



UArctic Congress 2016

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Abstract Book

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UArctic Congress 2016 Abstract Book

University of the Arctic/University of Oulu
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Welcoming words from UArctic President

I am very pleased to welcome everyone to our first ever UArctic Congress, hosted by St Petersburg State University. The idea of the UArctic Congress 2016 is to bring leading circumpolar scientists together with UArctic's leadership and members, including our Thematic Networks, Rectors' Forum, Student Forum, Council and Board of Governors.

For this unique event, the choice of St Petersburg is a fitting location - an important and historic meeting point between East and West. Further, as a long-standing UArctic member, Saint Petersburg State University is a high quality education and research institution, whose scientific discoveries and achievements of professors and alumni include eight Nobel Prize winners.

The centerpiece of the UArctic Congress 2016 is the Science section, showcasing the best that northern science has to offer from across the circumpolar world and beyond. The Science section promises an exciting array of themes and sessions, and the range of participants from key speakers and UArctic members will highlight and celebrate the importance of circumpolar cooperation in northern research and higher education.

I am certain we will enjoy the famous Russian hospitality from our hosts and see amazing historic locations in and around the city.

I look forward to meeting you all in St. Petersburg.



Lars Kullerud

UArctic President

Foreword

In times of change, the need for objective scientific knowledge and collaboration across conventional boundaries becomes more important than ever. University of the Arctic has throughout its existence promoted the dialogue between the academia, policy makers and the general public over the circumpolar region, and continues to be a driver for collaboration in research, education and capacity building both in the Arctic and globally. At the moment, new prospects with promising economic potential in the Arctic area are gaining global interest. As the utilization of these emerging possibilities are often accompanied by effects on environmental and societal sustainability, there is a strong need for research in this area.

The first ever UArctic Congress 2016 gathers together over 400 participants from the arctic scientific community and UArctic Members to learn from each other and to exchange ideas for a sustainable future in the Arctic. The Science Section focuses on five topics of current scientific interest: Vulnerability of Arctic environments and societies, local and traditional knowledge, building of long-term human capacity, and new markets for the Arctic including trade, tourism and transportation. These topics are in the core of UArctic research activities that strive to find solutions to the key challenges via transdisciplinary research, conducted by the Thematic Networks and UArctic Institutes, and through co-operation with Arctic scientific organizations.

The fore mentioned themes will be presented during the Science Section in numerous high-level keynote presentations and parallel sessions. The members of the scientific community have taken the first ever UArctic Congress Science Section close to its heart; over 270 abstracts can be found from this abstract book and an open-access eBook will be published in 2017 to follow. I wish to thank the scientists across the circumpolar region for their enthusiasm in submitting abstracts and participating to the important dialogue on securing a good future to the Arctic.

I wish to express a special thank you to the UArctic Congress 2016 Scientific Program Committee for their contribution to the success of the meeting, and to the local organizers at the St. Petersburg State University and UArctic staff for their unparalleled efforts in the practical arrangements of the congress.

I wish you all a productive and successful UArctic Congress 2016!



Kari Laine

UArctic Vice-President Research

Thule Institute, University of Oulu

Plenary sessions



Reindeer in Sarek National Park, Lapland, Sweden, 2009. (Kitty Terwolbeck, Wikimedia Commons)

IASC perspectives on Arctic science cooperation

Barr, Susan

Norwegian Directorate for Cultural Heritage

President of the International Arctic Science Committee (IASC)

The International Arctic Science Committee (IASC) has existed for 26 years with the aim of initiating and facilitating leading-edge arctic research. Through its 5 Working Groups IASC brings together scientists concerned with all aspects of arctic research, including social sciences and the humanities. In addition to the 8 arctic countries, 15 other countries with active arctic science programmes are members of IASC, and the number grows regularly. IASC also cooperates with its sister organization in the Antarctic - SCAR, the Scientific Committee on Antarctic Research. IASC has had a formal agreement on cooperation with UArctic and IASSA since 2011 and all 3 are observers to the Arctic Council. In 2015 IASC presented the results of ICARP III, which was a 2-year open process to identify the overarching research themes for the future. The speech will elaborate on the above subjects and give details of other aspects of IASC's activities, outreach and cooperation initiatives.

“Hidden” Challenges in Arctic Science

Callaghan, Terry V.

Royal Swedish Academy of Sciences (Retrd.), University of Sheffield, Tomsk State University, INTERACT

Johansson, Margareta; Royal Swedish Academy of Sciences, INTERACT, University of Lund

Within science there is an implicit arrogance that we seek the truth and we are objective. However in practice we are ever more submerged in quests for ever increasing amounts of data and ever increasing detail that often isolates us from the wider context of why we are doing our science. To quote the astrophysicist Neil de Grasse Tyson, “..deep understanding comes not from how well you describe an object [or system] but from how that object [or system] connects with the larger body of acquired knowledge and its moving frontier.” At this time of unprecedented climatic and environmental changes in the Arctic, there are important research agendas such as ICARP III that set out major, agreed priority research questions. However, to answer these questions we need to stand back and evaluate constraints on our science beyond the usually perceived lack of funding and other resources. This simple paper focuses on personal experience over half a century, and on experience working within the INTERACT Consortium of Arctic research stations, on the persisting constraints on our attempts to understand changing Arctic environments and ecology despite many major advances. The aims of the paper are not to review major science challenges that are presented in several authoritative documents such as ACIA 2005, SWIPA 2011, and the three ICARP meetings of 1995, 2005 and 2015. Instead, we explore fundamental challenges presented by time scales, spatial scales, and approaches. Finally, we explore potential solutions.

Hik, Peter

Professor, University of Alberta

The UArctic Congress Science Section has been organized around several themes identified during the 3rd International Conference on Arctic Research Planning (ICARP III). But from the very outset, ICARP III had four broad, over-arching and ambitious objectives: to identify Arctic research priorities for the next decade; to facilitate improved coordination of various Arctic research agendas; to inform policy makers, people who live in or near the Arctic and the global community; and to build constructive relationships between producers and users of knowledge. The twenty-one organizations participating in ICARP III collectively recognized that there is an increasing sense of urgency to address the rapid local and global changes taking place in the Arctic. Understanding the consequences of these changes and their connection to environmental, economic, societal and geopolitical factors requires improved knowledge of local, regional and global processes. Of course there is a solid basis for addressing these challenges, including previous (and ongoing) research and assessments. But, given the relative scarcity of resources to conduct this work, it is increasingly necessary to create new opportunities so that these research challenges can be addressed in a coordinated, efficient, targeted, and systematic way. This is not a simple task, and during my presentation I will discuss some ideas about the implementation of ICARP III priorities.

Foreseeable future - foreseeable developments in the Arctic

Härkönen, Aleksi

Finland's Ambassador for Arctic Affairs

The Senior Arctic Official of Finland Aleksi Härkönen will discuss expected developments in the foreseeable future of the Arctic region. He approaches the issue from the point of view of climate change and its effects on humans of the region. Arctic and Northern communities must be made more resilient to weather the changes - how could this be done? How can sustainable development be made a policy guide instead of being an empty phrase - could the United Nations Agenda 2030 serve this purpose also in the Arctic region? Education is a sine qua non for human development -how could modern teaching methods be used to guarantee equal opportunities in education throughout the Arctic region? Arctic cooperation so far is a success story and the Arctic Council deserves its 20th Anniversary. What are the challenges of Arctic cooperation during the next 20 years?

Sergunin, Alexander

Professor, St. Petersburg State University

This paper aims to examining the paradigmatic shifts both in security thinking and dynamics in the High North. First and foremost, a broader understanding of security (not only hard (military) but also soft/human security) is now deeply embedded in the regional elites' security thinking. There is a clear shift from the hard to soft/human security challenges in the Arctic. Issues, such as climate change; environment degradation; nuclear safety; maritime safety; local communities – indigenous and non-indigenous – well-being; labor force migration; the need for proper sustainable development strategies; the need for an adequate regional institutional framework, etc. are now in the focus of the Arctic debate. The hard security challenges are still there but now they are reduced to issues, such as the lack of mutual trust (especially in the wake of the Ukrainian crisis), arms control regime and confidence and security-building measures; the interruption of military-to-military cooperation because of the above crisis; a relative growth of military activities in the region; misperceptions regarding each other's military modernization plans, etc. The central idea of my paper is that these challenges will not provoke a new geostrategic rivalry/confrontation in the Arctic and can be successfully coped with the help of various international cooperative instruments.

The Health Transition: A Challenge to Indigenous Peoples in the Arctic

Sköld, Peter

Arcum – Arctic Research Centre, Umeå University, Sweden

President of the International Arctic Social Sciences Association (IASSA)

Indigenous peoples from all over the world suffer from poorer health and social outcomes compared to non-Indigenous populations. This is especially true for peoples of the Arctic. Major health challenges include high morbidity levels, infant mortality, infectious and parasitic diseases, obesity and diabetes, suicide, mental health, and fatal accidents. However, Indigenous individuals have an equal right to the enjoyment of the highest attainable standard of physical and mental health, and states shall take the necessary steps with a view to achieving progressively the full realization of this right. The health situation of Indigenous peoples in the Arctic is discussed in a long-term perspective including historical and present experiences of colonization, and stressing the effects of climate change. Based on a recent study published in the Lancet it is suggested that development of Indigenous data systems is done in close collaboration with Indigenous peoples, so as to ensure that Indigenous values, health concepts, and priorities are reflected in them. Indigenous data identifiers are required to disaggregate data by Indigenous status in their national data systems, and meaningful Indigenous engagement in a revitalized global partnership for development is needed to address the shortcomings in global health governance. We need strong global networks that draw together Indigenous health leaders, academics, and policymakers to support the development of Indigenous data systems, and further international studies with extended coverage of Indigenous populations' health issues, such as morbidity, mental health, and burden of disease. This should lead to a development by national governments of targeted policies for Indigenous and tribal health that address issues of health service delivery and the development of high-quality Indigenous data systems. A final focus is put on the effects of melting permafrost in relation to outbreaks of infectious diseases such as anthrax, Spanish flu and smallpox.

Tabata, Shinichiro

Slavic-Eurasian Research Center, Hokkaido University, Arctic Research Center,
Hokkaido

I will talk about the preliminary results of the Japan-Finland bilateral project entitled “Russia’s final energy frontier – Sustainability challenges of the Russian Far North,” funded by the Japan Society for the Promotion of Science (JSPS) and the Academy of Finland and carried out in the period from September 2014 to August 2016. The aim of this project is to examine the sustainability of the development of the Russian Far North based on oil and gas development and to analyze the contribution of these regions to the development of the Russian economy as a whole. Since the Russian Arctic areas are vast and significantly different from each other, we have distinguished three types of regions. The first one is the regions where oil and gas production is a driving force of their socio-economic development. This type includes Yamalo-Nenets and Nenets Autonomous Okrugs. The second type is the regions where mineral resources other than oil and gas are their driving force, including such regions as Sakha Republic and Krasnoyarsk Krai. The third type is other regions that are not so rich in mineral resources and which are trying to take advantage of their external relations with neighboring countries, including Northern Sea Route. This type includes Arkhangelsk and Murmansk Oblasts. Although this project will end soon, our new project will fortunately enable us to continue the research in this direction. This new project is a national project entitled “Arctic Challenge for Sustainability (ArCS),” funded by the Ministry of Education and Science for the period 2015-2020. I am the principal investigator of one of the sub-programs of this ArCS project, entitled “People and Community in the Arctic: Possibility of Sustainable Development.” We are planning to conduct multi-disciplinary research in Russia together with foreign scholars, including our Finnish and Russian colleagues.

The Mystery of the Geological History of the Arctic Ocean Sea Ice Cover

Thiede, Jörn

Institute of Earth Science, SPbGU Saint Petersburg/RF

Co-authors: Zhirov A.I., Kuznetsov V.J., Savelieva L.A.

Northern Eurasia, belonging mostly to the Russian Federation, and its adjacent seas are subject to extreme and fast environmental changes which affect its societies (and their technical infrastructure) in dramatic and unprecedented ways in real time. Hence it is important to search for evidences which would allow to predict for the near future speed and extent of the alterations of the physical and biological boundary conditions and their effects on the human habitats of both indigenous as well as non-indigenous people. Important information on spatial and temporal rates of changes in the past (as well as potentially in the future) can be collected from historic time series observed in geological records. Looking at the geography of Eastern Siberia one has to realize that the modern rivers of the entire Siberian platform virtually all drain to the North into the Arctic Ocean. The history and evolution of this drainage pattern is only poorly known, but is paramount for the development and history of the Arctic sea ice cover. It can probably deduced from drill cores from Lomonosov Ridge which demonstrated that a clear sedimentary impact of an Arctic sea ice cover started to appear in Eocene sediments, approx. 48 Ma, much earlier than known hitherto. The onset of IRD (coarse Ice Rafted terrigenous Debris) sedimentation was preceded by the Azolla-fresh water event (lower to middle Eocene sediments flooded with spores of *Azolla*) which seems to mark the onset of the drainage of large quantities of fresh water to the Arctic Ocean leading to the formation of the Arctic sea ice cover and a general cooling of the climate over the Northern Hemisphere. We believe that this event may be linked to the plate tectonic collision of the Indian plate with the southern Eurasian continental margin. During the Neogene and Quaternary the Arctic Ocean sediment record formed frequently under the influence of intensive melt water events from the NW Eurasian glacial ice sheets. The events of the past 200 000 years are known in considerable detail, but it is difficult to link them to the history of the large rivers draining the Siberian hinterland due to the lack of geochronological data of their history. As part of a major study of the paleomorphology of Northernmost Eurasia we are therefore aiming at resolving the history of the Lena River from its upper to the lowermost reaches.

Arctic trade, vulnerable societies and environment – complex interplay of varied interests

Vauraste, Tero

Vice-Chair of Arctic Economic Council, Finland

Trade is an integrated part of social and societal developments, whereas creating added value is eventually perhaps the only sound base of sustainable economical development. Unless it exists, the value chain flows in the wrong direction, which is namely consuming economical assets instead of creating them. This actually the case in most of the Arctic societies as they are in a complex transformational process from traditional livelihoods into modern societies or some kind of a mix of those. As these developments create new markets and infrastructural needs, the challenge of producing added value still remains in many cases. There are 4 million taxpayers in the Arctic, in an area which combines eight nations and their indigenous peoples. Based on this, we may ask ourselves, whether creating value adding trade independently within the Arctic can be achieved in the foreseeable future. And if that is not the case, at least in certain areas, perhaps the solution is to combine these value chains into broader, even global trade value chains as vital parts. Here, the challenge is to ensure that local environments, societies and traditional livelihoods are always respected whilst integrating Arctic SME:s and societies into these chains. In contrast, large multinational corporations have been working in the Arctic and will be doing that in the future as well. An Arctic Ethical Business Code could at least to some extent ensure that the value chain additions are done in a sustainable manner. This could be produces as a joint effort of the WTO and the Arctic Economic Council.

Theme 1: Vulnerability of Arctic Environments



Pack ice off northern Baffin Island, Canada, 2013. (Paul Gierszewski, Wikimedia Commons)

1.1 Climate Change and Environmental Management in the Arctic



The session will focus on the various aspects of the climate change and its impact on the Arctic environment and society. A special emphasis will be attended on the social and economic consequences of the observed and expected climate change. Objective of the session is to discuss questions of interconnected processes in the Arctic environment in order to predict perspective complications and/or their beneficial effects on the sustainability of the region.

Convener: Laura Sokka, VTT Technical Research Centre of Finland

Geo-informatics technologies for decision support in marine activity within the Russian Northern seas including natural risks management and adaptation to climate changes

Abramov, Valery

Russian State Hydrometeorological University Malookhtinsky prospect 98 Saint-Petersburg Russia

val.abramov@mail.ru

George Gogoberidze, Russian State Hydrometeorological University, Russia; Eugene Istomin, Russian State Hydrometeorological University, Russia; Nikolay Popov, Russian State Hydrometeorological University, Russia; Ruslan Bachiev, Russian State Hydrometeorological University, Russia

Marine activity in the Russian Northern seas is an important component of the Strategy for development of the Arctic zone of the Russian Federation (AZRF) till 2020 (AS-2020). When implementing AS-2020 important aspect is the management of natural risks. The planning horizon of AS-2020 requires the development of measures to adapt to climate change. Management of natural risks and adaptation to climate change require the development of innovative technologies for decision support based on the principles of geo-information management. In Russia the program-target method (PTM) is widely used to manage the development of marine activity. In the framework of PTM considerable attention has to be paid to risk management. The most common is currently the factor approach to risk management which is based on dividing the variety of risks of different nature on the economic and non-economic external and internal. Important and least studied factor group external non-economic risks for the marine activity in the Russian Northern seas constitute natural risks including those caused by hazardous weather phenomena (HWP) and climate change in Arctic. We proposed that natural risks management must be conducted with using innovative GIS technologies to support decision making. In the Arctic climate change is happening the rate of which is approximately two times higher than the similar process in the planet as a whole. A possible cause is the arrival of black carbon in the Arctic due to the General circulation of the atmosphere including from Russia. To manage climate risks due to black carbon we proposed strategy for the development of clean technologies in the framework of the national system of control black carbon. This strategy involves extensive use of information-analytical systems as tools for decision support in the development of measures to adapt to climate change. Research is executed with financial support of the Ministry of education and science of Russia (state assignment 2525.2014/166).

Changing the composition of zooplankton species in the fjords of Svalbard as a result of climate change

Abyzova, Galina

Shirshov Institute of Oceanology of the Russian Academy of Sciences (IO RAS) 36
Nakhimovski prospect Moscow Russia

galina.abyzova@awi.de

Species of the genus *Pseudocalanus* (Copepoda: Calanoida) are widespread in the North Atlantic Ocean and Arctic zone including Svalbard. In previous studies demonstrated the presence of two *Pseudocalanus* species in Svalbard waters: *P. acuspes* and *P. minutus*. Later had been shown appearance *Pseudocalanus moultoni* in Svalbard fjords which are more related with warm Atlantic waters. Archipelago Svalbard is influenced by warm Atlantic currents and the cold Arctic water masses. Isfjord is the broad fjord of Svalbard and it has the greatest influence of ocean currents. A phylogeographic analysis of *Pseudocalanus* from Isfjord using mitochondrial DNA marker COI showed the presence of two species *P. moultoni* and *P. minutus* and their distribution in the fjord. The haplotype networks showed different patterns for the two species. Our data demonstrate an unexpected species composition for Svalbard indicating a strong influence of Atlantic waters on Isfjord. The results show that there are intraspecific differences in the genetic structure. These results combined with tree-based and haplotype network analyses demonstrated particular structure of populations and haplotype composition in branching fjords of Isfjorden. Due to changes in temperature and the increased influence of Atlantic waters on Svalbard began to change the structure of the population and species composition *Pseudocalanus* around Svalbard compared with previous years. It has been found that a relatively new for that region species *Pseudocalanus moultoni* began to spread wider and deeper into the fjord.

