PROGRAMME AND ABSTRACTS

Global Change and Communicating Science

EDITED BY RIITTA KAMULA, MIKKEL BUE LYKKEGAARD, EVA PONGRÁČZ, ARJA RAUTIO AND KARI STRAND

THULE INSTITUTE

THULE RESEARCH SEMINAR AND WORKSHOP 2014

UNIVERSITY of OULU
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Preface

Thule Research Seminar and Workshop 2014 is part of the annual activities of the Thule Institute’s research and doctoral programmes. This time research seminar discussions will be focused on Global Change and Communicating Science. The workshop will provide essential knowledge about the best practices in communicating your science and also to improve your research funding applications.

The program consists of two interesting keynote presentations by Research Professor Hannele Hakola from the Finnish Meteorological Institute and Senior Research Scientist Philipp Schmidt-Thomé from the Geological Survey of Finland. These will be concentrating in air quality measurements in Finland and how climate has changed and is expected to change in future as well as climate change adaptation and structuring the communication process in practice, respectively. Science session will include topical oral and poster presentations given by doctoral students and post docs to introduce also multidisciplinary approach to research and possibilities for networking.

The Oulanka Research Station provides excellent facilities for our research seminar and workshop. During our field excursion we will visit the meteorological field station followed then by scenic walk to the top of Konttainen hill.

The Thule Research Seminar and Workshop also can serve well as a research plan seminar of the University of Oulu Graduate School ‘UniOGS’ for the early phase PhD students. Their presentations will be followed by discussion by fellow students and supervisors.

Special thanks to Mikkel Bue Lykkegaard for editing this abstract book. Thanks for Hannele Heikkilä-Tuomaala for providing a cover page design for abstract book and graphic consultation. We wish to thank the staff of the Oulanka Research Station for their contribution in all arrangements. The research seminar and workshop are financially supported by the Thule Institute.

We warmly welcome you to the research seminar and workshop and wish you stimulating discussions!

Kari Strand, Arja Rautio, Eva Pongrácz and Riitta Kamula
Programme

Wednesday October 1, 2014

8:15  **Departure** by bus in the front of the Thule Institute, the University of Oulu (address Paavo Havaksentie 3, Oulu)

Arrival in the Oulanka Research Station, Kuusamo at 12

12:00  **Welcoming address and lunch**

13:00  **Excursion** to meteorological field station and Konttainen hill.

15:00  **Opening session**

- Introduction of Oulanka Research Station and Its Activities, Director Riku Paavola, Oulanka Research Station
- Thule Institute’s Research Programme for Understanding Change in the North and the Best Scientific Practices, Research Prof. Kari Strand, Thule Institute, University of Oulu
- Introduction of Thule DP, Res. Prof. Arja Rautio, Centre for Arctic Medicine, Thule Institute, University of Oulu
- Illuminating the Arctic: Introducing the LUMINOUS Research Community, Dr, Director Eva Pongrácz, NorTech Oulu, Thule Institute, University of Oulu

17:00  **Dinner**
Sauna and mingling

Thursday October 2, 2014

8:00  **Breakfast**

9:00  **Keynote presentation**
Air Quality and Climate Change, Research Prof. Hannele Hakola, Finnish Meteorological Institute

9:30  **Science Session**

- Social and Technological Challenges in Present-Day Greenland, Mikkel Bue Lykkegaard, Arctic Technology Center, DTU
- The Metabolism of the Finnish Economy: Understanding exchanges between socio-economic and ecological systems, Pablo Piñero, NorTech Oulu (discussant Arttu Juntunen), Thule Institute, University of Oulu
- Sustainable Heating of Buildings in the North, Arttu Juntunen, NorTech Oulu (discussant Pablo Piñero), Thule Institute, University of Oulu
- Smart Grids and Social Wellbeing, Antonio Caló, Thule Institute, University of Oulu

11:00  **Lunch**
12:00 **Keynote presentation**  
Climate Change Adaptation – Structuring the Communication Process from Vulnerability Analyses towards the Implementation of Measures, Dr, Senior Scientist Philipp Schmidt-Thomé, Geological Survey of Finland

