning of land use and assessing the impacts resource extraction are needed, including decision-making processes and tools that consider the effects of multiple pressures on the environment and society and how they relate to local perceptions of sustainable development and a desirable future.

The final year of REXSAC will therefore focus on synthesizing REXSAC insights across the different research tasks and to reach out to a wider community to present and discuss REXSAC findings. We aim to reach academic audiences outside our network, decision makers and those who are affected by decisions about extractive industries. In the following, we describe some of the planned activities, but given the current situation with limitations on travel, we anticipate a need to be prepared for innovative solutions for our work and outreach.

Publications:

We will cover the wide REXSAC scope in several key scientific articles. One of those is already published in 2020, providing Arctic perspectives on the global SDGs (Nilsson and Nymand-Larsen 2020). Other papers in advanced progress are:

Rosqvist, N, Avango, D et.al., Understanding multiple pressures through a socio-economic-ecological systems perspective

Avango, D, Rosqvist, N et.al., The historical dimension of mining impacts in the Arctic: lessons from multidisciplinary research

Nilsson, A, et.al., Sustainable development goals as a potential tool for assessing the impacts of mining in the Arctic

Thisted, K, Sejersen, F et.al., Mining emotions

The first focus develops REXSACs innovative social-ecological-technological systems perspective, using it to understand multiple pressures. The second uses the same framework in an analyses of the impact of legacies of more than a hundred years of mining in the Arctic, and its impacts on the environment and local livelihoods. The third develops a framework on how to use the global SDGs for in processes to assess mining impacts. The fourth presents new views on how to understand drivers of resource extraction in the Arctic.

Two other major publication efforts in 2020 will be based on the results from the field work / field based workshops in Greenland and Canada in 2019. The Greenland results we will publish in a series of articles in different high profile journals, while the results from Canada will be published in articles contained in a thematic issue of the journal Extractive Industries and Society (articles comparing Canada and Fennoscandinavian contexts, co-authored with scholars from the MinErAL network).

A major syntheses output will be a book with the working title Future Arctic Extraction. This book is currently in advanced planning stage and under rapid development. The aim is to submit a manuscript to an academic publisher in 2021.

To reach a wider audience of decision makers and stakeholders, the syntheses process also involves REXSAC organizing a series of stakeholder workshop in late 2020, to discuss findings and insights with representatives from governments, county administrative boards, municipalities, indigenous communities and key branch organizations in countries involved in REXSAC.

Moreover, to communicate key messages based on findings and insights from the work, REXSAC will develop a short film (8-10 minutes) which will be featured at a stakeholder workshop in Stockholm in late 2020 and in all consequent stakeholder engagement activities. The film will bring in the different multiple pressure perspectives and will serve as a starting point for these discussions. The film content will also contribute to the overall communication efforts late 2020-2021.

REXSAC, together with MinErAL and Amedee Network, will also organize the international and multidisciplinary conference Mining the Connections. This conference explores the many connections between mineral extraction, local communities, and the environment from a multidisciplinary perspective. It seeks to build and increase

connections between governments, researchers, NGOs, practitioners, and community representatives from around the globe, in order to increase knowledge of mining development and its impacts. Because of the corona situation, the conference has been postponed from November 2020 until April 2021.

REXSAC scientists plan to organize a session at the Arctic Circle 2020 and contribute with presentations at several other conferences and workshops during 2020-2021 such as for example ASSW.

REXSAC scholars are also starting up new research efforts building on REXSAC. Joan Nymand Larsen is now partner in a newly funded EU H2020 project (2020-2024) JUSTNORTH. As part of JUSTNORTH Joan will be leading a case study in South Greenland (Nanortalik/Narsaq area) studying resource development and living conditions in South Greenland in view of climate change and economic globalization, with one of the objectives being to explore the distributive implications of different types of economic activities (renewable and non-renewable resource sectors) in South Greenland in light of the socio-economic and environmental changes taking place, and to develop a framework for analyzing the costs and benefits from resource development and net gains accruing to locals. A planned fieldtrip in the fall of 2020 will provide an opportunity for engaging with stakeholders in South Greenland to discuss results from REXSAC field work on issues of relevance to the final stage of REXSAC work and journal writing in areas of potential project collaboration. Another example is Dag Avango, who will direct the development of a PhD school focusing on conflicting sustainability goals and land use conflicts in the Arctic, based at Luleå University of Technology.

Finally our plan for our PhD school in the coming year: REXSAC and MinErAL originally planned to arrange a second PhD course / field based workshop in northern Sweden in June 2020. The objective of was to enable the participants in the Northern mining towns in transition in Quebec and Labrador to deepen their insights from comparing the north Canadian and Fennoscandinavian contexts. The participants were thereafter scheduled to present their work at the IXASS X congress in Archangelsk, Russia. Because of the Covid-19 pandemic we have decided to cancel the course and run it in connection with the ICASS congress which has been moved to June 2021.

Most of the REXSAC PhD students will defend their theses after the formal end of the NordForsk funding of the NCoE. Supervision will, however, of course continue and we will continue to provide opportunities for the students to share results and discuss findings. Our mission to share new findings and insights will thus continue also after the official end of the NordForsk program.

9. Success stories and unexpected results

An important measure of success is if REXSAC researchers are recognized as experts by others. We will here report a sample of such cases.

REXSAC researchers Annika E Nilsson was invited to present a workshop on Critical minerals organized 30 January 2020 by the Royal Swedish Academy of Science. In this workshop, REXSAC had an opportunity to argue for *the need for a systems-oriented approach in assessing the impacts of mining*, including the importance of trust in decision-making processes where conflicts of interests play an important role, including land-use conflicts. The invitation was prompted by an intervention Nilsson made in a seminar organized by the Swedish association of mines,

mineral and metal producers in May 2019 about mining and sustainable futures, in which REXSAC's core partner SEI played a key role. It subsequently led to an interview for the web-based magazine *Extrakt* (not yet published). The sequence of events highlights how REXSAC has built a strong network that reaches a range of audiences, including key stakeholders.