Afanasyeva, Victoria

VNIIOkeangeologia St. Petersburg Russia nab.Mojki

afanasyeva.vk@gmail.com

The Intergovernmental Panel on Climate Change (IPCC 2007) has highlighted a response of large ice sheets to climate change as the largest uncertainty in sea level rise predictions. Understanding how ice sheets behaved in the past can improve predictions of future changes. Global warming appreciably affect the Greenland Ice Sheet (GIS) second largest ice sheet in the world resulting in its accelerated melting change in dynamics and eventually contribution to sea level rise. (e.g. Velicogna & Wahr 2006; Kjær et al. 2012). An important player in the stability of the GIS might be the advection of relatively warm Atlantic waters with the West Greenland Current (WGC) bringing heat to the glacier tongues filling some of the West Greenland fjords (Andresen et al. 2011). The West Greenland Current transports water masses from the southern tip of Greenland northward. These waters are a mixture of relatively warm and saline Atlantic waters (Irminger Current) and cold and fresh Arctic waters (East Greenland Current) (Myers et al. 2007). Whereas the cold and rather low saline Arctic waters occupy the surface layer the warmer and saltier Atlantic waters predominate below 150m to 200 m (Seidenkrantz et al. 2012). The West Greenland Current propagates northwards along the west Greenland coast where it further mixes with cold arctic waters from the Canadian Arctic Archipelago (Knutz et al. 2011). The resulting waters finally drift southwards along the Canadian margin to the Labrador Sea forming Labrador Current. Previous analysis of these mainly Holocene sediment records has revealed some regional peculiarities. This study will focus on structuring knowledge about that.

Bashmachnikov, Igor L.

Department of Oceanography at the Institute of Earth Science of the St. Petersburg State University (SPbSU) 7/9 Universitetskaya nab. St. Petersburg 199034 Russia;
NIERSC- Nansen International Environmental and Remote Sensing Centre

igorb1969@mail.ru

Denis L. Volkov, University of Miami USA; Alla Yu. Yurova, NIERSC- Nansen International Environmental and Remote Sensing Centre Russia; Leonid P. Bobilev, NIERSC- Nansen International Environmental and Remote Sensing Centre Russia

Oceanic heat fluxes (Q) from the Nordic seas into the Arctic are investigated using an eddy-permitting Massachusetts Institute of Technology primitive equation model nested into an ECCO2 ocean state estimate where semi-empirical model coefficients are optimized for the Arctic Ocean. The model has 50 vertical levels and in the Nordic seas its mesh size is around 4 km. It is forced with the Re-Analysis model of the Japan Meteorological Agency for the period 1992-2013. The heat fluxes are estimated across 4 meridional sections in the Barents Sea Opening (BSO) and 4 zonal sections in the Fram Strait (FS). Comparison of the modelled means in-depth and along-section variations of water temperature volume fluxes and heat fluxes with the corresponding characteristics derived from in-situ measurements (Dickson et al. 2008) show a very close correspondence. The time-tendencies derived from the models and from in-situ data slightly differ as the model predicts about 2 times less annual increase of Q in the BSO and the FS between 1997 and 2007. The model data were further verified using satellite derived surface horizontal fluxes. Long-term variations of Q are investigated using wavelet analysis. The dominating periods are: seasonal 2-4 year and 6-9 year periods. Intensity of the seasonal and interannual variations of Q have similar intensity in BSO and FS. The seasonal variations of Q in the BSO has slightly higher correlation with volume flux (V) than with integral inflow temperature (T) while those of the FS correlate with V and very weakly with T . The 2-4 year interannual variations of Q are significantly correlated with variations of V and T in BSO and with V only in the FS. Relations of Q with local winds sea-level variations and local ocean-atmosphere heat exchange are discussed.

Permafrost thawing and CO₂ efflux of frozen peatlands: relationship spatial variability trend of climate change (Western Siberia Russia)

Bobrik, Anna

Department of Soil Science Lomonosov Moscow State University 1-12 Leninskie Gory 119992 Moscow Russia

ann-bobrik@yandex.ru

Georgy Matyshak, Lomonosov Moscow State University Russia; Olga Goncharova, Lomonosov Moscow State University, Russia

Climate change recorded in recent decades in the North West Siberia leads to a change in soils temperature regime changing plant associations gradual degradation of permafrost and changing landscape as a whole. Soil CO₂ emission is one of the major pathways by which CO₂ fixed by terrestrial plants is released back into the atmosphere. Understanding of the contribution of northern terrestrial ecosystems in global carbon cycle is very important for the assessment of interaction between oceans atmosphere and land. We investigated the spatial and temporal variability of active layer thickness and CO₂ efflux of CALM R1 grid. The research CALM site R1 (Nadym Grid) (N65°20' E72°55') is located on north of West Siberia (Russia) within the zone of sporadic permafrost of north taiga. Soil carbon dioxide emission is low and does not differ from year to year (156 ± 21 – 2013; 132 ± 17 – 2014; 170 ± 30 – 2015) mgCO₂m⁻²h⁻¹. Average content of TOC in the upper 15 cm of soil is high ($34.24 \pm 1.92\%$). The climatic record (weather station “Nadym”) indicates a progressive warming of annual air temperatures of ~2°C over the past 17 years (an average of -6°C to -4°C). For last 17-years period of CALM R1 measurements was determined that active layer thickness is characterized by high spatial and temporal variability. Area with small active layer thickness (<50 cm) decreased from 14% to 0% in this period. Areas with deepest thaw (more than 200 cm) increased from 16 to 56%. Average active layer thickness increases from 119 ± 6 to 166 ± 8 cm from 1997 to 2014. The values of microbial biomass are high but permafrost and hydrothermal conditions inhibit soil biological processes. So the main factor which determines the soil carbon efflux is the depth of permafrost table; it determines the organic matter transformation processes.

Bukatov, Aleksei

Marine Hydrophysical Institute RAS Kapitanskaya Str. 2 299011 Sevastopol Russian Federation

newisland@list.ru

Anton Bukatov, Marine Hydrophysical Institute RAS Russian; Margarita Babiya, Marine Hydrophysical Institute RAS Russian

Research of intraannual climatic variability of regional sea ice concentration distribution from 1969 to 2012 are carried out. The analysis of dynamics of monthly average climatic ice edge location is made on every longitude along its perimeter. The estimation of edge displacement velocity in latitudinal direction is given. Longitudinal sectors with the maximum and minimum intensity of edge dynamics are defined. Considerable dynamics of edge location in an intraannual cycle is observed in longitudinal sector from 20E to 55E and in the Bering strait. On annual average values of edge location latitude for every longitude degree the value of its linear trend is counted. For the majority of regions the trend is positive. The most significant the positive trend value is found in Greenland Barents and Chukchi seas and Bering strait. Regions with negative trend are noted. It is observed at Taimyr and in the east of Kara sea. Also there are regions such as Laptev and East-Siberian seas where on the one sections along edge perimeter its trend negative and on the others it is positive. Most essential on spectral density time cycles deviation of monthly average values of edge location latitude from its linear trend are revealed. The main signal in a spectrum is the oscillations with one cycle in a year. Oscillations with the maximum spectral density are in Barents sea. Also at spectrum of oscillations there are modes with two three and four cycles in a year. They are weaker annual and manifested only in separate longitudinal sectors. In some regions the low-frequency oscillations with the period from 2 and more years are observed. The analysis of the cross-correlation functions connecting edge latitudinal displacement and Wolf numbers of solar activity with take into account and without trend of edge position is made.

Elkina, Daria

All-Russian Research Institute for Geology and Mineral Resources of the World Ocean "VNIOKEANGEOLOGIA" 1 Angliysky Avenue St Petersburg 190121 Russia; St Petersburg State University Universitetskaya Embankment 7-9 St Petersburg 199034 Russia

darielfly@gmail.com

Alexey Piskarev, All-Russian Research Institute for Geology and Mineral Resources of the World Ocean "VNIOKEANGEOLOGIA" 1 Angliysky Avenue St Petersburg 190121 Russia; St Petersburg State University Universitetskaya Embankment 7-9 St Petersburg 199034 Russia

Considered to be an essential key for understanding of the Earth's paleoclimate the Arctic Ocean is currently an area of higher scientific interest. Despite the increasing number of studies dating of marine sediments here is still a challenge due to the lack of biological material restrictions of the radiocarbon method and discrepancies in the existing magnetostratigraphic patterns. A paleomagnetic study that was carried out on 8 sedimentary cores recovered from the Mendeleev Rise has been revealed magnetostratigraphy up to the Pliocene. Moreover these results have defined the mean sedimentation rate for the region which does not exceed ca. 1.5 mm/ kyr. It means that contrary to the other widely accepted estimations establishing a cm/kyr rate for the whole Arctic Ocean the sedimentation on the Mendeleev Rise can be characterized as rather low during the Quaternary period and first stage of Pliocene epoch. Spikes of the natural remanent magnetization intensity and magnetic susceptibility have been discovered near almost all assigned chron boundaries that may act as an independent factor for their determination and also as a signature of some fluctuations in the regional depositional regimes or other significant events. Furthermore inversions and abrupt changes of the Earth's magnetic field are nowadays thought to be linked with climatic variations to a greater extent than it was assumed earlier. Thus the determined boundary of the geomagnetic polarity reversals could be correlated with some short-term climatic events in the Arctic Ocean.

A multidisciplinary approach to investigate the Climate Change effects in Arctic permafrost areas

Guglielmin, Mauro

Dista Insubria University Via Dunant 3 21100 Varese Italy

mauro.guglielmin@uninsubria.it

Stefano Ponti, Insubria University Italy; Vito Vitale, ISAC CNR Italy; Nicoletta Cannone, Insubria University Italy

Since the mid-20th Century climate change (CC) has led to significant impacts in the arctic permafrost mainly through active layer thickening and permafrost thawing. The related terrestrial Arctic ecosystems that play a key role in the global carbon cycle have suffered different feedbacks. To monitor the effects of the CC at local scale a new multidisciplinary approach has been started at Ny Alesund since 2014. Here a grid of 50X50m at 55 m a.s.l. was equipped to monitor snow cover ground surface temperature (GST) active layer thickness and thermal regime and vegetation changes as coverage species richness composition and structure. In addition in each node the main soil properties were also characterized. Finally CO₂ fluxes measures with a IRGA system at the metric scale were carried out. Despite of the relative morphological homogeneity of the area GST and vegetation show a quite strong spatial variability. The vegetation coverage varies between 1-2% to 100% in metric plots. The first GST data are very variable with an annual mean ranges between -0.7 to -3.6°C. Vegetation type and snow characteristics seems the more effective factors in the GST differences. Snow cover in fact is extremely variable as demonstrated by the height during the last week before the onset of the melting ranged between 98 and 42 cm. The active layer thickness (ALT) as the depth of 0°C isotherm during the summer 2014 ranged between 117 and 194 cm. Despite of a good correlation between GST and ALT also the soil characteristics seem to be important in the ALT spatial variability.

The nutrient distributions and characteristics in summer of Kongsfjorden Arctic: Results based on a 10-year observation

Ji, Zhongqiang

The Second Institute of Oceanography SOA China 36# Baochubei Road Hangzhou
310012 China

jizq@sio.org.cn

Haiyan Jin, The Second Institute of Oceanography SOA China; Shengquan Gao, The Second Institute of Oceanography SOA China; Yanpei Zhuang, The Second Institute of Oceanography SOA China; Jianfang Chen, The Second Institute of Oceanography SOA China

Kongsfjorden is a glacial fjord in Northwest Svalbard Arctic. The water melting from glaciers in the inner fjord and the warm North Atlantic Current on the shelf will exchange with the fjord water inducing the variations of the nutrients. We have conducted about 10 years of observations on early July from 2006 to 2015. Five sampling sites were set from outer fjord to inner fjord for long-term nutrients and Chlorophyll a study above 200m. According to the 10-year observation this study achieved a general pattern of the nutrients (i.e. nitrate silicate and phosphate) distribution. During this period the controlling water mass is the water from North Atlantic Current i.e. Atlantic Water (AW; $T > 3^{\circ}\text{C}$, $S > 34.65$) and Transformed Atlantic Water (TAW; $T = 1.0 \sim 3.0^{\circ}\text{C}$, $S > 34.65$). In general salinity nitrate phosphate and silicate were increasing with depth in contrast temperature and Chl a showed a decreasing trend. The nutrient contents in AW and TAW is much higher than the limitation content so in most of the water column it shows a nutrient-rich pattern. The surface water plays an important role on the biological pump and the food web. In SW the averaged nitrate phosphate and silicate content were 0.8 0.22 and 2.1 $\mu\text{mol/L}$. Together with the N/P and N/Si ratio (4.08 and 0.36 in average) they showed a status of nitrogen limitation. The water in SW is mainly from the tidal glacier and runoff while they play a different role on the contribution of nutrients i.e. dilution and support separately. In glacial water the nutrient contents are lower than SW however in runoff they are higher for silicate and nitrate (about 2.0-10.0 $\mu\text{mol/L}$ and 2.0 $\mu\text{mol/L}$). Besides another important factor influencing the nutrient distribution in SW is the growth of phytoplankton which consumes a lot of nutrients and might induce the nitrogen limitation.

Impacts of ice retreat on the phytoplankton communities and organic carbon sink in the Western Arctic Ocean under the Arctic rapid Change

Jin, Haiyan

Second Institute of Oceanography SOA China

jinhaiyan@sio.org.cn

Jianfang Chen, Yanpei Zhuang Zhongqiang Ji Second Institute of Oceanography SOA China

The Arctic is facing the rapid and severe changes in recent decades. With the temperature rising and ice retreating Arctic Ocean became warmer and fresher. Such kind of changes have the critical influence to the main primary production and the phytoplankton community structures. In consequence it changed on-site carbon flux efficiency. Furthermore the inputs of terrestrial organic carbon were also changed due to increasing river runoff thawing permafrost and coastal erosion. Nutrients photosynthetic pigments and bulk organic carbon index were investigated based on 4 Chinese Arctic Research Expedition (CHINARE) Cruises since 2008. The change of the primary production and the phytoplankton community in upper layer of the Ocean as well as the composition of sedimentary organic carbon were studied compared with the collected reference historical data. Pigments induced phytoplankton communities showed that diatom dominated in shelf area and with the continuously nutrients support by Pacific inflow water the pelagic ecosystem would be lasted much longer than before. while in the deep basin the phytoplankton were dominated by nano- and pico-phytoplankton (with relative abundance increasing of prasinophytes and cryptophytes) due to ice retreating and freshening caused oligotrophic conditions. This would affect the marine origin organic carbon sinking flux. The result indicated that the biomass of ice algae was decreased while the pelagic ecosystem dominated and phytoplankton biomass was increase with the ice retreating. The marine origin organic matter in the sediment was mainly influenced by the nutrient level and the primary production in the upper ocean. The contribution of terrestrial organic carbon was also evaluated based on a ternary model including N/C ratio $\delta^{13}\text{C}$ and BIT index parameters.

Assessment of Arctic amplification based on new climate regionalization and analysis of surface air temperature variability and trends

Johannessen, Ola

Nansen Environmental and Remote Sensing Centre (Nansen Centre Bergen)/Nansen Scientific Society (NSS). Thormøhlens gate 47 N-5006 Bergen Norway

leonid.bobylev@niersc.spb.ru

Svetlana Kuzmina, Nansen Centre (St. Petersburg) Russia; Leonid Bobylev, Nansen Centre (St. Petersburg) Russia & Nansen Centre (Bergen) Norway; Martin Miles, Uni Research – Bjerknes Centre for Climate Research Norway, Institute of Arctic and Alpine Research University of Colorado USA.

Arctic amplification of temperature change is theorized to be an important feature of the Earth's climate system. For observational assessment and understanding of mechanisms of this amplification which remain mostly uncertain thorough and detailed analyses of surface air temperature (SAT) variability and trends in the Arctic are needed. Here for evaluation of Arctic amplification authors define an Arctic Amplification Index (AAI) as the ratio between absolute values of the Arctic and Northern Hemisphere 30-year running linear SAT trends and present an analysis of Arctic SAT variability in comparison with mid-latitudes and the Northern Hemisphere. This analysis is based on an advanced SAT dataset – NansenSAT – and a new Arctic regionalisation created from hierarchical cluster analysis. It is demonstrated that the temperature amplification in the Arctic is characteristic not only for the recent warming but also the early 20th century warming (ETCW) and subsequent cooling. The amplification appears to be weaker during the recent warming than in the ETCW simply because the AAI index values reflect the more pervasive nature of the recent warming that reflects the background of anthropogenic global warming. Cluster analysis identified six major natural regions in the Arctic that reflect SAT variability specific features. Statistical comparison with several climate indices showed that the Atlantic Multidecadal Oscillation is the mode of variability that is most significantly associated with the amplified warming-cooling in the Arctic with a stronger correlation during the ETCW and recent warming than during the intermediate period. Regionally SAT and AAI differences are identified in terms of annual and seasonal rates of change and in their correlations with modes of variability.

King, Leslie

Royal Roads University 2005 Sooke Road Victoria BC V9B 5Y2 Canada

leslie.king@royalroads.ca

Astrid Ogilvie, Stefansson Arctic Institute, Iceland; Neils Einarsson, Stefansson Arctic Institute, Iceland

ARCPATH is an interdisciplinary Centre of Excellence project recently funded by NordForsk (<http://www.nordforsk.org/en/news/nok-112-million-awarded-to-four-new-nordic-centres-of-excellence-in-arctic-research>). Nordic team members are from Iceland Norway Denmark and Sweden with international members from Canada USA UK Russia China and Germany. It is led by Yongqi Gao Nansen Environmental and Remote Sensing Centre Norway and Astrid Ogilvie Stefansson Arctic Institute Iceland with co-applicants Níels Einarsson (Stefansson Arctic Institute) and Leslie King (Royal Roads University) among others. The context of the project is that recent rapid changes in the Arctic are a challenge to human welfare already at risk from socio-economic as well as climatic drivers. The project's main goals are: i) To predict regional changes in Arctic climate over the coming decades using innovative methods to capture both anthropogenic and natural factors in global and high-resolution regional models; ii) To increase understanding regarding how changes in climate interact with multiple societal factors including the development of local and regional adaptation measures; iii) To combine improved regional climate predictions with enhanced understanding of environmental societal and economic interactions in order to supply new knowledge on potential "pathways to action". These will be achieved through cross-disciplinary collaboration including: climatology; environmental science; environmental economics; oceanography and cryosphere research; marine and fisheries biology; fisheries management; governance systems; human eco-dynamics; and traditional ecological knowledge (TEK). Drawing on these separate but interlinking disciplines will enable ARCPATH to form a truly synergistic centre of excellence where the overarching goal is to foster responsible and sustainable development in northern communities. The project will focus on three Arctic regions: northern Iceland eastern Greenland and northern Norway. Research results will have clearly defined socio-economic relevance to the national interest of Nordic countries and these will be disseminated to policy makers and stakeholder groups. This presentation will present the research plan as well as emerging findings of the project.