12:30 **Science Session**
- The Criticality of Indium: Final Sinks vs. Dissipative Losses, Eva Pongrácz, NorTech Oulu, Thule Institute, University of Oulu
- Winter Time Water Flow on Constructed Treatment Wetlands and Water Quality, Heini Postila, Water Resources and Environmental Engineering, University of Oulu (discussant Ekaterina Kaparulina)
- Late Pleistocene Ice Sheet Decays, Transport Mechanism and Provenance Changes Studied Via Heavy Mineral Geochemistry of Central Arctic Ocean Sediments, Ekaterina Kaparulina, Thule Institute, University of Oulu (discussant Heini Postila)
- Research Plan: The Effects of Climate Change and Land Use on Stream Biodiversity and Ecosystem Function, Romain Sarremejane, Thule Institute, University of Oulu (discussant Netta Keret)
- Family Relationships in Families with Violence - A multigenerational perspective, Anu Kangas, Thule Institute, University of Oulu (discussant Sandra Juutilainen)

Poster session:
- Structural Racism and Its Impact on Indigenous Health: A Comparative Study of Canada, Finland and Norway, Sandra Juutilainen, Thule Institute, University of Oulu (discussant Anu Kangas)
- Evolutionary Potential of Insect Life Histories – Implications to Trophic Interactions under Climate Change, Netta Keret, Department of Biology, University of Oulu (discussant Romain Sarremejane)

14:30 **Coffee**

15:00 **Doctoral Studies Workshop: Communicating science**  
Chair Dr, Director Eva Pongácz
- How to Give Scientific Presentations, Dr, Senior Scientist Philipp Schmidt-Thomé, Geological Survey of Finland
- The Increased Importance of Methodological Analysis in Scientific Publishing, Dr, Researcher Antti Huusko, Thule Institute, University of Oulu
- The Art of Applying, Dr, Director Eva Pongrácz, NorTech Oulu, Thule Institute, University of Oulu
- Round-up discussion

17:00 **Dinner**

18:00 **Group Work Session**  
Evening program with sauna, etc.
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<td>Oulanka Visitor Centre and the Kiutaköngäs Falls</td>
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Keynote abstracts
The air quality in Finland has been monitored since 1980, when acidification was the major environmental problem together with the trace element deposition originating from Kola Peninsula. Since that, air quality has improved a lot, but problems still exist. The European Environment Agency (EEA) estimates that the biggest risk to Europeans is caused by fine particles (PM2.5), especially in urban areas. Fine particles are harmful to people, because they can reach the lungs through the air that is breathed. After particles, ozone in the lower atmosphere is considered the most harmful air pollutant. Ozone is formed at the level of the earth’s surface when other pollutants react to sunlight. Ozone is also an efficient climate gas. Although the trends of many traditional air pollutants are declining, the concentrations of climate gases are increasing. Climate gas concentrations are measured at Pallas-Sodankylä Global Atmosphere Watch (GAW) station. Finland’s mean temperature has risen by less than one degree in the past hundred years. On the basis of climate models, the mean temperature is estimated to continue rising and precipitation will increase particularly in winter. In my presentation I will show air quality and climate gas measurements and trends in Finland and how climate has changed and is expected to change in future.
Climate change adaptation has gained considerable importance on the political and scientific agenda. There are some examples of climate change adaptation measures actually being implemented, but an overall shift in thinking for the need to adapt land use planning to climate extremes and potential changes to those is still lacking. It might in fact be argued that if land use practices were adopted to extreme weather events potential climate change impacts would be noticed far later, and to a lesser extent, than currently proposed. The exact impact of climate change on extreme weather patterns remains highly uncertain, and it is scientifically proven that the rising amount of damages and casualties observed over the recent decades is rather based on human vulnerabilities than on climate change impacts. It is of greatest importance to carefully structure the communication processes that are necessary to identify acceptable adaptation options. Climate (change) adaptation measures can only be implemented successfully if there is a common understanding on the exposure and the underlying vulnerabilities and risks. Risk perception varies among cultures and regions, and adaptation needs are usually weighted against economical interests. Adaptation measures must therefore be socially and economically feasible, and perceived as a benefit by the society. Examples of structuring of analyses concepts and communication processes are discussed, with outlooks on further development.
Supervisor abstracts
Thule Institute’s Research Programme for Understanding Change in the North and the Best Scientific Practices