Another example comes from the field of *stakeholder involvement and collaboration of the Nordic centres of excellence*. REXSAC and ReiGN (Reindeer husbandry in a Globalizing North) associated researchers Simo Sarkki, Mia Landauer and Hannu I. Heikkinen published a short article in the journal *Poromies* (eng. Reindeer herder) titled "Kuinka puhua kehityksestä poronhoitajat huomioiden" (Poromies 2020/1). The title can be translated as "How to talk about development recognizing reindeer herders' point-of-views". The Poromies paper is based on a peer reviewed journal article in *Land use Policy* (Sarkki et al. 2018). The Poromies Article handles four beliefs systems, that are often used to explain issues and offer management solutions related to reindeer herding and suggests ways out from these dead-end argumentations. One of these systems is a strong belief in majority democracy, which is used as a guiding principle often in land use negotiations where reindeer herders are equated with other stakeholders. However, equating herders with other stakeholders compromises social equity and neglects specific histories, dependencies, identities, cultures and practices of herders. As a solution, we propose to consider herders as traditional rights-holders instead of stakeholders. The idea of rights-holders will be elaborated in two forthcoming papers (In Springer NCoE book), and evoked interests in Reindeer Herders Association (RHA) of Finland. After the article Heikkinen and Sarkki were invited to give a keynote and join a panel discussion in the RHA's annual meeting (Poroparlamentti 1.6.2020), which brings together both Saami and Finnish reindeer herding cooperative (paliskunta) leaders and professional herders, but also forests management related representatives of central administration (Ministries and regional administration). This is an example of importance of popularizing research to target audiences. The science publications are often simply not read by societal actors, like reindeer herders and administrators, but targeted communications are needed for enabling societal impact. This can work as an impulse for continuous interactions, and enhanced dialogue between science and society, as happened in this case.

Sarkki S., Landauer, M and Heikkinen Hannu I. 2020. Kuinka puhua kehityksestä poronhoitajat huomioiden. *Poromies* 2020 (1), 38-40.

<https://paliskunnat.fi/reindeer-herders-association/organisation/poromies-magazine/>

Sarkki, S., H. I. Heikkinen, V-P Herva, & J. Saarinen. 2018. Myths on local use of natural resources and social equity of land use governance: Reindeer herding in Finland. *Land Use Policy* 77: 322–331.

<https://doi.org/10.1016/j.landusepol.2018.05.055>

Another example on REXSAC success is the *high interest in media for our research*. Even if the awareness of how climate change impact Arctic environments and society has increased significantly during the past decade (e.g. Special report on the ocean and cryosphere, IPCC 2019, and Arctic human development report, TemaNord 2014), there is still a great interest from media to cover *stories of how people in the Arctic cope with the changing climate*. Because one of the main REXSAC research tasks is to study multiple pressures from both climate change and human exploitation this continued interest comes handy. Thus we used the interest about how we combine Sami

knowledge and science to study climate impacts, but focused our story on how effects from exploitation (e.g. mining, forestry, energy, tourism) accumulate, and together with climate change effects now pose serious challenges. Instead of only confirming the already relatively well-known story about melting snow and ice. Because decisions about future exploitation of Arctic environments lack assessment of these full consequences, our message is important and urgent.

10. Stakeholder involvement

Stakeholder involvement

Primary stakeholders/key messages/interactions:

Intergovernmental Forums, and specifically the Arctic Council is a key international arena for REXSAC-relevant issues. REXSAC has been engaged with the Council's Arctic EIA project at workshops and through personal contacts during previous years, with the key message that Arctic EIAs need to take account on multiple pressures on long-term perspectives. We have also engaged with Swedish representatives of the Arctic Council, e.g. in dialogues concerning the Council's future strategy, and the need to include attention to the impacts of past, present and future mining in the Arctic as an important driver of change. This included informal discussions during the EU Arctic Forum in November 2019. In 2019, Iceland took over the chairmanship of the Arctic Council, where REXSAC through the Stefansson Arctic Institute maintain ties to ongoing efforts.

Non-governmental international organizations such as the International Council on Monuments and Sites (ICOMOS) and The International Committee for the Conservation of the Industrial Heritage (TICCIH). We have begun sharing expert knowledge and advice with these organizations. The purpose of further engagement would be to communicate insights from REXSAC on the complexities of post-extraction transitions in the Arctic and what they imply for policy makers within heritage protection and management. Mining legacies are often the subject of heritagization and related re-economization by tourism entrepreneurs, often supported by municipal governments and planners who wish to create new values. However, current practices in this field has created far too little attention to the multiple interpretations and consequences of mining legacies locally and associated understandings of the past. A more inclusive and holistic approach, paying attention to a wider variety of local perspectives, has the potential to build greater support for and engagement with heritagization and re-economization of legacies from past extraction. World leading heritage organizations such as ICOMOS and TICCIH could contribute to this.

National Government ministries: Within the scope of RT5, we have had meetings/discussions, inspections with the Norwegian Directorate for Cultural Heritage to discuss solutions for conservation and preservation of industrial heritage from coal mining. The key messages are that immediate measures are needed to save and secure this heritage as climate changes reduces the lifetime and that documentation therefore is crucial. REXSAC has also had contact with the Swedish National Heritage Board (RT 6-7) and the Museovirasto, the Finnish Heritage Board.

We have held a workshop in Stockholm (RT 4) with the Swedish Ministry of Enterprise and Innovation, the Swedish Ministry of Culture, the Swedish Energy Agency, The Swedish Environmental Protection Agency and the Mining Inspectorate of Sweden to increase knowledge about governmental agencies' obligations to follow laws to promote

reindeer husbandry as a part of the Sami culture and give the Sami community a voice in the permit process of future mining. We would like more engagement with the Greenlandic Parliament who, as of 2009, has full authority to make decisions regarding principal investments in mineral resource activities, including the granting of licenses.