Protecting Coastal Communities: International Cooperation against Oil Pollution in the Arctic Ocean

Kirchner, Stefan

University of Lapland Faculty of Law Yliopistonkatu 8 C 348 96300 Rovaniemi, Finland
stefan.kirchner@ulapland.fi

The dramatic reduction of sea ice impacts the Arctic Ocean environment and coastal communities. The reduction in sea ice cover threatens the entire biosphere of the Arctic Ocean. In this project it will be shown how a massive reduction of sea ice coverage will impact local communities along the coasts of the Arctic Ocean. Particular attention will be given to the potential impact of an increase of Arctic Ocean Shipping and the risks for coastal communities which will come with such an increased maritime traffic which is also driven by COSCO which announced the first regular liner service along the Northern Sea Route in October 2015. This increasing risk will then be contrasted against existing international legal rules. While the 1989 Exxon Valdez disaster which massively impacted the local coastal community could have been a wakeup call international law leaves much to be desired when it comes to prevent ship-borne pollution. While the overwhelming majority of pollution of the seas is caused on land coastal communities' long term interests are currently mainly protected through obligatory insurance schemes. It will be shown in this presentation how actors from across the Arctic including near-Arctic actors like the China the UK or the Northrange states the shipping industry and coastal communities can improve the practical and legal protection for coastal communities through pollution prevention in an increasingly busy Arctic Ocean.

High latitude northern Eurasian regions their vulnerability to climate change and the contributions of the KÖPPEN-Laboratory to decipher modes and rates of environmental change

Kuznetsov, Vladislav

Saint-Petersburg State University University Emb. 7/9 199034 St.Petersburg Russia

v.kuznetsov@spbu.ru

Andrey Zhironov, Saint-Petersburg State University, Russia; Jörn Thiede, Saint-Petersburg State University, Russia; Larisa Savelieva, Saint-Petersburg State University, Russia; Vladimir Sharin, Saint-Petersburg State University Saint-Petersburg & Polar Marine Geosurvey Expedition Lomonosov Russia; Grigory Fedorov, Saint-Petersburg State University, Russia

The paleoclimates of the youngest geological past are characterized by the great variability between Glacials and Interglacials which follow each other in a cyclical pattern (Milankovitch frequencies). This is of high socioeconomic relevance because our highly developed societies with their complex technologies urgently need scientifically based „early warning systems“ of the imminent climatic changes in the future. The Köppen-Laboratory of SPbGU tries to contribute to the question what this change may mean for the landscapes of the high Arctic and seas through producing 1) detailed paleogeographic and paleogeomorphologic maps; 2) providing precise dating of young sediment sequences and changes of their depositional regimes and 3) studying the fresh water fluxes from eastern Siberia into the Arctic Ocean. It is now well understood that the latter is a very important parameter for understanding global climate change in the course of the youngest geological past. The Köppen-Laboratory has the unique possibility of resolving the question if the fast changing Arctic environments can be used as „early warning systems“ for future changes. The large-scale geomorphological and Quaternary deposits maps have been created for the Svalbard Archipelago regions. An overview analytical geomorphological map of the Arctic has been composed in cooperation with Vniiokeangeologiya (St. Petersburg). The same scale orographical map of the Arctic is created now. None of these studies can be carried out without precise geochronological studies of the mid-late Pleistocene/Holocene sequences. We pay special attention on application and development of such palaeogeographical methods as micropaleontological (pollen foraminiferal) analysis geochemistry (elemental analysis) radioisotope (¹⁴C U-series) dating. Applying a comprehensive approach we have analyzed a number of the Upper and Middle Interglacial/Interstadial deposits from the northern regions of the East European Plain and Siberia. The joint Russian-German expeditions “Lena-2009-2012” resulted in creation of the “Photographic Atlas of Plants and Pollen of the Lena River”.

Assessment of Atmospheric Circulation in the Atlantic-Eurasian Region and Arctic Using Climate Indices. The Possible Applications of these Indices in Long-term Weather Forecasts

Latonin, Mikhail

Russian State Hydrometeorological University Saint-Petersburg Russian Federation

pianomike@yandex.ru

Oleg Pokrovsky, Russian State Hydrometeorological University Russian Federation

Ocean-atmosphere interaction is a very important chain when considering the elements of general circulation of the atmosphere which essentially defines the everyday weather that we experience. In the first part of this research an overview of the two key climate indices is provided that significantly characterize the weather in the Atlantic-Eurasian region. Namely the North Atlantic Oscillation and Arctic Oscillation indices were considered. The second part is devoted to the polar air outbreaks from the Arctic. It was founded out that North Atlantic Oscillation and Arctic Oscillation indices are not sensitive to the two completely different types of polar air outbreaks. The classification of polar air outbreaks was carried out. Based on this classification a conclusion about the presence of North Siberian anomaly that according to many features can be treated as the one more action center of the atmosphere was made. This has allowed to introduce a new climate index that was named Atlantic Arctic Oscillation index. This index characterizes the two types of polar air outbreaks with the high accuracy. A connection between the new climate index and temperatures in the regions that are investigated was analysed. Summer season in middle latitudes is becoming colder while winter season in the Arctic is becoming warmer and Atlantic Arctic Oscillation index shows it. One of the most important reasons of the diminishing Arctic sea ice is related to the domination for already 20 years of the second type of polar air outbreaks that cause high positive temperature anomalies in Eastern sector of the Arctic.

Coastal zone of the Euro-Arctic region of Russia - natural and social systems under climate change

Evgenia Markovskaya

Petrozavodsk State University

saltmarsh@mail.ru

Arctic coastal wetlands are vulnerable both to climate change and active industrial development. The “proactive ecosystem management” is one of many mitigation strategies in this case. This demands good background knowledge on ecosystem structural and functional characteristics. The ongoing global climate changes and the growing man impact influence lead to the disruption of functioning of natural complex of the Arctic coastal zone, which results in the disturbance of human activity affecting human health. The coastal wetlands unite such ecosystem types as coastal tundras, salt and brackish marshes, ephemeral sandy ecosystems and ecotones between all of them. They provide crucial ecosystem services having global significance: unique habitats including migrating birds and marine mammal species; carbon accumulation and store, matter balance regulation including accumulation of contamination; maintenance of the landscape integrity. The current threats to coastal wetlands are ocean pollution from offshore activity (including shipping etc.); enhancing access and infrastructure development; climate change reflected in sea level raising, high frequency of strong gales and storms and increase of ocean and soil temperature followed by thawing of permafrost. At the same time, on the shores of seas of Euro-Arctic region of Russia there is an active expansion of spheres of economic influence on the coastal zone of the Arctic seas, environmental safety ensures enhanced comfort of human life so highly specialized autotrophic components of coastal ecosystems, increased the risk of their disappearance in violation of these habitats. Studies of the interactions between abiotic and biotic processes enable us to determine the state of coastal biogeocenoses (development of the ecosystem) and make predictions of future changes. Held in the last 8 years comprehensive studies have shown that the constant volatility conditions leads to the fact that populations of plants and lichens do not reach the stage of full fitness and all species are in the stage of willing to make the microevolutionary changes in response to changes in the environment. The object of different legal assessments are primarily waters of the Arctic Ocean and its ice formations, and legal aspects of preservation of the coastal zone of Russia Euro-Arctic region (REAR) is controversial, waiting for a legally correct decision. Currently this topic is being rethought, not only in the context of climatic and economic changes that mark the contemporary processes in the Arctic region, but and with a lot of new knowledge on the state of biota of the coastal zone of REAR.

Environmental and economic consequences of climate change in the Northern Sea Route area for development of the Arctic

Masloboev, Vladimir

Kola Science Center of the Russian Academy of Sciences 14 Fersman street Apatity
Murmansk region Russia

masloboev@ksc.ru

Elena Klyuchnikova, Institute of Industrial Ecology Problems in the North, Russia

The Arctic is strategically important region for of the Russian Federation. One of directions of development are the Arctic communications. Global climate change impact on the ecological systems of the Arctic that is already causing economic losses and social problems. For the successful planning and implementation of measures for development of the Arctic communications is necessary for the registration of environmental-economic effects of climate change at all levels of planning. The positive aspect of climate change is increasing the duration of navigation and development of transport and tourism along the Northern sea route facilitating access to natural resources in the Arctic including shelf fields that will open new opportunities for economy but at the same time will generate additional threats to the environment. Will increase demand for highly qualified personnel and new technologies. Further reduction of resident population of the Arctic zone due to migration to other regions of Russian Federation and the aging population will lead to labor shortages. The role of scientific centers and universities will increase. Changes in bioproductivity of Arctic waters brings risks to the fishing industry and needed to develop aquaculture. Increasing productivity of forests moving of forest boundary to the North will promote the development of timber industry. Moving to the North pathogens of plants and animals leads to a reduction of food supply the occurrence of epizootics increasing the risk of losses in reindeer husbandry. The indigenous population the Saami and the Nenets have health risks due to new infections the worsening of conditions for storage of food changes in diet and disturbance of traditional lifestyles by increasing transport distance and increasing contact with non-natives. Scenarios of development for the Arctic zone show that intensity of Arctic communications will increase which will bring not only economic benefits but also significant challenges including environmental.

Mikhailov, Dmitrii

Saint Petersburg State University Russian Federation

st022903@student.spbu.ru

Sergei Korsun, Saint Petersburg State University Russian Federation

Climate changes affect biotic assemblages. The response of assemblage to induced environmental stress includes a shift in the community structure provided by transport of recruits from other populations. Less obvious but also important way of such shift is the in situ growth of dormant individuals activated when the new environmental conditions suite them. Foraminifera are meiobenthic protists diverse and abundant all over the world ocean including Arctic. They are well known for their intricate shell. Due to high fossilization potential of this shell Foraminifera are the traditional tool for paleoecological reconstructions affording for example extrapolation of past climate change events into the modern communities and vice versa. To improve our attempts in paleoreconstructions we still need a deeper insight in biology and ecology of modern foraminiferal species. In our study we investigate foraminiferal community response to environmental changes – transport recruiting (i.e. colonization process) and dormancy. In the present state of knowledge these processes are tightly connected in the foraminiferal life history. Dormant juveniles theoretically may be transported by water currents and then deposited in sediment where they stay inactive for years. They begin to grow if environmental conditions become suitable for them. Thus the dormant foraminiferal juveniles (“propagules”) form the pool in bottom sediments that ensures a rapid response of the foraminiferal community to the environmental stress. We deployed sediment traps which accumulated from plankton not only adult benthic foraminifera (as was expected) but also precipitating “propagules” of benthic foraminifera. Simultaneously we found the bank of “propagules” of the same species in the adjacent bottom sediment. So our experiments have proved the pelagic dispersal of benthic foraminiferal propagules. These results demonstrate how foraminiferal communities may response to future environment changes.

Response of Arctic mountain vegetation and invertebrate communities to climate change (evidence from the Polar Urals GLORIA summits)

Mikhailov, Yuri

Ural State Forest Engineering University Sibirsky trakt 37 620100 Yekaterinburg
Russia

yuemikhailov@gmail.com

Pavel Moiseev, Institute of Plant and Animal Ecology RAS Russia; Dmitry Moiseev,
Institute of Plant and Animal Ecology RAS Russia

Our study sites in the Polar Urals are part of the international long-term monitoring network GLORIA (Global Observation Research Initiative in Alpine Environments). In 2001 vascular plant species occurrence was recorded first on 66 mountain summits distributed across 17 study regions in Europe including Polar Urals. Polar Urals as GLORIA target region comprises a suite of four summits spanning an altitudinal range from the treeline to the uppermost peaks. The sampling areas cover the summits from their tops down to the 10 meter contour line and divided into eight sections connected with four cardinal directions. For each section a complete list of vascular plants was collected in 2001 and resurveyed in 2008 and 2015 (for herpetobiotic invertebrates - first collected in 2008 and resurveyed in 2015). The number of vascular plant species between 2001 and 2008 increased from 58 to 60 (on separate summits from 35-50 to 38-54). This is similar to South Scandes and less then in North Scandes. For the period 2001-2015 in the Polar Urals the abundance of dominant plant species significantly decreased on all summits several species completely disappeared from some plots while some species from lower belts appeared or increased the abundance. For all recorded species an altitudinal index was calculated and based on this upward or downward movement of species was found. Altitudinal species ranks of European mountain plants were used to calculate a thermophilisation indicator of mountain vegetation. For the Polar Urals between 2001 and 2008 it was 0.054 ($p < 0.0001$) which is exactly the same value as a European mean but much less than in South Urals (0.17). Data loggers has been measuring the soil temperature 10 cm below the surface at hourly intervals since 2001 until 2015. Maximum warming of the soil was recorded in 2012-2013 but in 2014 it reached the minimum. Before the resurvey of 2008 warming of the soil was near to long-term means.

Ecological and biochemical adaptations of aquatic organisms and changes in trophic relationships in the Arctic under climate change

Murzina, Svetlana A.

Institute of Biology Karelian Research Centre of the Russian Academy of Sciences
Pushkinskaya street 11 Petrozavodsk Russia 185910

murzina.svetlana@gmail.com

Svetlana N. Pekkoeva; Institute of Biology of Karelian Research Centre of the Russian Academy of Sciences Russia; Zinaida A. Nefedova, Institute of Biology of Karelian Research Centre of the Russian Academy of Sciences Russia

Climate change has special influence on high latitudes of the Northern hemisphere. The changes of temperature and salinity stratification of water bodies sedimentation processes duration of ice free season will lead to change of light conditions and the period of phytoplankton bloom rising and duration. They will influence the quantity and distribution of biogenic elements and producing capacity of the Arctic ecosystems. The study of mechanisms of adaptation to the complex of environmental factors among aquatic organisms of high latitudes will afford to assess their ability of effective adaptation to life in these conditions. The work was aimed to register and interpret the changes of lipids and fatty acids activity of enzymes of carbohydrate and energetic metabolism of the key marine organisms of the Arctic and Sub-Arctic (the White Sea) that are connected by food relations: copepods the White Sea herring *Clupea pallasimaris albi* bottom-living fish *Lumpenus fabricii* and *Leptoclinus maculatus* as an answer to the specific conditions of habitation in high latitudes as well as the complex of ecological factors that are typical for modern climate in ontogenetic and comparative aspects. The studied biochemical parameters of metabolism in aquatic organisms as well as processes of transformation and transfer of lipids through the food chains is important in terms of understanding of optimal functioning of all metabolic systems of organism under the conditions of changing environmental factors. Such research is significant in relation to the fundamental knowledge and for solution of practical tasks of biomonitoring in the Arctic. The study was carried out using facilities of the Equipment Sharing Centre of the IB KarRC RAS. The research was made in the frame of the budgetary theme № 0221-2014-0003 and supported by the Programme of fundamental research of the Presidium RAS № 114061940010; RFBR № 14-04-00473; the «SpitsEco» project (ES 504895).

Molecular composition of the bottom sediments in the Laptev sea outer shelf

Panova, Elena

Tomsk Lenina 30 Tomsk Polytechnic University

elenapanova@tpu.ru

Ivan V. Goncharov, Tomsk Polytechnic University Russia; Alexey Ruban, Tomsk Polytechnic University Russia; Andrey Grinko, Tomsk Polytechnic University Russia; Igor Semiletov, Tomsk Polytechnic University Russia

The ongoing climate change is apparently manifested in the Arctic region. Permafrost extended there is a huge reservoir of preserved organic matter (OM). In recent years there is a growing interest to the submarine permafrost containing orders of magnitude greater OM pool than the OM pool of ground permafrost. Therefore the involvement of submarine permafrost OM pool and coastal ice complex into the modern carbon cycle plays an important role in biogeochemical processes and sedimentation in the Eastern Arctic seas (EAS). The bottom sediments are the main source of methane in EAS while the rates of methane (CH₄) emission are determined by the degree of submarine permafrost degradation and the involvement of OM deep sources including hydrates and free gas. To understand the transport and OM transformation processes in the land-sea system including the massive methane emissions from EAS shelf into the water column (and then into the atmosphere) a new approach based on an understanding of the OM nature using its molecular composition studies is required. In that context the question related to the bottom sediments of the Laptev Sea is still poorly known. This work is aimed at identifying of the biomarkers complex - molecular "fingerprints" of the source organic matter - in the MBA regions characterized by a massive methane release and outside the seeps (background area) in the areas that are exposed to a coastal erosion and beyond them as well. A performed multi-component OM analysis allows to allocate some typical geochemical features in the distribution of the OM sediments molecular composition on the outer shelf of the Laptev Sea.

Necessity of lipids for growth of postlarvae *Leptoclinus maculatus* (Stichaeidae) in the Arctic

Pekkoeva, Svetlana N.

Institute of Biology of Karelian Research Centre of the Russian Academy of Sciences
Pushkinskaya 11 185910 Petrozavodsk Karelia Russia

pek-svetlana@mail.ru

Svetlana A. Murzina, Institute of Biology of Karelian Research Centre of the Russian Academy of Sciences Russia; Zinaida A. Nefedova, Institute of Biology of Karelian Research Centre of the Russian Academy of Sciences Russia; Stig Falk-Petersen, Akvaplan-niva

Leptoclinus maculatus (Stichaeidae) is a circumpolar fish whose population has begun increase in the Arctic Ocean; one of the main reasons of it is a climate change (Mecklenburg et al. 2011). The fish is a key link in food webs of polar ecosystems (prey and predator) and well adapted to low temperatures special photoperiod and diet. Adults are bottom whereas postlarvae - pelagic with unusual part of body called "lipid (fat) sac". The lipid sac accumulating high amount of lipids is an evolutionary adaptation to surviving under extreme factors. The research is aimed to study the role of lipids of *L. maculatus* postlarvae in muscles and lipid sac with special attention to their function in seasonal adaptations in the Arctic. The study was carried out using facilities of the Equipment Sharing Centre of the Institute of Biology KarRC RAS. The results show differences in quantitative and qualitative content of lipids in different tissues in seasons. So energetic triacylglycerols were dominant in summer whereas structural phospholipids predominate in winter in muscles of postlarvae. Postlarvae of fish are actively feed in short summer and store lipids in the lipid sac to survive during winter when food is scarce. Lipids are very sensitive and variable components and play significant role in maintaining function of membranes physiological activity of metabolic systems moving and feeding of fish. The changes of lipid content of the daubed shanny may be as an indicator of temperature changes and can actively use in the area of innovation management. The research was made in the frame of the budgetary theme № 0221-2014-0003 and supported by The Presidium of RAS «Searching fundamental research for development of the Russian Arctic»; and the «SpitsEco» project (ES504895).

Pilli-Sihvola, Karoliina

Finnish Meteorological Institute P.O. BOX 503 FI-00101 Helsinki Finland

karoliina.pilli-sihvola@fmi.fi

Riina Haavisto, Finnish Meteorological Institute Finland; Atte Harjanne, Finnish Meteorological Institute Finland; Adriaan Perrels, Finnish Meteorological Institute Finland

The future of the Eurasian Arctic is shaped by several drivers with all of them affected by uncertainty and some of them by deep unquantified uncertainty. To anticipate the future changes to increase the understanding of key uncertainties under different sources of uncertainty and to obtain an understanding of the possible near-term development and adaptation needs our study has developed a set of generic socio-economic scenarios up to 2040 for the Eurasian Arctic. The scenarios were based on existing climate and socio-economic scenarios and an international expert workshop conducted via participatory futures methods and held in 2015 in Helsinki Finland. Our analysis shows that plenty of potential pressures for major changes in the Eurasian Arctic exist. The scenario futures called Wild West Silicon Valley Exploited Colony Shangri La Conflict Zone and Antarctic describe the scale and scope of activities in the Eurasian Arctic by 2040. The scenarios have three dimensions: open – closed public - private and dirty – clean which describe the political economic social technological and environmental aspects of different futures. On the one hand different futures with drastic new developments in the region may unfold; on the other hand it is possible that despite all the hype and interest the Eurasian Arctic may remain a backwater in the global economy. Therefore decision makers should look into robust measures have a good eye for weak signals and tipping points and have the ability to prepare for risks and seize opportunities as they emerge in the area. Further analysis will assess the benefits of Weather and Marine Services in different futures with various methodologies.