Strand, Kari

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The themes under Thule Institute’s research programme are (1) Climate Change Dynamics, Impacts and Adaptation, (2) Human Health and Community Wellbeing and (3) Sustainable Resources Management. The programme consists total amount of 19 fixed-term research groups or consortiums all having major emphasis on doctoral training. Research group selection for years 2012-2016 was based on scientific evaluation. For the complete list of research groups and consortiums visit the web address: http://www.oulu.fi/thuleinstitute/research_themes. Aims are in better understanding dynamics and consequences of climate change and how to mitigate this change. Environmental protection, health and well-being call for further research. Interdisciplinary connections among research communities will be used to find also technological mitigation solutions. A specific doctoral program is built on the platform of the Thule Institute’s research.

Annual Thule Research Seminar and Workshop are parts of the activities of the Thule Institute’s research and doctoral programs. These are planned as forums for doctoral students and their supervisors to develop their research. The doctoral students and supervisors should closely work together during the thesis projects thus being beneficial to quality matters and planned schedules. The certain critical steps in the thesis work should be recognized for reaching satisfactory results and final target. First of all, the thesis work should have goals and an appropriate plan. Goals without work is like dreaming and that work needs then the required amount of independency. PhD studies demand certainly dedication and passion, which PhD students usually have. The relationship with the PhD student and supervisor changes during the thesis project. In the final phases, the supervisor is more or less given only questions and suggestions as the independence of the PhD student is growing. The supervisor needs to introduce all scientific criteria set by the academic community, which sometimes could be quite overwhelming and sensitive for the PhD student. A good thesis work, however certainly should challenge earlier research and ideas and finally create new scientific knowledge. Finally, the thesis defense is showing that the PhD student can trust to her or his own skills and resources. Always should be remembered that in a research work only authorized body will be research scientists themselves not media.
Global, environmental and climate changes impact the well-being of individuals and societies in the Arctic. At the same time the interests and processes of global economy meet the local in unpredictable way, seen as changes in cultural and socio-economic life and ways of living in the Northern communities. In addition, the climate change and the changes in natural environments can impair the physical security, especially in winter time. We need to seek solutions and adaptation strategies for safe and good life in urban and rural regions. The Arctic changes together with environmental issues are really current topic for our multidisciplinary Thule doctoral program. It covers the themes of Climate change, impacts and adaptation, Human health and community wellbeing, and Sustainable resources management - all these issues are needed when building sustainable communities and good life for the people living in the North.

The most important activities of Thule Institute are research and doctoral training. The format and name of the doctoral program has changed according to the trends and rules of the University of Oulu. Now it is time to change the name of the DP from Thule to Aurora, which means light of the morning, evening and night (sunrise, dawn and polar light). I hope that the courses and discussions in several meetings of the Aurora DP could support your studies and give good connections and network also for your future work and life.
The polar regions of the world are undergoing fast and dramatic changes that are anticipated to increase in the decades to come and result in significant global implications. The growing power of the "new North" changed the perception of the Arctic from peripheral to a new economic engine driven by its natural riches. Strengthening economic activity in the Arctic region is also a key target in Finland’s Arctic Strategy, which raises demand for arctic resources and expertise. The combined impacts of human activity and climate change also increase risks, and challenge human, natural and artificial systems. Climate induced changes in contaminant cycling threaten human health and necessitate finding markers to follow and estimate risk of exposure. The North is also becoming increasingly multicultural and pluralistic; new livelihoods and new inhabitants change societal stability, increase the challenge of adaptation and the risk of new diseases, violence and marginalization. The changes also trigger questions such as how to preserve safety and equity; how to produce a built environment that matches the needs of users and can adapt to changes; how sparse population and long distances challenge prevailing planning practices; and how users and service providers should communicate in order to ensure sustainability and adaptability.

The LUMINOUS Research Community is a collaboration effort of 120 researchers and 16 research groups in three research domains: Equality, diversity and change; Smart structures and Smart systems. Through trans-disciplinary cutting edge research, all researchers aim to work toward the common goal of building sustainable Northern communities. This requires recognizing the possibilities and challenges for sustainability, equality, equity, safety and well-being, both for individuals and communities. In light of these challenges, we will bridge the gaps between the life cycle of the Northern built environment and human well-being, and develop smart systems and solutions.