REXSAC was invited to present at the Swedish Royal Academy of Sciences seminar 'Innovation-critical metals and critical raw materials: utility or problems for society'. Several government authorities were among the stakeholders present.

REXSAC participated in the 14th edition of the Arctic Frontiers Conference: The Power of Knowledge in Tromsø, linking policy, business and science for responsible and sustainable development in the Arctic.

We are interested to further our discussions with the Mining Inspectorate of Sweden at the Swedish Geological Survey. The inspectorate participated in the scenario workshop that REXSAC organized in Kiruna in November 2019.

In 2020, we will step up our engagement with the Mining Inspectorate with the following key messages: 1) Mining legacies are not only holes in the ground – they consist of a wide variety of interconnected material and immaterial legacies, covering wide geographies, that inevitably change both environments and communities. 2) Assessing impacts of mining requires an integrated systems perspective 3) Assessing impacts of mining requires a long-term perspectives with attention to post-mining futures 4) Managing impacts in ways that do not destroy values is central to ensuring sustainability 5) With foresight and local influence, mining can create new values beyond the economic life time of the initial extraction by supporting local capacity building, planning for re-use of buildings and infrastructure facilitating tourism. 6) It will be essential to reform impact assessment processes in ways that legitimate these for all relevant stakeholder. This will entail further attention to environmental safeguards that take climate change into account and create long-term values for communities affected by mining.

Regional and Municipality planners and authorities: (RT5) The Governor of Svalbard, Regional authorities. Longyearbyen local government, Meetings/discussions, inspections to discuss solutions for conservation and preservation of industrial heritage from coal mining. They are positive to the research. The Stockholm workshop mentioned above also involved the Swedish County Administrative Boards (example: Västernorrland, Norrbotten). Andrea asking: And even update this with the Co-land workshop? During 2019, we started to step up engagement with local authorities, e.g. in the Kiruna scenario workshop. In 2020 we will build further on this work with interviews and site visits in Norrbotten.

Business Actors (e.g. mining companies, energy companies, subcontractors, consultancies, and investors, trade organizations). We have so far mainly engaged with mining companies through relevant trade organisations in Sweden (Svemin and Jernkontoret). REXSAC participated in the Future Mine and Mineral Conference in Stockholm in January, an event to interact face-to-face with mining operators, investors and regulatory agencies. REXSAC participated in the breakfast seminar, 'Mining and the Mining Industry in a Sustainable Future' organized by Stockholm Environment Institute and SWEMIN in May. Within RT 5 we have networked with public and private stakeholders from Canada, Denmark and Greenland at PDAC 2018 Convention, Canada and at the Greenland Conference in the Confederation of Danish Industry in 2017. , One mining company and one consultant company performing impact assessments participated in our the scenario workshop in Kiruna.

We plan to engage more with business stakeholders during 2020 with the message that there is a need to identify and assess all pressures on environment and society including mining areas in order to contribute to long term land use plans that ensure future sustainable development of the society. with the key message that mining systems and landscapes can create new values beyond the economic lifetime of the extraction, as places of memory, cultural heritage and resources for tourism. The potential post-extraction value making should be considered when planning for the closure of mining operations and environmental remediation measures.

Arctic Indigenous communities: REXSAC has ongoing collaborations with several Sámi organisations (e.g. Svenska Samernas Riksförbund, Sami Parliament of Sweden and the Sami Parliament of Finland) and several reindeer herding communities. The work is characterized by co-design of research and participatory positive collaboration. Sámi communities are motivated to collaborate because we provide them with concrete outputs that feed into their own processes (e.g. protecting their traditional livelihoods).

This engagement included organizing a trip to Australia including 8 Sámi delegates. REXSAC researchers and Sámi collaborators participated in the International Association for Impact Assessment 2019 conference in Brisbane. REXSAC presented in the session; ‘The cumulative dimensions of resource regions’ and organized the session; ‘Integrating indigenous rights and knowledges into impact assessment’. This session explored different ways of doing impact assessment, where impacted indigenous communities, and their rights and knowledges, took center stage.

Fieldwork was conducted by one of the PhD students together with indigenous women from the Kivalliq region of Nunavut, Alberta Canada. Focus was on social justice, mining and sustainability.

Local inhabitants and citizen organizations and tourism. RT 5 have engaged with local inhabitants in the region of Norrbotten in areas where extended mining was planned (RT5). Contact was in the form of interviews to derive anthropological observation data. The key issue was the forced housing due to mining expansion.

As reported elsewhere, REXSAC researchers visited South Greenland in August to learn more about how local inhabitants of Narsarsuaq, Arsuk, Narsaq and Ivittuut think about potential futures related traditionan livelihoods, mining and to climate change. For example we spoke to locals at an open meeting in Narsaq to learn more about their thoughts about the impacts of past and on-going changes in South Greenland. In RT 7 we have engaged with local communities, companies / entrepreneurs in tourism, citizens organizations (environmental, heritage societies), labor organizations and artists (painters, photographers, film makers). This interaction and valuable knowledge, gained by interviews and personal contacts, touches on the messages that the cultural legacies that mines leave behind defines the local communities and post-extraction futures can be influenced by those who live there. In RT8, we investigate tourism development strategies, emphasizing knowledge dialogues that support our common aim of sustainable management of the fjord systems in Norway. Doing this we also need to map the potential conflict zones between different stakeholders. Whales, tour-operators, fishermen, locals and scientists have different interests in the region, creating a cumulative number of conflicts. We will investigate knowledge-dialogues as a tool for bridging scientific and other stakeholder’s interests. We work closely with the project “Lønnsomme Vinteroplevelser” that organize around 70 companies in the Tromsø area, in addition to work with the sound artist Jana Winderen on an exhibition on whale in Kunstnerenes Hus, Oslo. During REXSAC doctoral course “Cumulative impacts on Arctic environments and societies”, several local mining, tourism and reindeer

herding stakeholder's contributed with their perspectives related to the municipalities of Pajala, Sweden and Kolari, Finland.