Giant Caldera in the Eurasian Basin of the Arctic Ocean: Evidence of Catastrophic Pleistocene Volcanic Event

Piskarev, Alexey

All-Russian Research Institute for Geology and Mineral Resources of the World Ocean "VNII OKEANGEOLOGIA" 1 Angliysky Avenue St Petersburg 190121 Russia; St Petersburg State University Universitetskaya Embankment 7-9 St Petersburg 199034 Russia

apiskarev@gmail.com

Daria Elkina, All-Russian Research Institute for Geology and Mineral Resources of the World Ocean "VNII OKEANGEOLOGIA" 1 Angliysky Avenue St Petersburg 190121 Russia; St Petersburg State University Universitetskaya Embankment 7-9 St Petersburg 199034 Russia

The improved bathymetric map of the Arctic Ocean has clearly demonstrated contours of a giant volcanic caldera with the center at 81°31'N and 120°E. The caldera is about of 40x80 km stretching along the axis of the Gakkel Ridge rift valley. The size of caldera puts it on a par with the largest calderas of Toba and Yellowstone. In 2014 data were first obtained on the caldera structure when the caldera was crossed by two seismic lines accompanied with multibeam echo sounding. It was established that the modern tectonic active rift valley i.e. divergent plate boundary dissects the caldera floor and has a width of ca. 10 km and a depth of ca. 500 m. Given that the average rate of spreading in the Eurasian Basin is 1 cm/yr the rough estimate of the caldera age could be equal to 1 myr. A huge amount of volcanic material erupted in the Arctic Ocean should be reflected in coevally formed sediments. Indeed the sedimentary cores which were sampled near the Mendeleev Rise at a significant distance from the caldera and from each other contain a few centimeter layers featuring with high values of magnetization. The youngest layer is of ca. 750 kyr determined by its proximity to the determined Brunhes/Matuyama boundary. Mineralogical analysis of the samples corresponding to this layer has shown a sharp increase of clinopyroxene and ore minerals simultaneously with a sharp depletion of "stable" minerals share i.e. garnet and others. These data confirm the volcanogenic nature of the sediment layer. Thus the Eurasian Basin of the Arctic Ocean is established as an area of a catastrophic volcanic eruption in the Pleistocene which undoubtedly has had an impact on short-term climate change not only in the Arctic but also globally.'

Probabilistic forecast of multi-year runoff under the climate change for long-term developing planning in the Arctic

Shevnina, Elena

Finnish Meteorological Institute P.O. Box 503 FI-00101 Helsinki Finland

elena.shevnina@fmi.fi

Ekaterina Gaidukova, Russian State Hydrometeorological University St. Petersburg
Russia

Climate warming has been and is expected to continue faster in the Arctic than at lower latitudes which generates major challenges for adaptation. Among others long-term planning of development of socio-economic infrastructure requires climate-based forecasts of the frequency and magnitude of detrimental runoff events. To estimate the cost of facilities and operational risks a probabilistic form of long-term forecasting is preferable. To evaluate the long-term forecast of the detrimental hydrological events and probability density function of multi-year runoff the stochastic hydrological model is adapted to the high-spatial regional climate projections. The outputs from the regional climate model by the Rossby Centre Atmosphere for RCP climate scenarios are used to perform the regional scale assessment of the detrimental hydrological events for the Arctic. Anomalies in the regime characteristics of the annual and maximal multi-year runoff are revealed and the warming regions where the frequency and magnitude of detrimental flood events are expected to change substantially are outlined for the Russian Arctic. The simple estimates of the potential economic value for the hydro-power generation and mining economical sectors are provided using “cost-lost” model.

Hierarchical regionalization system for Barents and Kara seas in connection with the multi-level environmental monitoring of macro-projects

Shilin, Mikhail

Russian State Hydrometeorological university 195196 St. Petersburg Malookhtinskij pr. 96

Shilin@rshu.ru

Denis Alexeev, Russian State Hydrometeorological university Russia; Kirill Petrov, St. Petersburg State university Russia

The interest to ecosystems of the Barents and Kara seas (BKS) increases recently in connection with (1) growing anthropogenic impact including development of oil-and gas sector and construction of new ports and (2) necessity to protect biological diversity of marine ecosystems. In our study the case of BKS is used to exemplify construction principles for a hierarchical system of landscape- and biome-based regionalization ranging from local to global scales. The units of sea basin regionalization are regions districts and undersea landscapes. A special place in this system belongs to the concept of natural bottom complexes regarded as morphological units. The description of the spatial irregularity of undersea landscapes is based on distinguishing of the morphological units by vertical and horizontal partitioning. The variegated mosaic of the natural bottom complexes is formed over a rugged relief featuring combinations of rocky and soft grounds with different communities constructed by macro- meio- and microbenthos. Being a prerequisite for rational exploitation and protection of marine biological resources at different levels developing of hierarchical regionalization system can be used for organizing the multi-level environmental monitoring of macro-projects – such as exploitation of Stockman gas field and construction of Sabetta port complex.

Marine Stewardship Council (MSC) certification of fisheries in Northern Russia

Smagina, Daria

St. Petersburg State University Department of Ichthyology and Hydrobiology Faculty of Biology St. Petersburg State University 16 line V.O. 29 199178 St. Petersburg Russia

daria.smag@yandex.ru

Dmitry Lajus, St. Petersburg State University Russia; Carina Keskitalo, Umeå University Sweden

Currently there is a number of ecological certifications of fisheries worldwide but Marine Stewardship Council (MSC) certification is the most known and demanded by market. This is a third-party audit of a fishery's compliance with certain criteria in particularly status of target species effect of fishery on ecosystems and effectiveness of management. The certificate holders are awarded by the MSC label which is recognized by consumers and provides market advantages for the fishery. The goal of this study is to analyze the process of MSC certification in Russia based on opinions of participating parties. We held twenty semi-structured interviews with four categories of stakeholders all possessing information on the process of MSC certification. The context analysis shown the problems named by the respondents vary depending on the fishing techniques and location of fishing. The most advanced in terms of management are the Barents Sea codfish fisheries which are co-managed by Russia and Norway. The main problem of these fisheries is use of bottom trawls which may seriously affect bottom communities. In Sakhalin and Kamchatka regions respondents note high level of illegal fishing and in some cases lack of scientific data. Pollock fishery in the Sea of Okhotsk during process of certification experiences serious pressure of rival US fisheries. Respondents from all fisheries denote problems of language barrier difficulties with access to scientific monitoring data and overall complexity of MSC certification process.

Wood-based energy as a strategy for climate change mitigation in the Arctic:
assessment of climate impacts and resource efficiency with life cycle assessment
(LCA)

Sokka, Laura

Senior Scientist Fulbright Arctic Initiative Scholar VTT Technical Research Centre of
Finland Ltd. P.O. Box 1000 02044 VTT Finland

laura.sokka@vtt.fi

Northern countries are committing themselves to large cuts in greenhouse gas (GHG) emissions within the next decades. For example the EU has agreed to cut down its GHG emissions by 40% by 2030. In a similar manner Norway has announced commitments to reduce its GHG emissions by 40% by 2030 compared to 1990. Achievement of these emission reduction targets will mean shifting the balance of energy consumption in the Arctic region towards renewable sources such as wind solar and biomass. There are large forest resources in the Arctic region. Moreover as a result of warming climate the boreal forest line is expected to move northwards displacing 11-50% of the tundra by boreal forests within the next 100 years. Increasing use of forest biomass for energy can provide emission reductions while also simultaneously help to reduce regional reliance on fossil fuels. On the other hand increased mobilization of forest biomass for energy decreases the growth of forest carbon sink and may in some cases even turn it into a carbon source. In the present paper the use of forest bioenergy to ensure energy security and climate change mitigation is assessed using life cycle assessment (LCA). Different value chains are studied with the aim of identifying those that are beneficial from both aspects. Impacts are compared to reference scenarios with alternative fossil fuels. Finally conclusions are drawn on how to simultaneously enhance energy security and resource efficiency and contribute to emission reduction.

Warming & High North Building

Turin, Alexander

Individual Researcher, Docent of Architecture, Member of Union of Artists of Russian Federation, Addresses: str. Yakornaya 4 apt.53 St.Petersburg 195027 Russia
alexanderturin695@gmail.com

Point Zero Grade of Celsius is super impotent for High North! Warming at even 1 Grade radically changes the situation! It opens the North-East and North-West Passages but melts the ground so building from brick and concrete loses the base slowly step by step becomes dangerous for its inhabitants! Paradigm of Building in the High North must be changed! Let me present to UArctic Congress invented by me universal transformable building system which as I think is capable to solve that problem! According with Invention every building is a rigid space frame structure that may be put on every curved surface or float in the bog.

Yegorov, Alexander

Russian State Hydrometeorological University 195196 St.Petersburg Malookhtinsky
pr. 98 Russia

egorovad@rambler.ru

Irene Potapova, Russian State Hydrometeorological University; Julia Rzhonsnitskaya,
Russian State Hydrometeorological University; Nadezhda Sanotskaya, Russian State
Hydrometeorological University

This paper discusses the problem of the reliability with which the characteristics of atmospheric aerosols are determined from the results of lidar and photoelectric measurements. The scientific and practical significance of lidar information concerning the characteristics of arctic aerosols is known. At the same time it is a difficult problem to develop methods of lidar probing of the atmosphere. The purpose of this paper is to discuss new lidar equation solutions developed for weak signal processing and the results of the analysis of the effectiveness of these solutions. The accuracy of interpreting weak backscattering signals can be improved using the effective beam-path averaging procedure and the linear approximation of the transmittance in the case of small extinction coefficient. The results of photoelectric measurements essentially depend on the optical properties of aerosol particles. The solution of the electromagnetic field differential equations was analyzed to propose new model of a spherical particle with the radially variable refractive index. The experimental data were used for this model development. The developed model was used to minimize the error of particle size optical determination. New technical solutions were proposed for the development of the aerosol particles spectrometer using polarized light.

Variation of biological pump and phytoplankton community based on biomarkers in sediments of the Western Arctic Ocean since 4200 year BP

Zhang, Haisheng

The Second Institute of Oceanography SOA China; 36# Baochubei Road Hangzhou
310012 China

jzq840705@163.com

Youcheng Bai, The Second Institute of Oceanography SOA China; Haiyan Jin, The Second Institute of Oceanography SOA China; Hongliang Li, The Second Institute of Oceanography SOA China; Jianfang Chen, The Second Institute of Oceanography SOA China

Surface sediment samples (multi cores) and gravity core were taken on RV XueLong in 2008. Organic carbon and $\delta^{13}\text{C}_{\text{org}}$ biogenic silica calcium carbonate and lipids in these sediments were determined in order to understanding “rain ratio” of biological pump the distribution patterns of marine and terrestrial organic matter and phytoplankton community of the western Arctic Ocean. The $\delta^{13}\text{C}$ values indicated that the sediment organic material was mainly derived from marine algae. In general the spatial patterns of organic carbon biogenic silica were similar but the calcium carbonate was reversely suggesting that biological pump was mainly dominated by siliceous phytoplankton. This was supported by phytoplankton community structure biomarkers. The higher values were in the middle of shelf than Alaska coast but lowest concentration was observed in the south of the Chukchi Sea near Bering Strait. The large opal/ CaCO_3 and Corg /Cinorg ratio which were 5.26 and 4.25 averaged respectively indicated a high efficiency of biological pump in Chukchi Shelf. A 4.2kyr core located in central Chukchi Sea indicated that during the first stage (4200-250yr BP) the $\delta^{13}\text{C}$ ratio and biomarkers suggested only 40% organic matter derived from marine algae. In contrast the proportion of marine algae derived organic matter markedly increased in the second stage (250yr – present) especially in the last several decades marine algae contributed as much as 95% of total organic matter.

1.2 Fresh Water in the Arctic Climate System: Consequences of Global Climate Change and Future Projections of the Arctic Environment



Observational data show that the Arctic Ocean environment has significantly and rapidly changed over the last few decades - change which is unprecedented in the observational record. One of the most prominent signs of Arctic climate change in recent years has been a reduction in both sea ice extent and thickness. This session will bring together results from numerical modeling, observational studies, and theoretical investigation addressing problems related to the role of freshwater in Arctic and global climate change.

Convener: Dmitry Dukhovskoy, Florida State University, USA

Aksenov, Yevgeny

National Oceanography Centre University of Southampton Waterfront Campus
European Way Southampton SO14 3ZH United Kingdom

yka@noc.ac.uk

Michael Karcher, Alfred Wegener Institute Germany; Andrey Proshutinsky, Woods Hole Oceanographic Institution USA; Rudieger Gerdes, Alfred Wegener Institute Germany; Sheldon Bacon, National Oceanography Centre UK; A.J. George Nurser, National Oceanography Centre UK; Andrew Coward, National Oceanography Centre UK; Elena Golubeva, Institute of Computational Mathematics and Geophysics Russia; Frank Kauker, Alfred Wegener Institute Germany; An T. Nguyen, Massachusetts Institute of Technology USA; Gennady A. Platov, Institute of Computational Mathematics and Geophysics Russia; Martin Wadley, University of East Anglia UK; Eiji Watanabe, Japan Agency for Marine Science and Technology (JAMSTEC) Japan

Pacific Water (PW) enters the Arctic Ocean through Bering Strait brings heat fresh water and nutrients from the northern Bering Sea and has impacts on ocean mixing sea ice and ocean dynamics as well as heat and salt budgets and ocean biology. Pathways and the circulation of PW in the central Arctic Ocean are only partially understood due to the lack of observations. We simulate PW pathways by tracking it with a passive tracer in a suite of coupled sea ice-ocean models. The tracer is released in Bering Strait during 1979-2010 and spreads from the Bering Strait region into the Arctic Ocean through the Barrow and Herald canyons and across the Herald Shoal and the central Chukchi shelf with a large fraction of PW accumulating at the periphery of the Beaufort Gyre. We analyse changes in the PW and associated oceanic freshwater sources through the Arctic Ocean due to changes in the wind focusing on seasonal and inter-decadal variations in the PW pathways. We put forward a hypothesis which relates variations in the PW pathways to the changes in the wind through Ekman pumping and via the changes in vertical shear of oceanic relative vorticity. We discuss the implications of the Pacific water variability for the recent changes in the Arctic heat and fresh water storage. The presented study was a part of the Forum for Arctic Ocean Modelling and Observational Synthesis (FAMOS) an international effort to coordinate Arctic Ocean modelling and observations.

Perspective of biological pump and carbon sink in a freshening and warming Arctic Ocean based on six “Chinare” cruises since 1999

Chen, Jianfang

Second Institute of Oceanography SOA 36 Baochubeilu Hangzhou 310012 China

jfchen@sio.org.cn

Haiyan Jin, Second Institute of Oceanography SOA; Yanpei Zhuang, Second Institute of Oceanography SOA; Hongliang Li, Second Institute of Oceanography SOA; Youcheng Bai, Second Institute of Oceanography SOA

With decreasing of ice cover there is the potential for deepening of nutricline and an increasing of biological pump in the Arctic Ocean because of more nutrients in the euphotic zone will be consumed in an ice free sea or open ocean. On the other hand freshening and warming of surface water will also lead to change of uptake of carbon dioxide from a physical chemistry view. Since 1999 (in summers 1999 2003 2008 2010 2012 2014) based on Icebreaker Xuelong six Chinese Arctic Expeditions (Chinare) been carried out in Chukchi Sea and Canadian Basin where upper ocean nutrients are abundant compared with European sector of the Arctic Ocean. During those cruises we analyzed nutrients DO pH pCO₂ chl a opal in the water column as well as organic carbon and biomarkers in a 3.6m sedimentary core in order to check how biological pump changes with decreasing of sea ice. The results showed that biological pump and carbon sink dramatically increased since the last two decades in the west Arctic Ocean. Sedimentary records also support that organic carbon burial has been increased since last 250a in Chukchi Sea.

Fresh water flow across the Wandel Sea shelf in Northeast Greenland comprised of the Arctic Ocean outflow through Fram Strait and the glacier-ocean interaction

Dmitrenko, Igor

Centre for Earth Observation Science University of Manitoba Winnipeg Canada 524
Wallace Building 125 Dysart Road Manitoba Winnipeg R3T 2N2 Canada

igor.dmitrenko@umanitoba.ca

Sergei A. Kirillov, University of Manitoba Canada; Bert Rudels, Finnish Meteorological Institute Finland; David G. Babb, University of Manitoba Canada; Leif T. Pedersen, Danish Meteorological Institute Denmark; Soeren Rysgaard, Greenland Climate Research Centre Greenland; Yngve Kristoffersen, Nansen Environmental and Remote Sensing Centre Norway; David G. Barber, University of Manitoba Canada

The first-ever conductivity-temperature-depth (CTD) observations on the Wandel Sea shelf in North Eastern Greenland were collected in April-May 2015 as a part of the Arctic Science Partnership. The CTD profiles are used to reveal the origin of water masses and determine the extent to which these water masses have interacted with ambient water from the continental slope and the tidewater glacier outlet from the Flade Isblink Ice Cap. The subsurface water layer from ~20-70 m depth is comprised of freshened water (30-32 psu) that is likely associated with the Pacific Water outflow from the Arctic Ocean through Fram Strait. The underlying cold halocline separates the Pacific Water layer from a deeper layer of modified Polar Water that has interacted with the warm Atlantic water outflow through Fram Strait. The Atlantic water with temperature above 0°C is recorded below 140 m. Over the outer shelf the low halocline layer shows numerous cold density-compensated intrusions indicating lateral interaction with an ambient Polar Water mass across the continental slope. Below halocline the colder and turbid water intrusions were observed at the front of the tidewater glacier outlet. On the temperature-salinity plots the CTD profiles from the glacier outlet comprise the mixing line that is different from the ambient water and seems to be conditioned by the ocean-glacier interaction. Our observations of Pacific Water in the subsurface layer are set in the context of upstream observations in the Beaufort Sea and downstream observations from the Northeast Water Polynya and clearly show freshening of Pacific Water during its advection across the Arctic Ocean from the Bering Strait to Fram Strait. Moreover ambient water over the Wandel Sea continental slope shows no halocline layer indicating the different origin and pathways of the on-shore and off-shore branches of the Arctic Ocean outflow through Fram Strait.