We define smart systems as those aware of their state, having the ability to act in an uncertain, changing environment and that can anticipate what will happen to them. While we acknowledge the far North as an area that belongs to the economically privileged part of the world, we also see it as a fruitful target for research because of its long history of both great challenges and smart solutions for human well-being. Thus it can serve as platform for emerging technologies and human agencies for enhancing sustainable communities under constant change.

To learn more about the activities of LUMINOUS, visit our page at http://www.oulu.fi/luminous/.
International scientific assessments, such as the Global Environmental Outlook and the Assessment Report of the Intergovernmental Panel on Climate Change, made increasingly evident that global economic growth can no longer be sustained without profound innovations of the energy regime. The global challenges which rose at the dawn of the 21st century, are stressing the limits of an infrastructure largely engineered to meet the needs of a highly centralized, primarily carbon based, energy network. The comprehensive and coordinated development of a set of technologies, referred to with the umbrella term smart energy grids, or smart grids (SGs), is a solution that can provide valuable answers to these challenges. Smart energy grids indicate energy production, transmission and distribution network systems based on a two-way communication between consumers and producers. Relying on a real time monitoring of the grid conditions, this model of energy network allows for a more dynamic system control, making it possible to respond more effectively to changes, improving energy efficiency, security and quality.

The development of smart energy grids is often described as the result of the convergence of a distributed communication network and the distributed energy network. In this framework, the two-way communication between consumers and suppliers occurs on two parallel levels: on an energy network level and on a communication network level. At the same time, there is currently no generally accepted definition of SGs, reflecting, in many respects, a lack of generally accepted understanding of what SGs should be, do or achieve. As a consequence, sustainability analyses focus almost exclusively on economic (read financial) and environmental (generally centered on the reduction of greenhouse gases emissions) performances. In our work we intend to discuss these elements, recognizing in the social wellbeing impact a key characteristic in the smart grid development efforts, with social acceptability providing a make or break feature, especially in terms of stakeholder participation, transparency and compliance.
Criticality is a research area receiving increasing attention. A raw material is labelled ‘critical’ when the risks of supply shortage and their impacts on the economy are higher compared with most of the other raw materials [1]. Clean energy technologies currently constitute about 20 % of global consumption of critical materials [2], and the share of global consumption of critical materials will grow as clean energy technologies are deployed more widely in the decades ahead. The EU study on the criticality of materials [1] concluded that supply risks may arise within a time period of 10 years, which would give rise to unrealistic expectations regarding the possibility for policy makers to intervene.

The two key elements in the criticality of metals are that they are minor metals and they are in dissipative uses. A screening of dissipative losses for critical materials has been performed by Zimmerman and Goßling-Reisemann [3] found that many critical materials have dissipation rates of over 90%. It has been presented in the literature to aim at establishing ‘clean cycles’ [4]. While this is a valid aim, its main attention is ensuring the purity of major metal flows and views minor flows as “pollutants” weakening the quality of major flows.

Figure 1a illustrates a simplified metal and product life cycle. The metal cycle is closed if end-of-life (EOL) products are entering appropriate recycling chains, leading to recyclates replacing primary metals. The life cycle is open if EOL products are neither collected for recycling, nor entering efficient recycling streams. Open cycles are typical for many metals in EEE [5]. In case of metals currently in stocks, secondary materials are entering the recycling cycle with some delay. Final sinks include products being discarded to landfills, products recycled through inappropriate technologies where metals are not or only in inefficiency recovered and metals recycling in which the functionality of the EOL metal is lost.

Figure 1 a) Simplified metal and product life cycle;  
  b) Dissipation form the point of parent metal streams: the primary streams get contaminated;  
  c) From the point of the critical metal, the amount in final sinks grows.

We need to refine the view of clean cycles for critical metals. The current view is that of Figure 1b), where the minor metal is a “pollutant” in the major flow, whilst in reality, when dissipated, the critical material ends up in a final sink (Figure 1c), from where it is unfeasible to recover.