Media: REXSAC Phd student at the Cultural Anthropology research unit at the University of Oulu in Finland was interviewed about her REXSAC fieldwork about the impact of extractive industries in Rankin Inlet by the website Women in the Arctic and Antarctic. The Associated Press and other news outlets shared our story that climate change dramatically affects reindeer herds in the Arctic in December 2019 and.

Museums: Several REXSAC researchers were engaged in the development of an exhibit, "The Arctic, while the ice is melting" at the Nordic Museum in Stockholm which opened in October 2019. This exhibition allows visitors to learn more about the people living in the Arctic, its resources and how climate change has an important impact on the region. REXSAC provided concrete advice and ideas for the exhibit and are also contributors to the exhibition catalogue.

Research networks and institutions: Participating annually in the of Arctic research program of Academy of Finland (ARKTIKO) meetings. (RT2). RT 2 also takes part to the organizing a workshop series "Mineral extraction and indigenous livelihoods" (Oslo, Helsinki, Stockholm in 2018-2019). REXSAC is a part of the Towards Environmentally Responsible Resource Extraction Network (TERRE-NET), a Canada-based international scientific network exploring new techniques and practices for mine site remediation. During 2019, REXSAC has added a new <Nordic partner – Nordland research Institute, gaining further access to its networks related to resource extraction with focus not only in Norway but also Greenland and Alaska. REXSAC is working to prepare for the *Mining the Connections, an international and multidisciplinary conference*, in Montreal, from 2-5 November 2020 together with MinErAL and Amedee Network. This international conference will explore the many connections between mineral extraction, local communities, and the environment from a multidisciplinary perspective. It seeks to build and increase connections between governments, researchers, NGOs, practitioners, and community representatives from around the globe, in order to increase knowledge of mining development and its impacts.

11. Relevance for society

The world is facing major transformation away from energy regime built on fossil fuel to renewable energy sources, but non-fossil energy also requires resources, including access to land for wind power mining of minerals. To ensure that the energy transition is sustainable over the long term both globally and locally, there is an increasing need for knowledge about interactions with other uses of land and how to resolve potentially conflicting interests. REXSAC addresses this challenge by methods that focus on integrating knowledge from different experts and by involving stakeholders directly in our research in processes that focus on co-production of knowledge. An example is REXSAC's analyses of multiple pressures (RT2), where field work and analyses are carried out in close collaboration with Leavas Saami Community, Norrbotten, Sweden. We also engage with local knowledge holders and decision makers in interviews and in workshops, such as a scenario workshop in Kiruna in November 2019 where participants identified drivers of change and management option around the theme 'Mines and sustainable development in northern Sweden – are they compatible.' The goal of this scenario research (RT 1/9) is to be provide suggestions towards improved impact assessments for mining that focus on the broad concerns of

sustainable development both locally and globally. This goal is further supported by a newly published analysis of the global Sustainable Development Goals in relation to assessment needs in the Arctic, building on REXSAC field work as well as earlier studies of human development in the Arctic. Further examples of engagement with stakeholder is reported under 4. Meetings and networking.

Many REXSAC researchers are active in the public debate about climate change, sustainable development, and Arctic politics, as well as in informal and formal consultations with decision makers. These contacts cannot always be linked to specific research tasks but the REXSAC project serves as an important base for broadening and deepening the expertise of its researchers, making them even more useful when they are called upon by decision makers, journalist or as speakers for specific events. An example is REXSAC's presentation at a seminar organized by the Royal Swedish Academy of Sciences about metals that are critical for innovative economic growth and workshops in Finland with focus on extractive industries and indigenous peoples.

REXSAC researchers also actively engage in promoting meetings of various stakeholders relevant for resource extraction and sustainable Arctic communities. Examples since our previous annual report include community consultation in Disko Bay, a town hall meeting in Narsaq in connection with a field trip in southern Greenland in August 2019, engagement in the planning of Greenland Science Week in Nuuk in December 2020 (Rastad Bjørst), our activities at Arctic Frontiers 2020 (Nilsson), and public lectures at Science days (Tieteen päivät) in Helsinki (Heikkinen). For more details, see 4. Meeting and networking and the details under 7. Output and dissemination

Engagement with a range of stakeholders has been a central feature of REXSAC's PhD courses. For example, our 2019 PhD course Cumulative impacts on Arctic environments and societies included field visits with mining and mineral processing companies in Finland and Sweden. Furthermore, by encouraging our PhD students to be active on the REXSAC website, we are also preparing them for becoming the next generation of experts that are active in public discussions related to societal challenges.

New mining ventures are often met by opposition creating conflicts around environmental and social impacts of the project. Emphasizing the nuanced local realities and examining present-day land use conflicts in a broader historical and cultural context is a step towards more constructive dialogue between the various parties. A specific example of REXSAC's work in relation to mining conflicts is a workshop (Heikinen as co-convener) on "Tools of consent or conflict? How mining law and institutional practices shape indigenous community consultations" (Helsinki, Finland, May 27 - 29, 2019).

Gender aspects are important in assessing the impacts of extractive industries, which have historically been dominated by male workers. One of REXSAC's PhD project, in Nunavut, Canada, has looked at how Kivalliq women and their families can be empowered by amplifying Kivalliq women's voices on fairness and resource extraction. Better understanding of what fairness means to different people in Nunavut, especially in connection with mining developments, can help decision makers with creating policies and practices for handling the benefits and risks of mining. Learning from the case study of the Kivalliq region has potential to benefit other indigenous and northern communities that are dealing with mining and other extractive developments, where women's perspectives have not received a lot research and policy interest in the past.