Role of Greenland Meltwater in the changing Arctic

Dukhovskoy, Dmitry

Florida State University Center for Ocean-Atmospheric Prediction Studies P.O. Box 3062741 Tallahassee

ddukhovskoy@fsu.edu

Andrey Proshutinsky, Woods Hole Oceanographic Institution USA; Paul Myers, University of Alberta Canada; Gennady Platov, Novosibirsk State University; Jonathan Bamber, University of Bristol UK; Mary-Louise Timmermans, Yale University USA; Beth Curry, University of Washington USA; Raquel Somavilla, Spain Institute of Oceanography Spain; Yevgeny Aksenov, National Oceanography Center UK

Observational data show that the Arctic Ocean environment has significantly and rapidly changed over the last few decades - change that is unprecedented in the observational record. One of the most intriguing manifestations of change is the cessation of decadal Arctic climate variability in the 21st century. Between 1948 and 1996 the Arctic atmospheric circulation alternated between anticyclonic circulation regimes and cyclonic circulation regimes with a period of 10-15 years. Since 1997 however the Arctic system has been dominated by an anticyclonic regime. Previous studies indicate that in the 20th century freshwater and heat exchange between the Arctic Ocean and the North Atlantic were self-regulated and their interactions were realized via quasi-decadal climate oscillations. The presented work is motivated by our hypothesis that in the 21st century these regular oscillations have been interrupted as a result of an additional freshwater source associated with Greenland ice sheet melt. Accelerating since the early 1990s the Greenland Ice sheet mass loss exerts a significant impact on thermohaline processes in the sub-Arctic seas. Surplus Greenland freshwater the amount of which steadily approaching the freshwater volume fluxed into the region during the Great Salinity Anomaly events can spread and accumulate in the sub-Arctic seas influencing convective processes there and thus interrupting quasi-decadal oscillations of the Arctic circulation regimes. The question arises where the surplus Greenland freshwater has propagated. In order to investigate the fate and pathways of Greenland freshwater in the sub-Arctic seas and to determine how and at what rate Greenland freshwater propagates into the convective regions a numerical experiment with a coupled 1/12° HYbrid Coordinate Ocean Model (HYCOM) and Los Alamos sea ice code (CICE) has been conducted. The experiment uses a passive tracer to track propagation of Greenland freshwater within the sub-Arctic. Results from this model experiment are analyzed in the context of observed salinity changes in the sub-Arctic seas.

Forming the chemical composition of surface waters in the Arctic (Case study of the lake-river system of the Paz River)

Mazukhina, Svetlana

Institute of North Industrial Ecology Problems KSC RAS 184209 Apatity Murmansk region, Akademgorodok 14a

mazukhina@inep.ksc.ru

Vladimir Masloboev, Institute of North Industrial Ecology Problems KSC RAS Russia;
Sergey Sandimirov, Institute of North Industrial Ecology Problems KSC RAS Russia;
Stanislav Ivanov, Institute of North Industrial Ecology Problems KSC RAS Russia

Due to the depletion of fresh water supplies and the deterioration of their quality as a result of anthropogenic impact on the Arctic ecosystems study of forming quality of surface and underground waters their interactions with rock development of the basis for their rational use and protection have both fundamental and big practical importance and require continuation of the detailed studies including use of physical-chemical modeling methods. The Paz River is the largest river in northern Fennoscandia and flows through three countries (Russia Norway Finland). According to the long-term monitoring data of the chemical composition of surface waters of the river and the study of the chemical composition of rocks the physical-chemical modeling (FCM) (Selector Software) was carried out. The FCM included 34 independent components (Al-B-Br-Ar-He-Ne-C- Ca-Cl-F-Fe-K-Mg-Mn-N-Na-PS-Si-Sr-Cu-Zn-Ni-Pb-V-Ba-Co-Cr-Hg-As-Cd-H-O-e) 996 dependent components including those in aqueous solution - 369 in the gas phase - 76 liquid hydrocarbons - 111 solid phases organic and mineral substances - 440. The set of solid phases of the multisystem was formed taking into consideration the mineral composition of the Baltic shield. The processes of forming surface waters in the system "water - rock - atmosphere" were investigated depending on the degree of interaction (ξ) of rocks with aqueous solutions under open conditions rock - orthoclase gabbro and amphibolized olivine pyroxenites. The composition of these rocks contained the maximum amounts of calcium and sodium - the elements whose concentrations affect the chemical composition of surface waters and the pH. The results show that the chemical composition of waters of the Paz River and Lake Kuetsyarvi included in the lake-river system were formed by the weathering of intrusive rocks of the Pechenga nickel complex and differ by the degree of "water-rock" interactions.

Impact assessment of current climate changes on the Ob River runoff to plan a rational water management in the Arctic region

Shestakova, Elena

Russian State Hydrometeorological University 98 Malookhtinsky prospect St.
Petersburg Russia 195196

lenny.marlya.spb@gmail.com

There are a lot of lower reaches and river mouths of North American and Eurasian rivers in the Arctic. The implementation of major projects for the extraction of hydrocarbons in the Arctic the development of agricultural industry as well as increased activity in the domestic sphere are in need of timely assessments of long-term variability of water resources. Their quality and quantity is subject to significant fluctuations due both irrational use and natural causes primarily because of climate fluctuations. In this paper comparison of river runoff and climate variability is made on the example of the Ob River basin. As a result of this work there are the following conclusions: 1. Observations of the average annual temperature and precipitation in the drainage basin under study indicate that the significant trends in the variability of these characteristics cannot be reliably established. 2. Despite the global warming and the projected increase of fresh water resources amount according to the atmosphere and the ocean general circulation model (ECHAM4 / OPYC3 HadCM3 and others.) there are observed succession of dry and humid phases caused by natural fluctuations. 3. It is not possible to establish the unidirectional changes of an annual discharge of Ob River throughout the basin. Statistically significant trends were found only for the runoff in the forest-steppe zone. 4. Increased runoff in the upper reaches has not significant impact on the annual discharge of the river due to the large scale of the basin. 5. Identified temperature and precipitation trends are not significant so it is possible that there will be changes the directions of climate processes in the future associated with changes in the macro-circulation processes.



The session will discuss the climate, and other, impacts on the role of lakes, streams and flow pathways for atmospheric CO₂ and CH₄ emission, as well as lateral C export, in Siberia. The session will also discuss various research approaches needed to address urgent questions. The outcome of discussions will be of importance for stakeholders and the scientific community as this will provide new insights of the role of inland waters in the C cycle in one of the least studied but largest terrestrial northern ecosystems in the world.

Convener: Sergey Kirpotin, National Research Tomsk State University, Russia

Ala-aho, Pertti

University of Aberdeen Address: B32 St Mary's Geography & Environment School of Geosciences Elphinstone Road University of Aberdeen Aberdeen AB24 3UF Scotland'

pertti.ala-aho@abdn.ac.uk

Chris Soulsby, University of Aberdeen Scotland; Sergey Kirpotin, Tomsk State University Russia; Oleg Pokrovsky, University of Toulouse France; Rinat Manasypov, Tomsk State University Russia; Sergey Loiko, Tomsk State University Russia; Doerthe Tetzlaff, University of Aberdeen Scotland

Western Siberia Lowland (WSL) is undergoing changes in permafrost extent which are likely to modify atmospheric carbon emission and lateral export of carbon to the sea from peat deposits. The main driver for the changes is global warming but the mechanisms controlling the pathways of freshly released carbon typically relate to inland rivers and lakes. To outline the changes in the carbon fluxes the hydrology of this remote and data-scarce lowland area needs to be better understood. Stable water isotopes (O^{18} and deuterium) can be used as tracers to infer the sources residence times and connectivities between different water stores. We present an extensive dataset for stable water isotopes ($n=604$) sampled in 2014 and 2015 from the river network of the Ob basin including significant tributaries and the main stem of the Ob. Samples also include a unique subset from supra-permafrost soil solutions and thermokarst lakes and ponds. Sample locations span the longitude of 73-88E and latitude of 56-68N covering a spectrum of permafrost free to continuous permafrost areas. The dataset is supplemented with precipitation and snow isotope data from other observation networks and studies. The dataset allows the first attempt to build 'isoscapes' outlining the typical water isotope signatures and their variabilities in different hydrological storages (rivers lakes soils snow) for western Siberia. Hydrological and geographical data such as river discharge catchment area permafrost extent lake and bog coverage and latitude will be used to seek explanatory factors for the isotopic variability. We expect the analysis to lead to an improved conceptual understanding of water flow paths in this vast lowland area which is important for estimating changes in the closely interlinked carbon fluxes.

Carbon emission from Siberian rivers

Karlsson, Jan

Climate Impact Research Center (CIRC) Dept. of Ecology and Environmental science
Umeå University Sweden

jan.p.karlsson@umu.se

Pertti Ala-aho, Univ. of Aberdeen UK; Sergei Kirpotin, Tomsk state Univ. Russia;
Hjalmar Laudon, Swedish University of Agricultural Sciences Sweden; Oleg
Pokrovsky, Univ. Toulouse France; Anatoly Prokushkin, Russian Academy of Sciences
Russia; Svetlana Serikova, Umeå University Sweden; Chris Soulsby, Univ. of
Aberdeen UK; Doerthe Tetzlaff, Univ. of Aberdeen UK

Siberia contains vast C stocks potentially vulnerable to mobilization following permafrost thawing and inland waters draining these regions are largely understudied. Thus research on inland waters of Siberia is of particular importance for understanding climate change. Here we present the first results of an interdisciplinary project (JPI Climate collaborative research project on Russian Arctic and Boreal systems www.jpi-climate.eu/projects) that link expertise in aquatic biogeochemistry hydrology and permafrost dynamics with the aim to improve the knowledge of the role of high latitude inland waters in emitting C to atmosphere and in exporting C to downstream coastal regions and how this varies between different climate regimes. We present results of comparative studies in 2015 of C emissions from rivers across a climate gradient in western and central Siberia covering a large range of climate and permafrost conditions (permafrost free to continuous). The focus is on the Ob Pur Taz and Yenisey river networks including major tributaries and the main stem of the rivers. We quantified the concentrations and net exchange of carbon dioxide (CO₂) and methane (CH₄) between water and atmosphere during 2 surveys of each river network and for selected sites we carried out shorter time series. The results show that these river networks are net sources of greenhouse gases to the atmosphere with significant temporal and spatial variability. We will relate these patterns to catchment characteristics and hydrological dynamics. Further the available results will serve as a basis for discussing the need of concentrated efforts to capture and understand the drivers of variability in gas exchange dynamics and also the need of data that enable upscaling of these fluxes to larger regions.

Climate-regulating role of Siberian wetlands: a multidisciplinary approach

Kirpotin, Sergey

Centre of BIO CLIM LAND Tomsk State University Lenina 36 Tomsk Russia

kirp@mail.tsu.ru

Oleg Pokrovsky, BIO-GEO-CLIM Laboratory Tomsk State University Tomsk Russia;
Sergey Vorobyev, BIO-GEO-CLIM Laboratory Tomsk State University Tomsk Russia

We report on concerted studies the climate-regulating role of western Siberian Lowland (WSL) via multidisciplinary approach that combines natural observations laboratory experiments and landscape-level modeling. The environmental context of WSL is extremely important for the biosphere and climate of our planet and highly attractive for Earth scientists for the following four reasons: (i) In the southern part of western Siberia the bogs are strong CO₂ sink from the atmosphere due to highly productive taiga forest and on-going peat formation; (ii) In the northern permafrost-bearing part of WSL the bog-lake landscape system contain a lot of frozen organic carbon that is being released to the atmosphere in the form of methane and CO₂. Here highly abundant thermokarst lakes act as important mediator of CO₂ flux from the frozen peat to the atmosphere; (iii) WSL contains mostly discontinuous and sporadic permafrost those temperature is between 0 and -2°C. Unlike continuous permafrost of the rest of Siberia this permafrost is highly unstable very vulnerable to even minor climate warming and can produce significant environmental and economic effects within the next 1 – 2 decades; (iv) Finally the Ob river is dramatically different from the other Siberian and subarctic rivers because of its huge flood zone. This flood zone represent a “hot spot” in biogeochemical cycles and essentially controls the flux of carbon and metals to the ocean from the full territory of WSL. These environmental factors and processes render western Siberia as absolutely unique indicator of on-going climate change but it is also strong regulator of CO₂/CH₄ exchange with the atmosphere. Here taking the advantage of our unique geographical location developed infrastructure and accumulated knowledge we characterize the current status and future changes of WSL mires.

Western Siberia as a natural mega-science facility - basis for large network projects and research consortiums

Kirpotin, Sergey

Bio-Clim-Land Center of Excellence Tomsk State University 634050 Lenina Avenue 36
Tomsk Russia

kirp@mail.tsu.ru

Oleg Pokrovsky, GET Géosciences Environnement Toulouse France; BIO-GEO-CLIM Laboratory Tomsk State University Tomsk Russian Federation; Terry Callaghan, Department of Animal and Plant Sciences University of Scheffield UK; The Trans-Siberian Scientific Way Centre Tomsk State University Tomsk Russian Federation; Sergey Vorobiov, BIO-GEO-CLIM Laboratory Tomsk State University Tomsk Russian Federation

Located on the vast territories from the Arctic Ocean coastline to its southern borders with Kazakhstan Mongolia and China and from the Urals to the Pacific Ocean Siberia is a huge expanse for research with a maximum extension of 3500 kilometers from North to South and more than 7000 kilometers from West to East. Due to its incredible size in comparison with other regions Siberia can be called “the Universe” because any project implemented on its territory is by definition of universal scale. If approximately 60% of the Russian territory is located in the permafrost area the major part of it is located in Siberia. Moreover the Siberian Arctic region and especially its western segment is the hottest point of a warm spell in the world. Indeed the north of Siberia is one of the most vulnerable places in terms of global warming. Metamorphoses that we see in this region due to its continental climate are the most dramatic and significant in comparison to other parts of the globe. The changes taking place here are impressive and are of huge importance for the whole planet. And opportunities for environmental research in Siberia are practically unlimited; they are unique and of interest to the international scientific community. Siberian landscapes regulate many natural processes on a global scale. For example they have an impact on carbon balance and they influence global climate change. As a result of long-term complex research in Siberia a concept of Siberia has been formulated in Tomsk State University as a unique natural mega-system which regulates the carbon cycle and the planet climate to a large extent which is unprecedentedly accessible to researchers and attractive for the global scientific community and which can become the basis for large network projects and research consortiums.

Biogeochemical features of sediments of thermokarst lakes in the Northern part of Western Siberia

Manasypov, Rinat

BIO-GEO-CLIM Laboratory Tomsk State University Lenina av. 36 Tomsk Russia

rmmanassypov@gmail.com

Oleg Pokrovsky, Tomsk State University Russia; Sergey Kirpotin, Tomsk State University Russia; Artyom Lim, Tomsk State University Russia

In the bottom sediments of thermokarst lakes in Northern part of West Siberia we studied organic carbon heavy metals and metalloids which are among the main components of air emissions and concentrations of Fe and Mn which play an important role in the adsorption of heavy metals in sediments. Anaerobic degradation of organic matter is a predominant condition in this region. This process does not provide a complete decomposition of oxidized-matter and the organic material does not decompose to fine particles. The high values of the organic carbon content not only in the surface but also in the lowest sedimentation layer (up to 20 cm) is a confirmation of the incomplete degradation of organic material in an aqueous medium. Iron and manganese are typomorphic elements for this region. Their concentration and migration properties largely determines the geochemical conditions that we investigated in thermokarst ecosystems. An high correlation shows that in this region the level of trace-elements is regulated by the organic carbon content and typomorphic elements (Fe and Mn).

Biogeochemistry of Ob's flood plaine (West Siberia)

Rozhkova-Timina, Inna

Tomsk State University

inna.timina@mail.ru

The flood zone of the Ob River the largest river of the Arctic Ocean basin is tens kilometers wide and is the world's second largest flooding territory (after the Amazon's floodplain). Chemical and microbiological composition organic and inorganic carbon of the Mid-Ob have been studied. Nowadays research of biogeochemistry of the Ob River and adjacent surface waters is relevant.

Thermokarst lakes in the south of permafrost zone of Western Siberia: a study of morphometry water budget and water exchange rates

Zemtsov, Valerii

Tomsk State University 36 Lenin Avenue Tomsk 634050 Russia

zemtsov_v@mail.ru

Sergey Kopysov, Tomsk State University Institute of Monitoring of Climatic and Ecological Systems Siberian Branch of Russian Academy of Sciences Russia; Victor Sinkinov, Tomsk State University Russia

Numerous thermokarst lakes in the northern regions of West Siberia play considerable role in organic matter production release of CO₂ CH₄ to the atmosphere and affect the ongoing processes of climate change permafrost thawing and landscape transformations. The morphometry hydrological regime water budget of Siberian thermokarst lakes as well as their bed composition and sediments remain insufficiently studied up to present. Only fragmentary data on the hydrology and dynamics of the thermokarst lakes have been collected by now. Some field surveys of thermokarst lakes and their watersheds located in the permafrost zone at the experimental site near the settlement of Khanymey (63.8° N 75.5° E) have been conducted. The work contained instrumental studies of lake bodies and catchment areas morphometry; lake bed composition and status (e.g. bed forming depositions presence of permafrost peat); snow cover depth density and water equivalent in different landscapes etc. Taking account of space imaginary and results of previous studies carried out by other researchers the collected data allowed estimating the annual long-term means of water budget components of lakes and their watershed areas parameters of water exchange rates such as coefficients of water exchange residence time of water in the lakes and obtaining the relationships between the lake size and the water exchange coefficients. All these new results are needed for ongoing more detailed studies of water balance and runoff formation in Western Siberia. The research has been supported by the grant issued in accordance with Resolution of the Government of the Russian Federation No. 220 dated 9 April 2010 under Agreement No. 14.B25.31.0001 with Ministry of Education and Science of the Russian Federation dated 24 June 2013 (BIO-GEO-CLIM) and by the grant No. 14-05-00700 of the Russian Foundation for Basic Research (RFBR).

1.4. Vulnerability of Arctic Communities to Natural Disasters



In the context of current international Arctic discussions, the risk of disaster from extreme natural events has received little attention. In fact it is human nature to ignore disasters until they occur, despite the general understanding that preventative measures can save lives and assets and enhance resilience. This session will examine the characteristics of principal natural hazards in the Arctic and provide examples of successful and failed practices in mitigating disaster risk.

Convener: John Eichelberger, University of Alaska Fairbanks, USA

Social and Economic Aspects of the Arctic Region in the Frames of Sustainable Development Concept: yesterday to-day and in Future

Alimov, Andrey

St.Petersburg State University School of International Relations Department of the World Policy; Russian State Hydrometeorological University the Department of Social and Humanitarian Sciences

alimovandrey@yandex.ru

Abramov V.M. Russian State Hydrometeorological University; Mandryka O.N. Russian State Hydrometeorological University; Terekhova A. St.Petersburg State University; Stecko E.W. St.Petersburg State University; Melvin G. Weissman University of Colorado USA

The Arctic region is one of a highly vulnerable territories of our Planet. But at the same time this region is very rich in many different natural resources. Many of them have to be used by modern human society with oil natural gas and biological resources and so on including different energetic resources. The Arctic has its own long history. According to archeological researches the first human beings set here in X-IX centuries B.C. On the other hand was mentioned in different times. For example in the XVII century A.D. there were so called "town-states" in the Northern part of Western Siberia. The best known one was called "Mangazeya". Russian merchants conducted special expeditions in order to get new markets in those territories. In the middle of the XX century special scientific researches were started. But now the Arctic countries undertake new researches namely in the field of ecological geographical geophysical researches in that area bearing in mind that those territories are the place of indigenous nations live there in our days. But the population of this region is strongly interested in extraction natural and mineral resources. According to the UN Charter they have a right to develop their economy. In those regions the volume of natural resources is big but they have low environmental sustainability. The indigenous settlers are in need of financial and other social and economic support from their governments. This approaches well developed in Canada and the US. The Russian Federation has to pay much more attention to these aspects of development. At the same time it is necessary to get support by nongovernment voluntary organizations. This is better made in the US and Canada. A special trend in socio-economic development should be addressed to ecological (environmental) aspects. It is necessary to provide well organized environmental education aimed at formation of environmental culture and consciousness. The research is provided with support of the Ministry of Education and Science of the Russian Federation (State Assignment 25.25. 2014/66).