A critical metal in research interest is Indium, because of the increasing demand to produce Indium Tin Oxide (ITO). ITO is a transparent conductive layer used in LCD screens and in thin-film solar photovoltaics (TF PV) [6]. More than 50% of globally refined indium is used to produce LCDs, whilst TF PV manufacturing accounts
for less than 2% of total demand [7]. In addition, light emitting diodes (LEDs) rely on Indium as well. The physical scarcity of Indium may be a major obstacle to mass production of LEDs as well [8].

It has been suggested that waste should be viewed as “a thing that in the given time and place, in its actual Structure and State, is not useful to its owner”. In addition, waste could be viewed as something that is “not performing its intended purpose”. [9] This is also true for the case of critical metals such as Indium being mixed in parent metal streams. Even though physically part of a useful object, they do not perform in accordance with their intended purpose; therefore, they can be regarded as a wasted resource. When dissipated critical materials are viewed as waste, the waste management hierarchy applies, which puts preference to waste prevention activities.

In order to avoid the dissipation of critical metals, there is a need to define the waste criteria for critical materials and propose a strategy for their minimization. Attention need to be given especially to describing the critical conditions of materials, and distinguish between materials in circulation within “clean flows” and those being lost due to dissipation.

References

Student abstracts
There are several technological challenges connected with constructing sustainable infrastructure in the Arctic region. These include, but are not limited to, poor accessibility, limited human and material resources, environmental fragility, harsh weather conditions and unique geophysical regimes. Solutions to these challenges exist, but are generally costly, both to establish and maintain. Furthermore, the economies of the High Arctic countries are vulnerable, most of them being virtually mono-product.

The thriving of human settlements in the Arctic area is therefore dependent on the development of simple and cheap technologies, along with innovative ways to ensure future economic stability, while preserving the unique and fragile environment. The mining and oil drilling industry seems to be a lucrative partner for several Arctic countries, but it is a business which involves high risks, both for the social and the natural environments. The Arctic Technology Center of DTU are addressing these challenges through various research programs and a bachelor program aimed at engineering capacity building for the Arctic in general and Greenland in particular.
In the sustainability arena, there is a growing interest in unconventional and holistic ways to study the relationship between natural and socioeconomic systems. In this search, the metaphor of the social metabolism (SM) is often invoked. According to this metaphor, socioeconomic systems have necessities inherent to their operation in terms of energy and materials received from nature, just like living organisms. These materials, in harmony with the mass conservation principle, sooner or later will return to the environment as waste or dissipated matter. At the core of the system, human labour and consumption act as regulatory entities (Ayres and Ayres, 1998).

For this project, it is maintained that the study of the social metabolism could help us to identify the biophysical roots of economic prosperity, shedding some light on materials and emissions inherent to the sustenance of socioeconomic systems and providing relevant findings on the path toward a more sustainable future. Therefore, the ultimate goal of the research is to explore the Finnish economy metabolic profile as an attempt to contribute to lay the foundations for a transmutation toward a less material intensive, clean carbon and more sustainable metabolism.

Regarding to the methods for this proposal, Input Output Analysis (IOA) is the key tool whereas others, such as Life Cycle Assessment (LCA) or Material Flow Analysis (MFA), will be used for complementary tasks only. IOA was first introduced to economics more than 80 years ago by Nobel laureate Wassily Leontief, and later applied to the sustainability field in the heat of the environmental debate. Nowadays it is considered a core tool within the System of Environmental – Economic Accounting (SEEA) published by the United Nations et al. (2014) and follow by statistics agencies worldwide. Basically, IOA is used to understand the relationship between economic sectors, focusing on the exchanges in monetary or physical terms which take place between the main activity branches. Moreover, because it tries to cover all activities within the economy it is especially suitable for studying the exchanges between socioeconomic and ecological spheres. For Finland, a remarkable previous experience using IOA in studying material and energy flows through the economy could be found in the ENVIMAT model (Environmental Impacts of material flows caused by the Finnish Economy) (Seppälä et al. 2009).

On the basis of the theoretical framework and methods described, the research aims are: Firstly, to assess the role played by different industries and final users (household, exports and investments) as driver of material extraction and environmental burden. Secondly, to identify through which paths flow especially relevant materials for the environment and the economy -critical materials- and waste products. Finally, to explore in pioneer way the social and environmental dimension of the Finnish imports by following loads along the supply chain of goods and services of key trade partners.