12. Long-term effects on policy

Impact of research on policy can rarely be assessed within the lifetime of a project. That said, there are examples of how REXSAC research has contributed to bringing issues that were once local into the domain of policy discussions. The most prominent example is the media attention, in both Sweden and internationally, to the impacts of climate change on reindeer herding. Another example, though still nascent in terms of broader public debate, is the growing awareness that energy solutions that are good for the climate can create other problems and that these need to be addressed to avoid growing conflicts in society. REXSAC is thus in a good position to place the issues on extractive industries, mining in particular, into a broader context of sustainable development at a time when the national and subnational implementation of the global SDGs is starting to take shape. A specific example is that insights from RT1/9 and RT 6/7 will be communicated through policy advice through LTU to the County Administrative Board of Norrbotten in 2020-21. Furthermore, our research contributes to developing Arctic-relevant indicators for the global SDGs, in ways that can contribute to improve assessments of the combined impact of Arctic change and extractive industry.

REXSAC has invested in PhDs and PhD education with a truly interdisciplinary approach. However, it will take time to reap the benefits, as the PhD students have perhaps had more things to process than many students who are working in a more 'standard' type of research projects and environments. Patience and trust in the long-term effects on policy are needed, but the seeds of new ways of educating future professionals have been planted, with implication for communication between researcher and policy makers, which will be critical for supporting decision making that pays attention to multiple pressures and interlinkages between different societal challenges and priorities. This will be critical for addressing the current polarization of opinions regarding extractive industries.

In many policy frameworks, decisions about extractive industries are based on expectations of economic benefits, not only for companies but also for nationally and locally. Less attention has been paid to the political and cultural context in which expectations are created and the long term-impacts of extractive industries on societies and cultures. REXSAC research has highlighted the role of expectation and emotions as well as the long-term legacies of mining on both environments and people's relation to these environments. Furthermore, REXSAC's attempts to locate mining within a history of larger narratives of a successful and culturally meaningful future for Arctic residents highlight that success is more dependent upon meeting the varied needs of communities rather than uniform measures like number of jobs or volume of tax revenue. It also shows that concepts like environmental protection are culturally and historically specific. These are important lessons for creating processes for assessing the long-term impacts of extractive industries in ways that make local sense, thereby contributing to improved trust in the assessment processes. We also expect that the long-term perspectives that take into account both social and environmental factors will create a sounder knowledge base for future decision making about extractive industries, including the policy frameworks that steer such decisions.

Sustainable policy processes require taking into consideration and reconciling different needs and interests. Gender perspectives have not been at the center of research and policy attention in the past. REXSAC research, including , a PhD project that focuses on women's perspectives on distributive social justice (in the context of impacts and benefits of mining) and a scenario workshop in Norrbotten have highlighted the critical importance of gender

dimension in assessing impacts of mining, creating the basis for including gender issues in future assessment about the impacts of extractive industries.

13. Programme evaluation

REXSAC is one of four Centres of Excellence established under the Nordforsk programme: Responsible Development of the Arctic - Opportunities and Challenges - Pathways to Action. The programme was staked out in the Noria-NET Arctic's Programme memorandum (with the same title), published in 2014. It is an ambitious programme with a forward looking approach. In REXSAC we share the ambitions laid out for the programme, and we also believe it is important to nurture the programme and reflect on its progress and its impact, taken as a whole as much as in consideration of its different parts.

In completing the fourth annual report we recognize the increasing value of strategic planning within the programme and an increased focus on work towards NCoE- and total programme synthesis.

From the point of view of REXSAC, the programme has worked by and large according to plan. As REXSAC, and the entire Nordforsk programme, moves towards an increasing share of synthesis activities, including publications, we are curious to hear more about how Nordforsk as an organization regards the synthesis phase, or whether this is left at the discretion of the NCoEs.

Annual Reporting of Nordic Centres of Excellence

Appendix 1.

Standard Report Format of Academic Output

Title:	Author(s)	Journal/Conference/Publisher	Publication type	Open Access
*"Constructing Northern Fennoscandia as a Mining Region."	Avango, Dag, Jan Kunnas, Maria Pettersson, Örjan Pettersson, Peder Roberts, Lovisa Solbär, and Urban Wråkberg	In <i>The Politics of Arctic Resources : Change and Continuity in the "Old North" of Northern Europe</i> , edited by Carina Keskitalo, 78-98. Milton Park, Abingdon, Oxon; New York, NY: Routledge, 2019.	Book chapter	No
* "När industrierna tystnat – värdeskapande i post-industriella samhällen"	Avango, Dag	Vetenskapens Hus, Luleå, December 6, 2019.	Invited lecture	Yes
*"Resource extraction and sustainability in the Arctic"	Avango, Dag	Polarforum, Swedish Polar Research Secretariat, Umeå University, Sweden, November 19, 2019	Invited presentation	No

*"Industrins avtryck: hum-sam forskning i Polartrakterna"	Avango, Dag	Inauguration of the Swedish Polar Research Secretariat, Luleå University of Technology, Sweden, September 4, 2019.	Invited presentation	No
*"Mining legacies in Arctic futures: remediation, heritagization, re-economization"	Avango, Dag	Karlsruher Institut für Technologie, January 16, 2019.	Invited lecture	No
*"Disproportionate Water Quality Impacts from the Century-Old Nautanen Copper Mines, Northern Sweden"	Fischer, Sandra; Rosqvist, Gunhild; Chalov, Sergey, R; Jarsjö, Jerker.	<i>Sustainability</i> , Special Issue: Watershed Modelling and Management for Sustainability	Journal article	Yes
*"Planning for reindeer herding- a field of power struggles"	Anna-Maria Fjellström	Nordic Environmental Social Science (NESS) Conference, 10-12 juni 2019	Conference presentation	No
*Sustainable development in Nunavut and beyond: connections between social justice, mining, culture and environmental risk – Kivalliq women's perspectives	Jasmiini Fransala (née Pylkkänen)	21st Inuit Studies Conference, October 3-6, 2019, Montreal, Quebec, Canada	conference presentation	No
*Challenges of engaging anthropology of resource extraction in-between of contradictory expectations	Heikkinen H. I.	Perspectives and stories in a world of facts and figures? Exploring the potential of anthropology in tackling environmental issues. Environment and Anthropology Network Inaugural Meeting, Cologne, 12-13 December 2019.	Conference presentation	No
*Conflicting Environmental Interests and the Problem of Empathy in the European North	Heikkinen H. I.	60 minutes in Ethnography, Theory, Anthropology, University of Cologne 9 th of October 2019.	conference presentation (invited speech)	No
*Kuinka korvata arvot, joita ei voi korvata?	Heikkinen H. I.	Tieteenpäivät Helsinki 10th Jan. 2019. (Science days Helsinki 9th – 13. Jan. 2019)	conference presentation (invited speech)	No
*Sharing experiences with supplementary feeding in reindeer husbandry	Horstkotte Tim, Risvoll Camilla, Lépy Élise, Eilertsen Svein Mortern, Löf Annette, Sarkki Simo, Landauer	15 th Arctic Ungulate Conference, August 12-16 th 2019, Jokkmokk, Sweden	conference poster/presentation	No