Reducing the impact of spring ice-jam floods in the Arctic

Eichelberger, John

Graduate School University of Alaska Fairbanks Fairbanks Alaska 99775 USA

jceichelberger@alaska.edu

Tuyara Gavrilava, North-Eastern Federal University Russia; Yekaterina Kontar, University of Alaska Fairbanks USA; Mikhail Prisyazhniy, North-Eastern Federal University Russia

The phenomenon of springtime ice-jam floods imposes significant socioeconomic effects on residents of the Far North especially in rural regions where disaster response and recovery are challenged by limited infrastructure communication and distance. Dialog and participatory research were conducted by a Russia-US team in paired flood-prone communities: Galena in Interior Alaska USA and Edeytsy in Central Yakutia Russia to identify best practices in springtime flood risk reduction. We engaged with all stakeholders - emergency managers; federal regional and local policy makers and leaders; and citizens including the elderly - to determine their perception of the effectiveness of flood mitigation measures and disaster response and recovery efforts. A high point of the project was enabling the community leaders of these flood-stricken towns to visit each other and their counterparts' community. Galena and Edeytsy are similar: remote from urban centers; situated on vast river flood plains; benefiting from Indigenous traditions and a strong sense of self-reliance; have a number of very large families; experienced the shock of sudden inundation in places they thought were safe; worked long on reconstruction. Both gained a sense of optimism from more awareness of the flood hazard better levees raising of homes and schools above the last flood level and more capacity to shelter in place without evacuation. The project is part of the U. S. Department of State's Peer-to-Peer Program with additional support from the University of Alaska Fairbanks North-Eastern Federal University Northern (Arctic) Federal University the U.S. National Oceanic and Atmospheric Administration the Yakutsk-Fairbanks Sister Cities Program the Russian Academy of Sciences the many government agencies that spent time with us and the people of Edeytsy and Galena.

Cultural Change Exposed Indigenous Peoples to Catastrophic Floods

Filippova, Viktoriya

Institute for Humanities Research and Indigenous Studies of the North SB RAS
Yakutsk Sakha Republic Russia

filippovav@mail.ru

Sharon Hildebrand, University of Alaska Southeast USA; Tuyara Gavrilova, North-Eastern Federal University Russia

Indigenous Peoples of Yakutia and Alaska required access to water for cattle horses sled dogs fish and transportation. They understood the environment and chose high locations for their settlements. River sites were temporary camps occupied when flood risk was low. Even if flooding did occur the loss of property was minimal. Larger permanent settlements appeared with the arrival of Russians in Yakutia and Russians and then non-Native Americans in Alaska. Large permanent towns were founded on rivers - Yakutsk on the Lena and later Fairbanks on the Chena and Tanana. Records of catastrophic floods begin with Yakutsk in the 19th century. Soviet collectivization enlarged the typical size of Yakut settlements but reduced their number. Areas at high flood risk were selected for housing. Edeytsy is a typical traditional Yakut community whose people came from the hills to the site on the Lena in 1930. Galena was first a military base used to support the USSR's war effort through Lend-Lease. After the Cold War the town used the base for a regional school and airport. An extensive levee protects it but not the town. Galena is a regional airport hub for supplies and travel. An important difference from Edeytsy is lack of roads increasing importance of the river. To a village child the Yukon is life. In winter it is a highway from one village to the next. In summer it provides boat travel to summer fish camp. When ice is breaking up in spring and forming in fall there is a trapped restless feeling of nowhere to go. Alaska Natives can't migrate as they did so they choose the river despite outside recommendations to move after a flood. These are ancestral grounds that have been used from time immemorial.

Toward Paradigm Shift in Disaster Risk Research

Ismail-Zadeh, Alik

Institute of Earthquake Prediction Theory and Mathematical Geophysics Russian Academy of Sciences Profsoyuznaya str. 84/32 Moscow 117997 Russia; Institute of Applied Geosciences Karlsruhe Institute of Technology Karlsruhe Germany.

alik.ismail-zadeh@kit.edu

Despite major advancements in knowledge on disaster risks and disasters caused by natural hazards yet we are not seeing a concomitant decline in disaster impacts and losses. Convolving geophysical engineering social and behavioral sciences and practices with policymaking into co-designed and co-productive work should significantly reduce disaster risks caused by natural hazards. To this end a fundamental change in scientific approaches to disaster risk reduction is to be made by shifting the emphasis from an individual hazard and risk assessment dominant in the geoscientific community today to a trans-disciplinary system analysis with action-oriented research on disaster risk reduction co-produced with other stakeholders including policymakers in ways that facilitates the ability of diverse stakeholders to provide complementary perspectives. Such a paradigm shift will allow for acquisition of useful knowledge and for immediate application of scientific achievements to knowledge- and evidence-based policy and decision making for disaster risk reduction. The need for the paradigm shift is more critical now than ever before because such a shift would provide scientific results to support disaster policy across governments and would present a cross-cutting action in policy and practice related to climate change and sustainability so important in the Arctic region.

Reducing socioeconomic impacts of breakup floods in rural Arctic communities through effective multi-agency disaster communication and coordination strategies

Kontar, Yekateria

International Arctic Research Center (IARC) University of Alaska Fairbanks 930 North Koyukuk Drive Fairbanks Alaska USA 99775

ykontar@alaska.edu

Viktoriia Fillipova, The Institute for Humanities Research and Indigenous Studies of the North Russian Academy of Sciences Siberian Branch Yakutsk Sakha Republic Russia; Antonina Savvinova, North-Eastern Federal University (NEFU) Yakutsk Sakha Republic Russia

The villages of Edeytsy in Sakha Republic Russia and Galena in Alaska United States suffered severe negative socioeconomic impacts after breakup floods on the Lena and Yukon Rivers in May 2013. Over 90 percent of the entire public infrastructure and private residences were destroyed in both communities. As a result many families lost not only their shelter but also means of their livelihoods and were forced into long-term evacuation. We surveyed the impacted populations and conducted a series of roundtable discussions with representatives from local regional state federal and tribal administrations with the goal to determine the effectiveness of the annual flood risk reduction strategies in both regions. There are many similarities between how the people and government authorities in the two regions prepare for and respond to floods but also many differences. Some of the differences arise because of different systems of governance but others are because Russia has more people and area at risk to this hazard and therefore more experience in managing it. Emotional impacts conveyed by pictures that transcend language barriers come from loss of valued possessions loss of animals extended separation from home the unpleasant task of cleaning up polluted flood deposits and debris and the question of relocation. Interest in the latter wanes as recovery proceeds. It is clear that ongoing multi-way communication which takes into account cultural ethnic socioeconomic characteristics and respective roles of all stakeholders is crucial for effective flood risk reduction in rural Arctic regions.

A spaceborne assessment of the Barents Sea phytoplankton biomass vulnerability to cyclone impacts: assessment for 2003-2013

Pozdnyakov, Dmitry

Scientific Foundation "Nansen International Environmental and Remote Sensing Centre" Office 49; 7 14th Line V. O. 199034 St. Petersburg Russia

dmitry.pozdnyakov@niersc.s[pb.ru]

Evgeny Morozov, Nansen-Centre St. Petersburg Russia; Lingzis Tang, China Institute of Oceanology Chinese Academy of Sciences Guangzhou China; Lasse Pettersson, Nansen-Centre Bergen Norway; Hartmut Grassl, Max-Planck Meteorological Institute Hamburg Germany

A pilot satellite-based investigation of modulations exerted upon mixed-layer phytoplankton fields by cyclones was performed for the first time across a selected part of the Arctic Ocean the Barents Sea (BS). Resorting to a synergistic approach cyclones were first identified from NCEP/NCAR data for the summer period during 2003–2013 and their propagation throughout the BS was further surveyed. The above-water wind force was retrieved from QuikSCAT data. These data were further accompanied by ocean colour data from SeaWiFS and MODIS to examine the spatial and temporal distributions of surficial phytoplankton chlorophyll concentration (chl) dynamics along the trajectory of the cyclone's footprint across the sea. Sea surface temperature was retrieved from MODIS data. The spaceborne data obtained over more than a decade indicate that on balance the cyclone passage led to increase in chl within the cyclone footprint area. On average this increase did not exceed $1\text{--}2\ \mu\text{g l}^{-1}$ which is nevertheless appreciable given that the mean chl within the cyclone footprint rarely exceeded $1\ \mu\text{g l}^{-1}$. Specific mechanisms of the chl enhancements in the BS are revealed and proved. However given that (i) the annual number of cyclones capable to produce the above impact is low (2-3) (ii) the cyclone footprint area generally accounting only for about 14% of the BS area (iii) short duration of chl enhancement (between a few days and a fortnight) the cyclones studied are hardly capable of boosting annual primary productivity in the BS. Moreover it can be conjectured that the same conclusion can be drawn with respect to the pelagic Arctic tracts that are generally less productive and more extensively cloud-covered than the BS.

Physical processes and mitigation techniques during ice-jam floods on the Yukon River Alaska and Lena River Sakha Republic

Tananaev, Nikita

P.I. Melnikov Permafrost Institute SB RAS Yakutsk Russia (University of Toulouse France; Ugra Research Institute of Information Technologies Russia)

nikita.tananaev@gmail.com

Edward Plumb, National Weather Service USA; Jessica Cherry, University of Alaska Fairbanks USA; Alexei Kostin, Diamond and Precious Metal Geology Institute Russia

Ice jams during spring breakup in the Arctic illuminate the intersection of environmental and social systems that lead to natural disasters. We compared circumstances leading to and following flood disasters in the similar towns of Galena on the Yukon and Edeytsy on the Lena in May 2013. Both jams formed where they had formed before at an abrupt bend in the river. The ice packs that jammed were 'local' in origin not from upstream reaches. Although the severity of the Yukon breakup was attributed to an unusually cold spring followed by sudden warming weather and breakup time in the Lena basin were normal. At Edeytsy the Lena rose constantly at 0.12-0.15 m/h during two days in May (14-16 May) remained high for 3 days (16-19 May) and then drained in one day to the safe levels. The Galena jam formed on 26 May and broke on 29 May at which time the river was backed up more than 60 km. For both towns inundation was as severe as ever recorded. Ice conditions on the Yukon are monitored primarily by satellite and aircraft and by resident ground observers; on the Lena by ground observers and drones (UAS). In the Edeytsy region a multi-government group meets regularly beginning well before breakup to review conditions. There does not seem to be this level of early coordination in Alaska. Also in the Edeytsy evacuation drills are conducted and the ice cut and sanded above known jam points before breakup. Both towns are still in need of better levee protection but both now have better ability to shelter in place and rely less on evacuation. In both countries mitigation methodologies are experience-based with Russia having much more experience. Neither country is doing much research to test the efficacy of such methods or discover better ones.'

1.5. Assessment of Environmental Impact of Industrial Activities in the Arctic



The Arctic has for long received an ever increasing attention from the industrialized countries, not the least as a source of various natural resources. Since extraction of raw materials generally are associated to significant environmental impact there are great concerns that such activities in the vulnerable Arctic environment will cause substantial adverse effects in this region. There is definitely a need for improved methods for both assessing the environmental risks and impact connected to extraction of raw materials and to develop new and improved techniques to re-mediate effected areas. This session will provide an opportunity for researchers and also consultancies in the area to share experiences and results. A particular objective is to elucidate technical and scientific issues related to the vulnerable Arctic environment.

Convener: Lars Lövgren, Umeå University, Sweden

The problems in the sustainable development of indigenous peoples of the Arctic region

Knyazeva, Galina

Syktyvkar State University Russia Komi Republic Syktyvkar Oktyabrsky prospect 55
167000

gknyazeva@mail.ru

Ekaterina Kniazeva, Syktyvkar State University

Specific national interests of Russia in the sustainable development in the Arctic cover its economy ecology social science and policy. Peculiarity of the accumulated environmental damage problem in the Arctic zone of the Russian Federation unlike many industrialized countries is caused by industrial production based on very large enterprises. The transition to a market economy was accompanied by a decline in production and resulted in a considerable number of unclaimed objects and abandoned polluted areas. The government did not have effective tools to evaluate and develop measures for liquidation of accumulated environmental damage and currently builds strategic plans on the intensification of the exploitation of natural resources in the Arctic. However the first results of the inventory and liquidation of accumulated environmental damage met critics of expert and scientific community. The strategy barely explores issues related to the indigenous peoples of the North living in the Russian Arctic. To support the sustainable development of the Arctic zone of Vorkuta the research center "Sustainable development of the North" at Syktyvkar State University conducts research on several areas: elimination of accumulated environmental damage impact of environmental pollution on the health of indigenous people assessment of the resource potential of traditional activities. The research objectives include projects development for the elimination of accumulated environmental damage taking into account the interests of indigenous peoples living in Arctic zone - Vorkuta.

The features of natural and artificial recovery in quarries of the forest-tundra zone of Western Siberia

Koptseva, Elena

Saint-Petersburg State University Universitetskaya nab. 7-9 199034 St. Petersburg
Russia

ekoptseva@hotmail.com

Alexander Egorov, Saint-Petersburg State University Russia

The development of territories construction of buildings settlements are required mineral resources including sand. Sand mining disturbs natural vegetation. Sand quarries were investigated in the forest-tundra zone of Western Siberia many times (2000-2013). Natural revegetation in quarries in the North is complicated due severe environmental conditions such as permafrost low biological production slow accumulation of organic matter and etc. Our investigation shows that natural recovery process in quarries takes a lot of time. Only the initial stages of formation of zonal type communities with participation of cenosis-forming woody plants are observed even after 30 years from the beginning of overgrowing process in quarries. Special actions on biological re-cultivation will effectively restore and return sites to original state. Our observations and experience of other researchers have allowed to develop following recommendations: - adding of peat or forest fertile soil in sufficient quantity; - to take into account the possibility of erosion even on plots with a slight slope surface; - planting of annual and perennial grasses; using rapid growth annual grasses which create protection for perennial species to stabilize soil surface; - to use adventive and aborigine plant species; - to use leguminous plant species for increasing soil fertility; - creation a sufficient tree density during planting. Absence of regulations and methodic instructions makes the situation with effective recultivation of quarries worse. High prices and labor costs for recultivation of disturbed sites are forcing tenants to look for effective ways to badland restore only for the first year when acceptance of results by local authorities occurs. For successful recovery in quarries it is necessary to develop the criteria for effective biological reclamation. Clear quantitative indicators of effectiveness for restoration process are also required. This work was supported by the Department of Science and Innovation of the Yamalo-Nenets Autonomous District (grant № 01-15/4 25.07.2012).

Geospatial Analysis of Persistent Organic Pollutant Deposit in the Arctic Ecosystems and Environment

Kudrjashov, Vladimir A.

Russian State Hydrometeorological University Voronezhskaya str. 79 198007 Saint-Petersburg Russia

vakudrjashov@rambler.ru

In the last decades in the whole world there has been permanent growth of industrial activity mineral mining and agriculture intensification. Various pollutants arise as a result of these processes. They can have negative influence on ecosystems and environment. By means of transboundary transportation these substances enter the Arctic. Among these pollutants there are persistent organic pollutants (POP) which maintain proper activity over a long period of time and also they accumulate in the arctic trophic chain ecosystems and environment. The following research was carried out with for the purpose of evaluation of POP accumulation and localization in different level trophic chain ecosystems and the environment of the Russian Arctic. POP were represented by as the two toxic anthropogenic chlorinated hydrocarbons with heavy molecular weights: polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane (DDT). The geospatial analysis was fulfilled with the use of calculations of various POP area concentration in the ArcGIS software environment. The data obtained were expressed as the interactive histogram series with additional vertical lines that showed limited concentrations of POP. The same method was applied to the region areas in which the POP concentration exceed the limited concentrations or it was within the normal values. The geospatial analysis was executed for sea water sea-bed sediments components of trophic chains in the sea and terrestrial ecosystems. Various calculations data analysis and modelling were executed by means of Excel package and R software environment. The accumulation coefficients of PCB and DDT in the various level trophic chain ecosystems and also in the environments was calculated. An obtained data analysis gave the opportunity to establish the biomagnification effect for POP accumulation in the ecosystems. By the use of data modelling it was recognized that there is exponential character of the POP accumulation in the trophic chains of arctic ecosystems and environment.

Masloboev, Vladimir

Kola Science Center of the Russian Academy of Sciences 14 Fersman street Apatity
Murmansk Region Russia 184209

masloboev@ksc.ru

Svetlana Vinogradova, Center of Humanitarian Problems of Barents region Russia;
Vladimir Didyk, Institute of Economical Problems Russia; Elena Klyuchnikova,
Institute of Industrial Ecology Problems Russia; Elena Korczak, Institute of
Economical Problems Russia; Tatyana Mingaleva, Institute of Industrial Ecology
Problems Russia; Victor Petrov, Kola Biodiversity Conservation Center Russia; Larissa
Ryabova, Institute of Economical Problems Russia

The mining industry is becoming the leading industry in Arctic especially in the Barents region. Climate change and especially economic globalization have opened up the region's plentiful resources for global consumption. In this regard there are certain challenges and risks for the region: the population is concerned about the irreversible environmental changes due to negative effects of mining activities and fewer opportunities for the development of other livelihoods also. In order to escape the expenditures related to conflicts with local communities we recommend the companies to apply a concept of "social license to operate" in the North during the development of their social policy. Such approach will not only decrease the reputational losses of the company but bring additional profits related to more reasonable use of the potential of the local communities in the company's activities. To receive the social license to operate the companies should take care for the social sustainability of the local communities which is provided by living standards and favorable environment. That's why the companies should follow the environmental requirements search for new environmentally friendly technologies of production processing and waste treatment. The company should set such a long-term goal as the real assessment of environmental expenditures of the company and include them into the value of the final product. Self-regulation of the companies should be based upon striving for a real dialog with the local communities and the regard for the interest of the local business. The opinion and interests of indigenous peoples should be taken into consideration during the development of new mining projects at the earliest stages because they will actively protect their interests in case of potential risks.