References
Heating of houses in sparsely populated northern areas in a sustainable way is a challenge in demanding climate conditions, when the expectation is that the emissions of energy production need to be minimized.

The most environmentally friendly options in thermal energy production are low-carbon solutions such as the utilization of biomass, solar radiation, or geothermal heat. Also electricity generated from renewable energy sources (RES) is a viable option. Since geothermal heat in the Nordic countries is not easily accessible due to the bedrock, the best available options are biomass, solar radiation, and electricity from RES. Currently, a considerable share of the thermal energy is produced in combined heat and power and condensing power plants, and then distributed through a district heat network to thermal energy end-users. These power plants typically burn coal, peat, waste, forest residues, and industrial residues as energy source, thus resulting in a notable carbon footprint. Better technical solutions are available already, but monetary and political obstacles hinder the development in both industrial and small-scale production.

Apart from the environmental challenges, another problem to overcome in the production of thermal energy is its varying demand. Variation is a result of end-user behaviour and increasingly the intermittent nature of some RES. The phenomenon is similar to the one in power system; production must be in balance with consumption at all times. Recent research suggests that there are ways to exploit the inertia of the buildings and thereby enable power plants with more stable operation. More conventional option is to apply thermal energy storage in the energy system. Thermal storage can vary in type, capacity, and arrangement within the system, and the most convenient options for different settings need to be studied. A novel aspect in this study is to recognize the connection points for thermal and electrical energy systems, and evaluate the possible benefits and drawbacks of utilizing them in system architecture planning. For example, one connection is to transform excess electrical energy from wind power plants to thermal energy, to be stored or used in households via the district heating network.

The aim of this research is thus to study what elements an alternative low-carbon thermal energy system should consist of and to recognize the measures to take in order to achieve it.
Due the increasingly warmer winter time the constructed wetlands should be used more generally also winter time for purifying runoff from peat extraction areas. The aim of this study was 1) monitored the ground frost formation and based on that evaluate where the runoff water can flow and 2) evaluate the water purification on constructed treatment wetland during winter time.

In this study was three constructed treatment wetlands, which treat runoff from peat extraction areas also winter time in Finland. Two of these wetlands located in the North Ostrobothnia (Pehkeensuo and Korentosuo), and one in Western Finland area (Kapustaneva). Each of these areas was installed three ground frost pipe on January 2010 and fourth ground frost pipe on Pehkeensuo were installed on October 2010. These ground frost pipes were monitored during two winter time. In addition outflow and partly also inflow water quality was analyzed.

Based on the ground frost pipe results, the water can some places flow also winter time on the above peat layer or the upper peat layer, which is not frozen. However, some places the ground frost layer was even 30-40 cm deep. Water purification on constructed wetland can happen also winter time under the snow covers, so then these areas are useful for water purification purposes.
Late Pleistocene Ice Sheet Decays, Transport Mechanism and Provenance Changes Studied Via Heavy Mineral Geochemistry of Central Arctic Ocean Sediments

Ekaterina Kaparulina¹, Kari Strand¹ and Juha Pekka Lunkka²

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²Oulu Mining School, University of Oulu, Finland

The central Arctic Ocean sediments preserve the data of paleoenvironmental conditions in the Arctic region, understanding of which as well as reconstructions of past events may help to estimate the current changes in the Arctic environments and predict future scenario of environmental and climatic development in this region. The marine sediments are the most reliable recorders for major past environmental changes. The detailed study of marine sediments via different proxies provides valuable information for paleoenvironmental reconstruction. The sediments deposited in the seas and oceans or marine sediments provide the most continuous record of Earth surface processes because: there is nearly always accommodation space to put the sediment; sediment is always being transported from the land to the sea; and further sediments are being produced biologically and chemically in the ocean waters. The mechanisms for transport of sediments from the land to the sea are rivers, ocean currents, as well as sea ice and icebergs in high latitude environments. The detailed geochemical composition of heavy minerals in marine sediments provides information for prominent provenance areas with further reconstruction of the transport ways.