	Mia, Heikkinen Hannu I., Hovelsrud Grete			
*Working together: reflections on a transdisciplinary effort of co-producing knowledge on supplementary feeding in reindeer husbandry across Fennoscandia	Horstkotte Tim, Lépy Élise, Risvoll Camilla	forthcoming	book chapter	No
*Supplementary feeding in reindeer husbandry across Fennoscandia - a process of knowledge co-production	Horstkotte Tim, Lépy Élise, Risvoll Camilla (lead authors)	forthcoming	report	No
*Manoeuvring Conflict: Industrial Land Use Projects and 'Refusal to Resist' Among Reindeer Herding Communities in Northern Fennoscandia	Komu, Teresa	2019 Ethnos: Journal of Anthropology.	Journal article doi:10.1080/00141844.2019.1580304.	no
*Dreams of Treasures and Dreams of Wilderness – Engaging with the Beyond-the-Rational in Extractive Industries in Northern Fennoscandia	Komu, Teresa	The Polar Journal 9 (1): 113-132.	Journal article doi:10.1080/2154896X.2019.1618556	no
"Foreword: towards a Nordic manifesto xix – xxiii"	Kramvig, Britt	in Cecilia Cassinger, Andrea Lucarelli & Szilvia Gyimóthy, <i>The Nordic Wave in Place Branding Poetics, Practices, Politics</i> , UK: Edward Elgar Publishing.	Book chapter	No
*"From Dreamland to Homeland: A journey towards futures better than pasts"	Kramvig, Britt and Rachel Andersen. 2019.	In Lilya Kaganovsky, Scott MacKenzie, and Anna Westerståhl Stenport (eds.) <i>Arctic Cinemas and the Documentary Ethos</i> , Bloomington: Indiana University Press, 322-335.	Book chapter	No
"Turbulent indigenous objects – controversies around cultural appropriation and recognition of difference"	Kramvig, Britt and Anne Britt Flemmen. 2019.	<i>Journal of Material Culture</i> Vol. 24: 1:64-82, DOI: 10.1177/1359183518782719	Journal article	No
*"The Economy of the Arctic". 2019.	Larsen, Joan Nymand and Andrey N. Petrov.	In The Palgrave Handbook of Arctic Policy and Politics (Eds. Ken S. Coates and Carin Holroyd). Palgrave	Book chapter	No

*"Sustainable Economies in the Arctic".2020	Larsen, Joan Nymand and Lee Huskey.	Vol I. Chapter 2 in: <i>Arctic Sustainability: A Synthesis of Knowledge</i> . (Eds. Andrey Petrov and Jessica Graybill). Routledge. Routledge	Book chapter	No
*"Energy Resources and Electricity Generation in Arctic Areas"	Magnus de Witt, Hlynur Stefánsson, Ágúst Valfells, Joan Nymand Larsen.	Renewable Energy	Journal article	No
*Enchantment of the underground: touring mines in early modern Sweden.	Naum, Magdalena.	<i>Journal of Tourism History</i> 2019 11(1): 1-21.	Journal article	No
*A Clockwork Porridge: An Archaeological Analysis of Everyday Life in the Early Mining Communities of Swedish Lapland in the Seventeenth Century.	Nurmi, Risto	In T. Äikäs and A.-K. Salmi (eds.), <i>The Sound of Silence: Indigenous Perspectives on the Historical Archaeology of Colonialism</i> . Berghahn, New York, 2019. pp. 90-118.	Book chapter	No
*Socio-economic and policy implications for coastal communities"	Larsen, Joan Nymand	Presentation in session: Near-future changes in the North Atlantic Arctic. Arctic Circle international conference, Reykjavik, Iceland. Oct 10-13, 2019	Conference presentation	No
Science for Socio- economic Adaptation – An Example from the Arctic Coasts"	Larsen, Joan Nymand.	Presentation in session: Connecting Arctic Science with Society: Lessons learned and progress. Arctic Circle international conference, Reykjavik, Iceland. Oct 10-13, 2019	Conference presentation	No
"Permafrost Thaw and Models of Risk".	Larsen, Joan Nymand.	Presentation in risk Workshop held in Roskilde, Denmark, May 31-June 1, 2019.	Workshop presentation	No
*Guest editor. Arctic Indicators and Scenario Development, a special issue of Polar Geography (accepted for publication)	Larsen, Joan Nymand	Polar Geography	Guest Editor	No