Environmental assessment in the oil and gas production areas (North of Western Siberia)

Opekunova, Marina

Saint-Petersburg State University Russia Saint-Petersburg 199178 10-th line 33-35 room 65.

m.opekunova@mail.ru

Anatoly Opekunov, Saint-Petersburg State University Russia; Stepan Kukushkin, Saint-Petersburg State University Russia; Mikhail Shirokov, Saint-Petersburg State University Russia

Analysis of the environment state of oil and gas regions in the Yamalo-Nenets Autonomous District (YaNAO) on the basis of researches in the north of Western Siberia (2003-2015 years) is carried out. Study methodology is based on the collection collation and interpretation of ecological and geographical information of key environmental components (surface water bottom sediments soil vegetation and snow). The analysis is performed on three levels of landscape organization: local (near the sources of pollution) territorial (within the license areas) and regional (YaNAO territory). Regional geochemical background of content of microelements in the landscape components is calculated and geo- and bio-indicators of anthropogenic contamination during oil and gas production are found. At the local level chemical pollution by hydrocarbons (HC) naphthalene and some microelements of all landscape components near the quarries wells roads are identified. High total content of Ba V and mobile forms of Pb Cu Ni Co Zn are indicators of contamination of snow soils and bottom sediments during drilling operations. Representative indicator plants species of environmental contamination (*Ledum decumbens* *Cladonia alpestris* *Vaccinium vitis-idaea* and the bark of *Larix sibirica*) are identified. Secondary biocenoses after fire and secondary swamping are established. Complete or partial transformation of the landscape or the territory desertification after geomechanical effects are found. At the territorial level the increased background contents of HC in water and soils within individual license areas is defined. Geomechanical effects are the most common this is reflected through the disturbed areas (1-2% of the area). Desertification and secondary vegetation in some areas are observed (up to 15-25% of the territory). At the regional level a slight increase of HC content in natural waters as well as a weak PCB contamination of soil are found. Changes in soil and vegetation covers and landscape geomechanical disturbances are slightly expressed.

Sustainable development of ecosystems and local communities in the industrial development of the Arctic regions

Potravniy, Ivan

117997 Russian Federation Moscow Stremmianiy per. 36

ecoaudit@bk.ru

V.V. Gassiy, Kuban State University Krasnodar Russia; Tatjana Tambovceva, Riga Technical University Latvia; S.A. Zakharov, Head of Environmental Services JSC "Almazy Anabara" Republic of Sakha (Yakutia)

In recent years there is a process of active industrial development of the territories including the lands of compact habitat of indigenous peoples of the North. The future of the Russian Arctic zone is undoubtedly associated with the subsoil use development which is a "locomotive" of economic modernization. However in this context the important question is the interests' correlation of the indigenous inhabitants (the preservation of culture traditional nature use etc.) with the objectives of subsoil user companies. Therefore the development of interaction mechanisms of business with indigenous peoples of the North in industrial territories is must be developed in according to target groups' interests. Thus one of the tools to reconcile the interests of the target groups in the field of traditional nature use is an ethnological expertise of projects. The examples of such mechanism implementation for target groups interests' coordination in the area of traditional nature use can be found in the industrial development practice of the Republic of Sakha (Yakutia). As the modern Russian practice analysis shows the industrial development areas in indigenous peoples' habitat areas without adequate accounting for their opinions interests and needs as well as environmental and socio-economic factors (e.g. Sakhalin projects on shelf; the mineral resources mining in the Yamal-Nenets and Khanty-Mansi autonomous okrugs etc.) may cause a conflict of interest between target groups (communities government business etc.). To address them in environmental management it is necessary to establish the legal framework of the subsoil user interaction with the authorities tribal communities engaged in traditional nature use. The Republic of Sakha (Yakutia) has become a pioneer in legal regulation of the traditional nature use sphere. One of the main instruments of such regulation is ethnological expertise.

Tsibulnikova, Julia V.

St.Petersburg State University Institute of Earth Sciences Universitetskaya nab. 7-9
Russia 199034 St.Petersburg

juxik@yandex.ru

Vladimir G. Zayonchek, St.Petersburg State University Russian Federation

The significant amount of geological engineering across the Arctic region has to be concentrated rather on the continental shelf than on land. The bottom sediments analysis data is applied in various branches of geology from purely scientific stratigraphy to mineral prospecting. However marine sediments sampling is heavily complicated due to the specific environmental conditions. The following article features current data analysis of physical and mechanical parameters of the shelf ground and its load capacity using the White Sea as an example. The research was carried out in the sphere of modernizing methodology and technical equipment of engineering geology expeditions which is of vital importance in terms of both improving the effectiveness of the work and providing convenient working surroundings for the stuff. The necessity of ecological security is taken into consideration. International geology engineering methods are observed from the point of possible improvements in compliance with all safety requirements. The author presents some implications of seabed grounds laboratory testing form the White Sea shelf and describes the particular characteristics of using innovative methods of geology engineering. Several specific technical solutions to the problem of production modernization are reviewed in details. The main result of the research is the justified proof for the necessity of implementing improvements in various methods of geology engineering on the Arctic shelf.

Sensitivity of Arctic coastal environments to oil spill impacts

Zagretdinova, Dilyara

Lomonosov Moscow State University Marine Research Center. St. Leninskie gory
1/77 room 104 Moscow 199234, Russian Federation

dilyara.zagretdinova@gmail.com

Shabalin Nikolay, Lomonosov Moscow State University Marine Research Center
Russia

In the face of increasing economic opportunities in Russia's Arctic regions the need to improve state of preparedness for oil spill related emergencies in particular is critical. This report presents an overview of resources that are vulnerable to oil spills. It includes baseline coastal information such as shoreline form substrate and vegetation type which is required for operational prioritization and coordination of on-site spill response activities as well as sensitive biological resources and sensitive human use resources. The study area includes the coastal area that extends along the mainland from the Kandalacsha Bay to the Onega Bay of the White Sea. Shoreline mapping in White Sea has focused on the generation of a pre-spill database as part of the oil spill response planning for that area. The mapping is based on Environmental Sensitivity Index (NOAA 1976). In the first step the coast is divided into alongshore segments within which the physical shore-zone character is relatively homogeneous. From this initial detailed mapping a pre-spill database is created using the ESRI software. The purpose of this data set is to provide a detailed analysis of the shore-zone character. This data set is entered into the geographic information system (GIS) and the interpretation presented in this data set provides a simplified characterization of the primary features of each segment. To date over 300 km of shoreline in the White Sea has been mapped. Analysis of the geomorphological structure of the coasts of the Onega and Kandalaksha bays has allowed to classify the coastal zone by ESI to potential oil spill and find out what the shore of the Kandalaksha Bay is much less vulnerable to oil spills (share of coastline with index 1 – 28%) compared with Onega (share 8%).

1.6 Strategies for ecosystem services and sustainable environmental management of soils and contaminated areas in the Arctic



The Arctic has in the recent decades been increasingly affected by industry development, such as mining and extraction of hydrocarbons, and logistics. At the same time, pronounced climatic changes have occurred affecting the environmental quality. It is of critical importance that there is an environmental management of the vulnerable Arctic region based on scientific knowledge. The session aims to create a forum for sharing of experiences among scientists and engineers concerning methods to reduce the environmental burden caused by past and current industrial activities in the Arctic.

Conveners:

Lars Lövgren, Umeå University, Sweden

Sebastian Zubrzycki, University of Hamburg, Germany

Soil ecosystem services of polar environments: new approaches in applied and environmental soil science

Abakumov, Evgeny

Dept. of Applied Ecology Faculty of Biology Saint-Petersburg State University Russia
199034 16 line 29 Vasilyevskiy Island Saint-Petersburg

e_abakumov@mail.ru

Ivan Alekseev, Saint-Petersburg State University; Sebastian Zubrzycki, Universität Hamburg; Eva-Maria Pfeiffer, Universität Hamburg

Ecosystem services are benefits which humans can receive from environments. These direct and indirect benefits are different in origin and way of impact and they are divided into few groups: supporting provisioning regulating and cultural services. Soils are crucial components of all terrestrial ecosystems and play the role of spatial basis of ecosystems. At the same time soils support terrestrial ecosystems and human infrastructure by spatial stability of environment. Polar biomes have many crucial soil ecosystem services: carbon sequestration and greenhouse gas cycle regulation water quality and biodiversity levels control contaminants accumulation and redistribution. Intensification of human activities in Polar Regions and high vulnerability of polar environments result in soil degradation and further degradation of soil ecosystem benefits. Polar Regions are represented by cryogenic landscapes with sparse population. However these regions have been increasingly affected by industry development and hydrocarbon exploration and logistics in recent decades. At the same time pronounced climatic changes have occurred and affected the environmental quality of vast areas in Polar environments. Investigations of soil functioning in polar ecosystems and evaluation of the benefits for human beings from soils in polar environments are critical for the development of strategies for sustainable environmental management in response to anthropogenic disturbances and climatic changes. There are many gaps in sense of knowledge about Arctic and Antarctic soils and their ecosystem services. New approaches to assessment soil ecosystem services of polar environments in applied and environmental soil science will be discussed in details in our presentation. It will be shown that the ecosystem services tool is more appropriate for describing and analyzing the mutual interrelations between ecosystems and human beings than traditional interpretation of soil ecological functions.

Use of Vertical Electric Resistivity Sounding for Monitoring of “Soil Space” as Ecosystem Service

Abakumov, Evgeny

Department of Applied Ecology Faculty of Biology Saint-Petersburg State University
199034 16-line Vasilyevskiy Island 29 Saint-Petersburg

e_abakumov@mail.ru

Ivan Alexeev, Pomor Master Programm, Saint-Petersburg State University

Soils underlain by permafrost are widely distributed in cold environments (Arctic and Antarctic). Permafrost affects the soil genesis and morphology it also regulates the main chemical and physical processes and determines the structure of the soil cover. Moreover permafrost regulates the mechanical stability of the soil cover while the soil is the spatial basis for human activity. Active layer thickness and the depth of the permafrost table are the basic features of soil cover of polar regions and can be assessed by different direct or indirect methods. The classic method is to dig the soil profile or to drill the soil mass with the aim of fixing the permafrost table morphologically. It is also possible to push a sharpened steel bar into the ground until the frozen ground is encountered. Nowadays direct-current resistivity methods have been used for the identification of permafrost depth and soil profile heterogeneity. Geophysical methods have many advantages and have been widely used for permafrost identification. Vertical electric resistivity is a quantitative method which allows to make quick measurements of ER along the different soil profiles and the permafrost layer. The one-dimensional model was used for mapping of the permafrost depth in relatively homogenous conditions whereas the two-dimensional approach was proposed for plots with a high degree of heterogeneity. Examples of VERS application for monitoring of permafrost table depth will be discussed in presentation in details.

New prospects for greening the Arctic infrastructure: mycelium-based insulating bio foams

Amstislavski, Philippe

Department of Health Sciences University of Alaska Anchorage Bragaw Building
Suite 220 3211 Providence Drive Anchorage

pamstislavski@alaska.edu

Zhaohui (Joey) Yang, Department of Civil Engineering College of Engineering
University of Alaska Anchorage Anchorage 99508 United States; Maria D White,
Department of Chemistry University of Alaska Anchorage Anchorage 99508 United
States

Polymeric foams such as polystyrene and polyurethane foams are commonly used for thermal insulation in infrastructure and housing construction particularly in Alaska and in other cold climate regions. These hydrocarbon-based materials are not subject to decomposition or decay in the environment. They are non-renewable and their production and use involve complex manufacturing processes large energy inputs and waste streams creating problems with respect to recycling reuse and landfill operation. Mycelium the vegetative part of fungi is a hollow tubular “root” structure that provides a fast growing safe and inert binder for a new generation of bioengineered insulating foams or biofoams. Biofoams can serve as replacements for the petroleum-based polymers for geoengineering applications and offer several advantages over polymeric foams including freedom from petroleum products low energy inputs and low cost of production fast renewability carbon capture and storage and bio-degradability at end of use. This research characterizes key occupational health thermal and mechanical properties of an innovative fungal mycelium-based biofoam. Samples were tested for cytotoxicity density thermal conductivity elastic moduli and compressive strength. Findings indicate that this material is not cytotoxic and its compressive strength and thermal conductivity meet or exceed like characteristics of the conventional polymeric thermal foams except dry density. The results suggest that fungi mycelium-based biofoam offers a strong potential for application as an alternative to polymeric foams particularly in cold regions. Potential future uses include road underlayment and backfill for geoengineering applications and as insulation in buildings and infrastructure. Keywords: Fungal mycelium-based biofoam; Forestry byproducts Circumpolar North Thermal conductivity; Elastic moduli Compressive strength Cold regions Chitin Sustainable development Biomaterials.

Potential capability of soils of Yamalo-Nenets Autonomous region (Western Siberia) for woody plants cultivation

Bakhmatova, Ksenia

St. Petersburg State University Universitetskaya nab. 7-9 St. Petersburg 199034
Russia

kbakh@mail.ru

Alexandr Egorov, St. Petersburg State University Russia

The soils on experimental sites of woody plants cultivation in the forest tundra and northern taiga in Yamalo-Nenets Autonomous region (Western Siberia) were investigated. The aim is to find out the soil capability for woody plants cultivation. Native soils of the region refer to Al-Fe-humus podzols cryozems peat soils and alluvial soils according classification system of the soils of Russia (2004 2008) and Carbic and Rustic Podzols Histic and Turbic Cryosols Cryic Fibric Histosols and Fluvisols (IUSS Working Group WRB 2015). The anthropogenic soils of experimental sites in Salekhard and Nadym refer to replantozems (Russian soil classification system 2004 2008). Studied soils are predominantly acidic and strongly acidic ($\text{pH}_{\text{KCl}} = 3.2-5.3$; $\text{pH}_{\text{H}_2\text{O}} = 3.9-6.1$) and base-unsaturated. At the same time the replantozems have a neutral reaction ($\text{pH}_{\text{KCl}} = 5.6-5.9$; $\text{pH}_{\text{H}_2\text{O}} = 6.3-7.2$). Hydrolytic soil acidity and exchangeable base status of surface horizons vary considerably ($0.25-63.0 \text{ mmol}/100\text{g}$ and $<0.2-10.1 \text{ mmol}/100 \text{ g}$ respectively) depending on type of horizon (organic or mineral) and cation exchange capacity. Organic matter content also varies (from <0.5 to $5-7\%$). The significant increase of organic matter content to $11-14\%$ and more was found after peat and peat-humus material addition. The majority of investigated soils have very low content of mobile forms of N P K. The low availability of nutrients partly depends on sandy and loamy-sandy texture of soils which is advantageous in terms of their faster heating in summer. Light textured soils also have insufficient water capacity that may lead to instability of plants water supply during warm period without precipitation. The optimal availability of plant nutrients should be maintain by addition of mineral and organic fertilizers. It is also recommended to carry out the entire set of agronomic practices including watering when it needs to. This work was supported by the Yamalo-Nenets Autonomous District (N01-15/4_25.07.2012).

Changes of Arctic soils mycobiota under influence of anthropogenic factors

Kirtsideli, Irina

Botanical Institute of Russian Academy of Sciences 197376 St. Petersburg Russia

microfungi@mail.ru

Vlasov D.Yu., Saint-Petersburg State University Russia; Zelenskaya M.S., Saint-Petersburg State University Russia; Krylenkov V.A., Saint-Petersburg State University Russia; Abakumov E.V., Saint-Petersburg State University Russia; Teshebaev Sh.B. , Arctic and Antarctic Research Institute St. Petersburg Russia; Sokolov V.T., Arctic and Antarctic Research Institute St. Petersburg Russia; Barantsevich E.P., Northwestern Almazov Federal medical research center of the Russian Federation; Ministry of Health St. Petersburg Russia

Arctic and Antarctic soils can be considered as one of the most extreme environment. Mycobiota (microfungi species) of natural Arctic soils (in polar desert and arctic tundra) is characterized by relatively little list of species oligodomination for soil microfungal complexes a wide range of their ecological responses and the psychrophily of the most constituent species and can be considered as peculiarities of polar desert and arctic tundra mycobiota The main pathways of microfungi in the Arctic are 1) air environment 2) the water of the northern seas and oceans 3) anthropogenic influence. The species composition of microfungi changes in soils near Arctic settlements. The species from natural uncontaminated soils and invasive species not previously mentioned in natural soils are present there. Anthropogenic influence on the soils microfungi complexes can be expressed as 1) the introduction of new species into the soil through air or water environment 2) the introduction of new materials or substrates contaminated (polluted) by microfungi 3) the introduction of materials or substrates which can change the structure and processes in soils and provide an advantage in the development of a cosmopolitan species Significant similarity of microfungi in contaminated soils and anthropogenic substrates was observed. In the polluted soil 76 species of microscopic fungi were noted 41 species (53.9%) of them were identified at anthropogenic substrates and materials. At the same time anthropogenic contaminated soils lose their resemblance to natural soils. Wide temperature range mesophilic species enables the development and adaptation to low temperatures. These include the species from genera *Alternaria* *Aspergillus* *Aureobasidium* *Chaetomium* *Cladosporium* *Exophiala* *Geomyces* *Humicola* *Penicillium* *Mucor* *Phoma* *Rhodotorula* *Trichoderma* and *Ulocladium*. Adaptation to Arctic natural conditions take place both at the level of a system that is at the level of microfungi complexes and at the level of species and isolates.

Attenuation of metals from mining areas by natural processes

Lövgren, Lars

Department of Chemistry Umeå University SE-901 87 Umeå Sweden

lars.lovgren@chem.umu.se

The major cause of severe environmental impact of mining is oxidation of sulphide minerals in soils and residues from milling and processing of the ore (tailings) and waste rock. Oxidation results in extensive generation of commonly acidic metal laden leachates. To minimize these effects it is necessary to undertake remediation measures commonly aiming at reduced entrance of oxygen into the sulphidic materials and at neutralizing the acidity. This is a particular challenge in the Arctic due to the scarcity of fine-grained geologic materials and lack of alkaline industrial residues (e.g. ashes from combustion of wood products or residues from the pulp industry) which are suitable materials in this context. Instead geochemical processes providing opportunities of natural attenuation of heavy metals can be of significance. This is about metal ions which can be re-associated to solid matter by precipitation of secondary solid minerals and adsorption to mineral surfaces. Within unoxidised tailings heavy metals may be immobilised from anoxic porewater by forming secondary metal sulphides or carbonates. Under aerobic conditions secondary iron minerals can remove metals from water by co-precipitation and adsorption processes. These natural attenuation processes can be important parts of barrier systems protecting recipients of discharged water. In this paper is presented and discussed results from field and laboratory studies aiming at determining the potential of natural attenuation processes. Unoxidized sulphidic tailings as well as secondary iron precipitates have been sampled at Swedish mines and investigated by various laboratory experiments.