The detailed study of two decays of Eurasian Arctic ice sheet by investigation the central Arctic Ocean sediments during Marine Isotopic Stages (MIS) 4-3 and 5-6 for their provenance and transport processes is the main aim of current research. The mineralogical and geochemical data generated from the sediment core (AO96-12pc1, Lomonosov Ridge) make it possible to evaluate the Barents-Kara Ice Sheet history and to make assumptions about those probable sediment drainage and provenance changes. Detailed study of sediments via heavy minerals proxy allows the best implications of the above mentioned aims. The obtained dataset of heavy minerals compositions by Electron Probe Microanalyzer (EPMA) were compared with previous published data generated from the study of rocks of the prospective provenance areas. Correlation of the generated data allows to assume the distinct source areas and also the prominent pathways of the central Arctic Ocean sediments of terrigenous origin by sea ice and iceberg transport. The provenance area was divided into main sources according to the heavy minerals assemblages, e.g. we identified Amerasian and Eurasian source areas, including Precambrian Anabar massif, Permian-Triassic Putorana Plateau flood basalts and Lower Paleozoic Verkhoyansk Fold Belt, as a possible provenance for central Arctic sediments.
At the northernmost latitudes, air temperature is predicted to increase steeply by the end of the century. Precipitation and snow-fall are also predicted to change with potentially significant effects on river flow regimes. As a consequence, aquatic organisms are likely to confront novel flow regimes and water temperatures that may strongly affect their distribution and ecosystems functioning. In boreal regions, water temperatures are unlikely to exceed the upper physiological limits of species adapted to warm waters, but cold-water species may be unable to escape the novel thermal regimes and their distributions may be strongly affected by global warming. Most research on human-induced stressors in freshwater ecosystems has focused on the effects of single factors. In reality, most ecosystems are subjected simultaneously to multiple stressors. However, little is known about the interactive effects of climate change and other anthropogenic stressors such as eutrophication or acidification which might synergistically affect communities and their functioning.

The main objective of this PhD project is to assess how changes in local and global factors associated with climate change will influence stream biodiversity and ecosystem processes and, consequently, stream bioassessment. I aim to use a combination of broad-scale correlative surveys, manipulative field experiments and mesocosm experiments to address the following questions: 1) Does climate change affect the performance of stream bioassessment? 2) Do the combination of land-use and climatic related disturbances modify ecosystem processes and stream assemblages? 3) What are the likely effects of climate change on stream invertebrate community composition?

To answer these questions I propose: (1) to build a model to predict the effects of climate change induced modifications of temperatures and discharges on biodiversity of stream assemblages. Results from this modeling exercise will allow to identify the species and stream types most vulnerable to climate change. In addition, the results will help to understand how compositional variability (i.e. beta diversity) of macroinvertebrate assemblages is likely to change in response to climate change. (2) I will conduct a manipulative field experiment to address the combined effects of acidification and eutrophication on stream organisms and ecosystem processes. This study will help to understand responses of stream communities and ecosystem processes to multiple stressors and their interactions. Lastly (3), I will use mesocosm experiment to disentangle the independent and interactive effects of water temperature and nutrients on stream organisms and ecosystem processes. This experiment will also reveal the relative importance of microorganisms and invertebrates on organic matter decomposition, and how this might vary with the environmental context.
This study examines family relationships across generations in families with violence. The aim is to explore the family relationships and the progression of relationships both individually and intergenerationally, and also to track elements of change in relation to violence.

Currently the data consist of 23 interviews with 12 persons from 8 families in Northern Ostrobothnia and Lapland. All interviewees are victims of physical violence. The method of interviews is a thematic in-depth interview. The data is analysed using a qualitative method. My initial theoretical framework for the analysis is Bowen’s family systems theory. According to the theory, people are more likely to repeat their roles in the family of origin the less they have achieved emotional autonomy from the family members and the family relationship processes.

Preliminary results indicate that there can be many kinds of violence in various family relationships and that different family members can be differently affected by it depending e.g. on their gender, time of birth and their position in the family constellation. It also seems that being subjected to emotional abuse and control in the family of origin may increase the vulnerability to a similar kind of abuse and control in the family of procreation. The emotional abuse and control may or may not be accompanied with physical violence and it typically continues to characterize the parent-child relationship in adulthood. The presence of physical violence in the family of origin seems to lead to worse outcomes and higher tolerance to violence in the family of procreation, but the progression is not straightforward.