*"Mining industry perspectives on indigenous rights: Corporate complacency and political uncertainty"	Lawrence, Rebecca. , & Moritz, Sara. (2019).	The Extractive Industries and Society, 6(1), 41-49.	Journal article	No
"Mine Closure on the Aboriginal Estate"	O'Faircheallaigh, Ciaran., & Lawrence, Rebecca. , (2019)	Australian Aboriginal studies, No.1, June:65-81	Journal article	No
"Accumulating Minerals and Dispossessing Indigenous Australians: Native Title Recognition as Settler-Colonialism"	Howlett, Cathy., & Lawrence, Rebecca. , (2019)	<i>Antipode</i> , 51(3): 818-837.	Journal article	No
"Unfinished Business: Rehabilitating the Ranger Uranium Mine,"	Lawrence, Rebecca. , & Sweeney, Dave., (2019),	Research Report, Sydney Environment Institute, University of Sydney		No
*Fighting to Be Herd: Impacts of the Proposed Boliden Copper Mine in Laver, Älvsbyn, Sweden for the Semisjaur Njarg Sami Reindeer Herding Community	Lawrence, Rebecca. and Kløcker Larsen, Rasmus. (2019).	SEI Report, April 2019. Stockholm Environment Institute, Stockholm.	https://www.sei.org/publications/fighting-to-be-herd-impacts-copper-mine-sami/	Yes
References to iconic landscapes in the debate surrounding the founding of Finland's national parks, circa 1880-1910.	Niemelä, Juho & Ruuskanen, Esa.	<i>International journal for history, culture and modernity</i> Vol 7 (2019): 741-764.	Journal article http://dx.doi.org/10.18352/hcm.579	Yes
*Making Regional Sense of Global Sustainable Development Indicators for the Arctic	Nilsson, A.E. and Larsen, Joan Nymand	<i>Sustainability</i> . January 2020. DOI: 10.3390/su12031027	Journal article	Yes
*Towards improved participatory scenario methodologies in the Arctic.	Nilsson, A. E., Carson, M., Cost, D. S., Forbes, B. C., Haavisto, R., Karlsdottir, A., Larsen J. N., Paasche, Ø., Sarkki, S, Larsen, S.V. and Pelyasov, A.	<i>Polar Geography</i> . August 2019. DOI: 10.1080/1088937X.2019.1648583	Journal article	Yes
<i>Anthropocene Ecologies: Entanglements of Tourism, Nature and Imagination.</i>	Norum, Roger Mostafanezhad, Mary	London: Routledge.	book	no

<i>Geopolitics and Tourism: Assemblages of Power, Mobility and the State</i>	Norum, Roger	In press. Tucson: University of Arizona Press	book	no
"The anthropocenic imaginary: political ecologies of tourism in a geological epoch",	Norum, Roger Mostafanezhad, Mary	2019. <i>Journal of Sustainable Tourism</i> 27:4, pp. 421-435.	Journal article (reviewed)	no
"Bin ich ein Berliner? Graffiti as layered public archive and socio-ecological method",	Norum, Roger Valisena, Daniele	2019. <i>Green Letters: Studies in Ecocriticism</i> 20:2, pp. 83-102.	Journal article (reviewed)	no
"Sounding wild spaces: Inclusive mapmaking through multispecies listening across scales."	Norum, Roger	In press. In: <i>Handbook of Sonic Methods</i> . London: Bloomsbury.	Book chapter	no
"De/placed experience: Connectivities, mobilities and the mediated presumption of lifestyle"	Norum, Roger	Lifestyle Migration Hub meeting, Umeå, Sweden, 28 November	Conference presentation	–
"Re-present self: Negotiating immediate temporalities of becoming momentarily, mobilely social"	Norum, Roger	Mobile Socialities workshop, Lund, Sweden, 25 October	Invited seminar presentation	–
"Environing global infrastructure locally: China's 'green' belt and road planetary development"	Norum, Roger	Situating the 'Global' in Contemporary Humanities conference, National Research University Higher School of Economics, St. Petersburg, 18 October	Conference presentation	–
"Transience, sociality and the contemporary experience of mediated mobility"	Norum, Roger	Department of Communication and Media, University of Lund, Sweden, 13 March	Invited departmental lecture	no
"Un-Finnished business: The culture of work, innovation and entrepreneurship in the Nordic countries."	Norum, Roger	Oulu University of Applied Sciences, 24 January	Workshop presentation	no
*"Putting the carte before the source: Producing Arctic pasts and futures through the map"	Norum, Roger	European Society for Environmental History conference, Tallinn, 24 August	Conference presentation	no
"Investigating infrastructures: the archive of the contemporary."	Norum, Roger	14th Congress of the Society for International Ethnology and Folklore (SIEF), Santiago de Compostela, Spain, 15 April	Conference presentation	no

“From migrant ecologies to multispecies migrations: Imaginaries of mobility in the peripheries of Europe”	Norum, Roger	Crafting the Long Tomorrow: New Conversations & Productive Catalysts Across Science and Humanities Boundaries as the Global Emergency Worsens conference. Biosphere 2, University of Arizona, 22 February	Conference presentation	no
“Thinking anthropologically about experience: Northern built environments”	Norum, Roger	Urban Space Design seminar, University of Oulu, 9 May	Invited seminar presentation	no
*Arctic tourism in times of change: Seasonality	Rantala, O., de la Barre, S., Granås, B., Jóhannesson, G., Müller, D.K., Saarinen, J., Tervo-Kankare, K., Maher, P.T., Niskala, M.	TemaNord 2019:528, Nordic Council of Ministers 2019	Report https://www.norden.org/en/publication/arctic-tourism-times-change-seasonality	Yes:
*“The Rise and Fall of Greenland as a Model for Administering the Canadian North”	Roberts, Peder	Canadian Historical Association annual meeting, Vancouver, June 2019	Conference presentation	No
*The Arctic in tourism: complementing and contesting perspectives on tourism in the Arctic	Saarinen, J. & Varnajot, A.	Polar Geography, 2019, 40(2)	Journal article	No
*Enclaves in tourism: Producing and governing exclusive spaces for tourism.	Saarinen, J. & S. Wall-Reinius .	Tourism Geographies, (2019) 21(5), pp. 739-748. Dou:	Journal https://doi.org/10.1080/14616688.2019.1668051	Yes
*Communities and sustainable tourism development: Community impacts and local benefit creation tourism.	Saarinen, J.	In Stephen F. McCool and Keith Bosak (Eds), A Research Agenda for Sustainable Tourism, (2019) pp. 206-222. Cheltenham: Edward Elgar Publishing.	Book chapter	No
*Co-evolution and resilient regions: Moving towards sustainable tourism development.	Brouder, P. & J. Saarinen.	In Saarinen, J. & A. M. Gill (Eds). Resilient Destinations: Governance Strategies in the Transition towards Sustainability in Tourism, (2019) pp. 67-76. London, Routledge.	Book chapter	No
*Conclusions: Challenges and opportunities in the transition towards sustainability.	Gill, A.M. & J. Saarinen.	In Saarinen, J. & A. M. Gill (Eds). Resilient Destinations: Governance Strategies in the Transition towards	Book CH	No

		Sustainability in Tourism, (2019) pp. 189-196. London, Routledge.		
*Tourism, resilience and governance strategies in the transition towards sustainability.	Saarinen, J. & A.M. Gill.	In Saarinen, J. & A. M. Gill (Eds). Resilient Destinations: Governance Strategies in the Transition towards Sustainability in Tourism, (2019) pp. 15-33. London, Routledge.	Book chapter	No
Introduction: Placing resilience in the sustainability frame.	Saarinen, J. & A. M. Gill.	In Saarinen, J. & A. M. Gill (Eds). Resilient Destinations: Governance Strategies in the Transition towards Sustainability in Tourism, (2019) pp. 3-12. London, Routledge.	Book chapter	No
*What are Wilderness Areas for? Tourism and Political Ecologies of Wilderness Uses and Management in the Anthropocene.	Saarinen, J.	Journal of Sustainable Tourism (2019) 27(4), 472-487	Journal article (https://doi.org/10.1080/09669582.2018.1456543).	No
*How boundary objects help to perform roles of science arbiter, honest broker, and issue advocate. - Science and public policy	Sarkki, S., Heikkinen, H., I, Komu, T., Partanen, M., Vanhanen, K. & Lépy É.	Science and public policy [Epub ahead of print 29 Nov 2019], 1-11.	Journal article https://doi.org/10.1093/scipol/scz055	yes
Human values as catalysts and consequences of social innovations.	Sarkki, Simo, Andrej Ficko, David Miller, Carla Barlagne, Mariana Melnykovych, Mikko Jokinen, Ihor Soloviy, Maria Nijnik.	Forest Policy and Economics, 2019 104: 33-44.	Journal article https://doi.org/10.1016/j.forpol.2019.03.006	Yes
*Matching knowledge demand, research funding and knowledge supply: trends and scenarios about reindeer herding in Finland	Sarkki Simo, Rasmus Sirpa, Landauer Mia, Lépy Élise, Heikkinen Hannu I.	15 th Arctic Ungulate Conference, August 12-16 th 2019, Jokkmokk, Sweden	conference presentation	
“An environmental reckoning in the High Arctic: Sverker Sörlin lauds an integrative history of remote Beringia, revealing the cost of overexploitation in fragile ecologies”	Sörlin, Sverker	Review of Batsheba Demuth: Floating Coast: An Environmental History of the Bering Strait (New York: W.W. Norton, 2019). In: <i>Nature</i> , vol. 572 (2019) 8 August, p. 177-178.		No

*"Introduction: Understanding historical contingencies into the future: Cases from northern Europe"	Keskitalo, E. Carina H., Maria Pettersson, Sverker Sörlin	in: E. Carina H. Keskitalo, ed., The Politics of Arctic Resources: Change and Continuity in the "Old North" of Northern Europe (Abingdon, Oxon & New York, NY: Routledge, 2019), pp. 1-17.	Book chapter	No
*"State and Resources in the North: From territorial assertion to the 'smorgasbord state'."	Sörlin, Sverker	In: E. Carina H. Keskitalo, ed., The Politics of Arctic Resources: Change and Continuity in the "Old North" of Northern Europe (Abingdon, Oxon & New York, NY: Routledge, 2019), pp. 38-61.	Book chapter	No
"Frygten for at miste"	Sörlin, Sverker	<i>Weekendavisen</i> [Denmark] 2019-03-15, p. 12,	Media appearance	Yes
"How a warming Arctic connects to populism in the US and Europe"	Sörlin, Sverker	[interview by Martin Breum] <i>Arctic Today</i> 28 March 2019.	Media appearance	Yes
"Klimatet: Hur agerade vi under 2010-talet?"	Sörlin, Sverker (with Johan Rockström)	Studio ett, Sveriges radio P!	Media appearance	Yes
Entrepreneurship in nature-based tourism under a changing climate	Tervo-Kankare, K.	Current Issues in Tourism 22(11)	Journal article	No
*"Walk the line": an ethnographic study of the ritual of crossing the Arctic Circle – Case Rovaniemi	Varnajot, A.	Tourist Studies, 2019, 19(4)	Journal article	No
*Digital Rovaniemi: contemporary and future arctic tourist experiences	Varnajot, A.	Journal of Tourism Futures, 2020	Journal article	No
*Cruising the marginal ice zone: climate change and arctic tourism	Palma, D., Varnajot, A., Dalen, K., Basaran, I. K., Brunette, C., Bystrowska, M., Korablina, A. D., Nowicki, R. C. & Ronge, T. A.	Polar Geography, 2019, 42(4)	Journal article doi.org/10.1080/1088937X.2019.1648585	Yes
*Countering "Arctification": Dawson City's "Sourtoe Cocktail"	Cooper, E. A., Spinei, M. & Varnajot, A.	Journal of Tourism Futures, 2020	Journal article	No

*The Arctic on Instagram: Tourists' social media practices at the age of overtourism – Case Rovaniemi	Varnajot, A.	Nordic Geographers Meeting, Trondheim, June 16–19 2019	Conference presentation	
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