Change in the individual and intergenerational level is slow despite awareness of maltreatment and conscious effort to act differently. It appears in my data that that one of the key elements in the change process is the person’s own realization and conviction of the need for a change in their own life. This process can be facilitated by e.g. help providing organizations and other people’s actions. It also appears in my data that relatives do not necessarily intervene in violence even when they are aware of it, although they may provide help in some other ways.

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The theme of the research is based on the health disparities of Indigenous peoples that exist even in rich countries like Canada, Finland and Norway. Previous studies have documented that individuals who report experiencing racism have greater rates of illnesses (Williams & Mohammed, 2009). While this body of research has been invaluable in advancing knowledge on health inequities, it still locates the experiences of racism at the individual level. Yet, the health of social groups is likely most strongly affected by structural, rather than individual, phenomena. (Gee and Ford, 2011) The structural forms of racism and their association to health inequities remain under-studied.

Residential schools and boarding schools were examples of colonial education systems that were discriminatory and racist by design, whether or not this intent was embedded directly in the policy. These schools existed in attempts to ‘civilize’ Indigenous people, and produced similar experiences of intergenerational impacts at the individual, family, community and nation level for Indigenous peoples worldwide (Smith, 2009). This study aims to investigate the relationship between structural racism and residential school and boarding school attendance.

Article based dissertation includes the following articles:


Theoretical framework and conceptual considerations

I utilize a decolonial theoretical framework with the Two Row Wampum as my starting point. It is a Haudenosaunee philosophy that embodies equitable relationships between individuals, nations, and the environment. Also relevant to my theoretical discussion is Foucault’s theory of power and critical race theory.

References

Evolutionary Potential of Insect Life Histories – Implications to Trophic Interactions under Climate Change

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In seasonal environments, only a part of the year is suitable for growth and reproduction, which imposes selection on traits associated with timing of life history events (i.e. phenology). The predicted effects of the climate change in boreal region include increasing year-around temperature, prolonged summer and shortened period of snow cover and call for evolutionary changes in life histories to match with the novel selective regime. Apparently, climate change would shift optimal phenologies towards spring and ease time constraints for growth and development. The worst case scenario is that species-specific responses to environmental change disturb temporal asynchrony between trophic levels (e.g. insects vs. insectivorous birds) impairing function of whole ecosystems.

Organisms adapt to prevailing conditions by phenotypic plasticity or microevolution. Microevolution requires evolutionary reactive additive genetic variation in respective characteristics and takes place across generations. Because the whole life history is under selection and adaptation is a function of several interacting traits, the optimization of any trait independently appears impossible. Hence, genetic variances and covariances among the traits determine evolutionary potential of any trait and need to be studied to predict the direction and rate of evolution under environmental change.

To study evolutionary potential of insect life histories, we applied trivariate Bayesian Animal Model approach to data on growth parameters of Chiasmia clathrata (Lepidoptera: Geometridae) larvae with known degree of relatedness. The pedigree-based analysis segregates additive variation from total phenotypic variation and enables estimation of heritability as well as genetic covariances among the traits. We concentrated on three key elements: large body size determines fecundity and can be achieved only by prolonged development time unless variation in growth rate that can be allocated either of the two traits is taken into account.

Nationwide analysis revealed that each trait express relatively high heritability, which indicates remarkable evolutionary potential in these traits. At the regional level, however, heritability estimates were reduced and showed spatial variation. In the extreme time-constrained bivoltine populations, development time (and growth rate) is under strong selection and has negligible evolutionary potential. In less time-constrained univoltine populations, development time is highly heritable, but constrained by negative genetic correlation with body size, which is under strong fecundity selection.

Our results suggest that seasonality modifies insect life histories resulting in adaptive responses associated with only limited evolutionary potential locally. Apparently, evolutionary potential of traits that affect insect phenologies, and thus trophic interactions, is highly dependent on gene flow among geographically distinct populations. Even then, genetic correlation structure among traits in question has potential to limit micro-evolutionary change unless correlation structures as such are labile.