Shtangeeva, Irina

St. Petersburg University Universitetskaya nab. 7/9 St. Petersburg 199034 Russia

shtangeeva@gmail.com

Remediation of polluted soil is currently one of the most important and difficult tasks. This problem is of particular importance for many territories. Unfortunately different soil remediation techniques used today are too costly and moreover can lead to destruction of the soil i.e. decrease “soil health”. Since metals usually accumulate within upper soil layer it seems possible to remove the metals from the soil using metal accumulating plants. Transfer of elements in the soil – plant system is natural process and no destruction of the soil will follow. Such a technique is cost-effective and thus represents an economical solution of the problem. About 20 years ago application of the plants to clean up contaminated soil became an area of intense study in Europe and the United States. However it was found in the short run that wide implementation of this technique is limited by sufficiently low rate of transfer of toxicants from soil to the plants. In north areas an application of phytoremediation may additionally be limited by low temperature and as a result low rate of the development of the plant biomass. Meanwhile it may be suggested that possibilities of the phytoremediation technique are still not fully used. It is of critical importance to improve our understanding of chemical processes in the soil to be able to predict under which circumstances metals will be dissolved and become available to plants. The main goals of our research were to assess potential possibilities of application of phytoremediation technique in contaminated soil in Arctic and make an estimate of chemical processes in the soil characterized by different types and levels of contamination.

Soils in the Lena River Delta serve as a large Carbon storage

Zubrzycki, Sebastian

Institute of Soil Science Center for Earth System Research and Sustainability
Universität Hamburg Allende-Platz 2 20146 Hamburg Germany

sebastian.zubrzycki@uni-hamburg.de

Evgeny Abakumov, Department of Applied Ecology Saint-Petersburg State University
St. Petersburg Russia; Aleksei Desiatkin, Institute for Biological Problems of
Cryolithozone SB RAS Yakutsk Russia; Lars Kutzbach and Eva-Maria Pfeiffer, Institute
of Soil Science Center for Earth System Research and Sustainability Universität
Hamburg Hamburg Germany

The largest Arctic delta the Lena River Delta extends over an area of 32 000 km² and likely holds more than half of the entire soil organic carbon (SOC) mass stored in the seven major deltas in the northern permafrost regions. Around 60 % of the Lena River Delta region consists of true Holocene deltaic units: a river terrace dominated by wet-sedge-polygons covered by a soil-complex of Glacic Aquiturbels and Typic Historthels and active floodplains covered mainly by sand dominated soils as Psammentic Aquorthels and Typic Psammorthels. The mean SOC stocks for the upper 100 cm on both units were estimated at 29 kg m⁻² ± 10 kg m⁻² at the river terrace and at 14 kg m⁻² ± 7 kg m⁻² on the floodplains. For the depth of 100 cm the total SOC storage of the Holocene river terrace was estimated at 121 Tg ± 43 Tg and the SOC storage of the active floodplains was estimated at 120 Tg ± 66 Tg. The mass of SOC stored within the observed seasonally thawed layer was estimated at about 127 Tg assuming an average maximum thawed layer depth of 50 cm. The SOC mass which is stored in the perennially frozen ground below 50 cm soil depth which is excluded from intense biogeochemical exchange with the atmosphere was estimated at 113 Tg. The mean nitrogen (N) stocks for the upper 1 m of soils were estimated at 1.2 kg m⁻² ± 0.4 kg m⁻² for the Holocene river terrace and at 0.9 kg m⁻² ± 0.4 kg m⁻² for the active floodplain levels respectively. Considering projections for deepening of the seasonally thawed layer up to 120 cm in the Lena River Delta within the 21st century these large carbon storages could become increasingly available for decomposition and mineralization processes.

1.7 Invasive species in Arctic ecosystems in the changing world: Is it a real threat?



Arctic ecosystems are quite vulnerable to disturbances associated with the invasion of undesirable species; however, harsh climatic conditions represent not only a barrier to the penetration of undesirable species, but also act as a barrier to mass outbreaks of pests and epidemics of diseases. Undesirable plants can easily be carried to the north by different means. At the first stage of invasion, the spread of invasive plants is likely to be limited by rural places. This session will discuss, do invasive species represent a real threat to the local ecosystems at this stage? How the situation will develop in future under conditions of changing climate and increasing human disturbance?

Conveners:

Aleksandr Egorov, St. Petersburg State University, Russia

Rimvys Vasaitis, Swedish University of Agricultural Sciences, Sweden

Possibilities of further range expansion of the emerald ash borer *Agrilus planipennis* (Coleoptera: Buprestidae) in the North-West of European Russia: What factors will limit the invasive range?

Afonin, Alexander N.

Saint Petersburg State University Universitetskaya nab. 7-9 St. Petersburg 199034
Russia

afonin-biogis@yandex.ru

Dmitry L. Musolin, Saint Petersburg State Forest Technical University Russia;
Alexander A. Egorov, Saint Petersburg State University Russia; Saint Petersburg State
Forest Technical University Russia; Andrey V. Selikhovkin, Saint Petersburg State
University Russia

Emerald ash borer *Agrilus planipennis* is a new and aggressive invasive pest that has arrived from Asia to North America and European Russia and quickly killed millions of ashes. In Russia Moscow Region is believed to be a center of the species' invasive range. The beetle is known to feed on different *Fraxinus* species. Even though ash is not a major forest species in Russia ash forests cover about 265 000 ha in the European Russia mostly southwards of Moscow. In the northwards regions ash forests are scarce and ash stands might be separated from each other by dozens of kilometers what make it difficult for *A. planipennis* to spread because the beetle can fly only 6.5–20 km/year (Musolin et al. 2016). First recorded in Moscow in 2003 the beetle has spread over 11 administrative regions of European Russia mostly southwards but also in other directions (Baranchikov 2013). Northwards invasive range expansion of this species might be limited by either thermal resources or availability of food plants (ashes). Our preliminary data suggest that highly flexible seasonal cycle of *A. planipennis* might allow this species to move behind the northern limit of ash's continuous range. Ashes are often used for planting in cities and other populated places. Temperature in urban heat islands is higher than that outside populated places. Thus ash trees planted in cities outside the established continuous range of ashes (i.e. in St. Petersburg) can still be infested by the emerald ash borer. To spread the beetle can use ashes planted in tree belts along highways or in some cases can be carried by cars. Keeping this in mind it is very important to know distribution of ashes along highways from Moscow to large cities located northwards and monitor the pest in Novgorod Saint Petersburg and Petrozavodsk.

Free choice of the Nature in the changing world

Arefjev, Yuri

Voronez State University of Forestry and Technologies 394077 Votonezh boulevard
Pobeda 7/229

arefjev@voronezh.net

Our changing world have required biologists to focus more attention in new ways. The internationally connected scientific systems and technologies are growth. The different regions of the world react differently to global changes. But the nature laws are uniform and it gives us possibilities to predict the events in changing world. Long-term researches have shown that in the Central Russian forest-steppe global warming favoured asexual reproduction of invasive pathogens of pine and oak. This phenomenon will be actual in the future in more northern regions. It is a real threat for forest. The management of forest ecosystems in this conditions consists in creating of mosaic plantings. They will be a well suitable basis for a free choice of the nature.

Emerald ash borer *Agrilus planipennis* (Coleoptera: Buprestidae) a new invasive pest threatening ash in Europe

Baranchikov, Yuri N.

V.N. Sukachev Institute of Forest Siberian Branch of the Russian Academy of Science
Akademgorodok 50 Krasnoyarsk 660036 Russia

baranchikov-yuri@yandex.ru

Dmitry L. Musolin, Saint Petersburg State Forest Technical University Russia; Andrey V. Selikhovkin, Saint Petersburg State University and Saint Petersburg State Forest Technical University Russia

Ash species (*Fraxinus excelsior* *F. angustifolia* *F. chinensis* *F. mandshurica* *F. pennsylvanica*) cover around 666 thousand ha in Russia. They are widely used in urban greening shelter-belts and along roads. Approximately 80 insect species can seriously damage ashes in Europe but they are not threatening the existing ash populations in Russia. Emerald ash borer *Agrilus planipennis* (Coleoptera) is a new invasive pest that has arrived from Asia to North America and killed more than 25 million ash trees there (Herms & McCullough 2014). This destructive species was also detected in Moscow in 2005 and now it quickly expands its invasive range in all directions. By 2012 *A. planipennis* reached Smolensk Region bordering Belarus and by 2013 Voronezh Region bordering Ukraine. Currently the species' invasive range in European Russia covers 11 administrative regions and continues to spread. In native range (likely limited by China Korea Japan and Russian Far East) *A. planipennis* is not a major pest and only infests weakened trees of *F. chinensis* and *F. mandshurica*. In European Russia and North America the species damages all non-Asian ashes and can kill ash stands completely (Baranchikov et al. 2014). The beetle infests trees aged 10 or more years. Its flight period in Moscow Region is from early June to early July. Adults feed on ash leaves and lay eggs in bark crevice of trunks. Four larval instars feed under the bark and in wood. Most individuals overwinter twice as larvae and pre-pupae (Orlova-Bienkowskaja & Bieńkowski 2015). Life cycle of *A. planipennis* takes two years in Moscow Region and only one year in warmer regions. This flexibility along with aggressive nature of the beetle absence of natural resistance and natural biological control agents in invasive ranges can result in fast decline of ashes over entire Western Europe including its Northern part.

The first records of *Corbicula* clams (*Bivalvia Corbiculidae*) in Northern European Russia: main causes and possible consequences genetic and shell morphological discrepancies

Bespalaya, Yulia

Institute of Ecological Problems of the North Ural Branch of Russian Academy of Sciences Severnaya Dvina Emb. 23 163000 Arkhangelsk Russian Federation

jbespalaja@yandex.ru

Ivan Bolotov, Institute of Ecological Problems of the North Ural Branch of Russian Academy of Sciences Russian Federation; Olga Aksenova, Institute of Ecological Problems of the North Ural Branch of Russian Academy of Sciences Russian Federation; Alexander Kondakov, Institute of Ecological Problems of the North Ural Branch of Russian Academy of Sciences Russian Federation

Biological invasions are a serious threat to environmental protection and the conservation of biological diversity (Oliveira et al. 2015). It is known that the proportion of alien species is lower in Polar Regions than it is elsewhere (Alsos et al. 2015) however increased human activity and climate change are expected to increase the numbers and the impact of alien species in the Arctic (Alsos et al. 2015). According to some authors *Corbicula* clams can be found in northern regions in waters that are heated by thermal power plant (Karataev et al. 2007; Vinarsky et al. 2015). In accordance with this in 2015 the *Corbicula* spp. was found for the first time in Arkhangelsk thermal power plant in Northern European Russia. Total DNA was extracted from the foot tissues according to standard phenol/chloroform procedures (Sambrook et al. 1989). The mitochondrial genes (COI) and large ribosomal subunit rRNA gene (16S) sequences were obtained from 18 specimens. Among the discovered patterns of *Corbicula* clams we can differentiate two morphs visually: morph-1 (light form Rlc) and morph-2 (round form R). They correspond to the forms described by Pfenninger et al. (2000) and Marescaux et al. (2010). The two haplotypes were detected in specimens of *Corbicula* clams. It was established that the individuals having the morphotype R exhibited the COI haplotype 2 (found in form S) and the individuals having the morphotype Rlc exhibited the COI haplotype 1 (found in form R). The same results were obtained for 16S haplotypes. It is hypothesized that mitochondrial and morphology mismatches are resulting from an-drogenetic mitochondrial capture which are often detected at some of the locations where different lineages occur in sympatry (Hedtko et al. 2008; Pigneur et al. 2011). This study has been supported by the Russian Foundation for Basic Research (project numbers: 16-05-00854 14-04-98801 and 15-04-05638).

North American invasive species of the upper Volga basin flora

Borisova, Elena

Ivanovo State University 150025 Ermak str. 39 Ivanovo Russia

floraea@mail.ru

Upper Volga basin is one of the industrial districts of European Russia with high level of urbanization. It includes Ivanovo Kostroma Yaroslavl Vladimir and Tver' administrative regions. The ecosystems of the area are strongly transformed anthropogenically. Present flora consists of 802 alien species among them 116 species originate from North America. Less than half of North American species (46.6 %; 54 species) are successfully naturalized 39 species invaded into the natural and semi-natural plant communities. 15 woody species (*Acer negundo* *Amelanchier spicata* *Fraxinus pennsylvanica* *Physocarpus opulifolius* seldom *Aronia mitschurinii* *Padus pensylvanica* *P. virginiana* *Parthenocissus incerta* *Symphoricarpos albus* etc.) invaded into different forest types and participated in the formation of underbrush. *Juncus tenuis* *Lupinus polyphyllus* are common among herbaceous plants in disturbed forests. 13 species (*Bidens frondosa* *B. connata* *Echinocystis lobata* *Elodea canadensis* *Epilobium adenocaulon* *Solidago gigantea* *Xanthium albinum* *Zizania palustris* etc.) invaded into the bodies and riparian habitats 11 species (*Aster salignus* *A. lanceolatus* *Helianthus tuberosus* *Hordeum jubatum* *Lupinus polyphyllus* *Oenothera rubricaulis* *Palacroloma septentrionale* *Solidago canadensis* etc.) – into the different types of meadows 9 species (*Lepidium densiflorum* *Populus balsamifera* s.l. *Senecio viscosus* etc.) – into the open sand habitats and dry slopes 6 species (*Aronia mitschurinii* *Epilobium adenocaulon* *Linaria canadensis* *Scirpus cyperinus* etc.) – into the moss bogs and peat pits. 27 species are aggressive wide spread and play the role of transformers therefore they are included into Middle Russia Black Book. 7 species (*Amaranthus albus* *A. retroflexus* *Erigeron canadensis* *Lepidothea suaveolens* etc.) mastered anthropogenic ecotopes. More than 60 species (*Ambrosia artemisiifolia* *A. trifida* *Collomia linearis* *Cuscuta campestris* *Cyclachaena xanthiifolia* *Lepidium virginicum* *Panicum dichotomiflorum* *Puccinellia nuttalliana* etc.) occur as casuals. Systematic control of North American invasive plant species and study of its biological characteristics should be continued in the Upper Volga region.

Alien plant species in the north of Western Siberia

Egorov, Alexandr

St. Petersburg State University Universitetskaya nab. 7-9 St. Petersburg 199034
Russia

egorovfta@yandex.ru

Vyachaslav Byalt, Komarov Botanical Institute of Russian Academy of Sciences
Russia; Elena Pismarkina, Botanical Garden of the Ural Branch of the Russian
Academy of Sciences Russia

The North of the Western Siberia is still poorly floristically investigated. At the same time there are a lot of activities of mining industries the active road building pipeline construction development of infrastructures growth of settlements the development of agriculture horticulture gardening etc. It is created the preconditions for the invasion and dispersal of alien species on disturbed areas: roadsides and slopes of roads river shallows badlands in airports and train stations. The abstract presents the data on the alien plant species collected during the field observations made in 2012-2014 in the settlements of the Yamalo-Nenets Autonomous District which are located in southern tundra (1 settlement); forest tundra subzone (5); northern (3) and middle taiga (1). "Adventive plant" status has been given in the following cases: 1) an indication in the literature as a skid type for the region; 2) an occurrence of species only or mainly in ruderal and / or weedy habitats; 3) an occurrence of the species in isolation from its main natural areal. 143 adventive species belonging to 31 families from Magnoliophyta were identified. Herbarium specimens are stored in the herbarium LE KFTA SVER. More than half of the species (59%) are represented by 6 families (Asteraceae - 24 Poaceae - 16 Fabaceae - 12 Apiaceae 11 and Brassicaceae Rosaceae – on 10). 100 new species and 11 genera of adventive plants for the territory of the District have been identified including 18 new species for the flora of Siberia: *Aethusa cynapium* *Anthyllis vulneraria* *Chaerophyllum aureum* *Dianthus barbatus* *Epilobium bergianum* *Geum urbanum* *Medicago romanica* *Potentilla obscura* *Rubus strigosus* etc. However the synanthropic plants are settled exclusively in anthropogenic habitats practically not invading into the taiga tundra and another undisturbed ecotopes. This work was supported by the Department of Science and Innovation of the Yamalo-Nenets Autonomous District (N01-15/4_25.07.2012).

Galanina, Olga

St. Petersburg State University Institute of Earth Science 199034 St. Petersburg
Russia

o.galanina@spbu.ru

Dmitriy Philippov I.D., Papanin Institute for Biology of Inland Waters of Russian
Academy of Sciences Russia

The big river valleys are the natural corridors for migration of alien plant species and penetration into the northern ecosystems. The data on distribution of *Elodea canadensis* Michx. an invasive aquatic plant of North American origin over the Arkhangelsk region North-West Russia is given. This alien plant species appeared for the first time in the White Sea basin about 100-110 years ago. It was recorded in the tributaries of the upper course of the Sukhona River in 1920th (Perfiljev 1934). In 1932 *Elodea canadensis* was collected by A.P. Shennikov in the river basin of Vajmuga (a left bank of Emtsa River). In 1940 it was already seen in the upper course of the Northern Dvina River. In mid-1960th this plant spread along the whole valley of the Northern Dvina River. Later the floristic revisions of this species had proved its distribution over the rest of Arkhangelsk region (excluding islands) (Vekhov 1994; Schmidt 2005; Razumovskaya et al. 2012; Herbaria: LE LECB IBIW). It was noticed that *Elodea canadensis* is nearly absent in the big rivers but it is rather abundant in the small ponds of the river valleys. Our data show that *Elodea canadensis* forms the plant communities in about 60-70% of oxbow lakes in the middle courses of Northern Dvina and Pinega Rivers. This fact probably can be explained by the young age of oxbow lakes and ponds peculiarities of their hydrologic and hydro chemical regimes underlying calcareous and gypsum bedrocks. *Elodea canadensis* was noticed in the slow and shallow waters of small rivers; less often it occurs in the medium-size rivers on sandy-silt grounds with a depth up to 0.6-0.8 m. It replaces the native species of aquatic macrophytes acting the most actively at the initial stages of plant successions. This work was supported by the RFFR (grant № 13-05-00837).

Changing climate and outbreak ranges of forest pest insects in Finland - Observed changes and future projections

Neuvonen, Seppo

Natural Resources Institute Finland (Luke) Yliopistokatu 6 FI-80100 Joensuu Finland

seppo.neuvonen@luke.fi

Heli Viiri, Natural Resources Institute Finland; Antti Pouttu, Natural Resources Institute Finland

Forest insect outbreaks have been occasional in Finland but they may increase in a warming climate. *Neodiprion sertifer* is the main pine defoliator and outbreaks have been rare in eastern and northern Finland due to cold winters. The outbreak range of species is predicted to expand if winter temperatures increase. No outbreaks of *Acantholyda posticalis* were known in Finland until ten years ago. In 2006 an outbreak of *A. posticalis* killed about 20 ha in the western coast of Finland and currently the outbreak area has expanded to 200 ha. The outbreak was probably triggered by several dry years but it is difficult to predict future developments. Outbreaks of *Ips typographus* and other bark beetles attacking spruce have increased in southern Finland since 2010. More frequent storm damage and warm summers have enabled the development of more sister broods and even a second generation. In a warming climate the reduction of spruce bark beetle risks with management actions (timely salvage and sanitation cuttings) is urgent to quarantine the sustainability of forestry. Cyclic outbreaks of defoliating geometrids (*Epirrita autumnata* *Operophtera brumata*) are typical for the mountain birch forests of NW Europe. The intensity of peaks varies a lot and the largest outbreaks have killed hundreds of square kilometres of birch forest having devastating effects on ecosystem services and the condition of reindeer pastures. Due to warmer winters (not capable of killing the overwintering eggs) the incidence of outbreaks is predicted to increase in the continental areas of Northern Europe. The number of defoliation years has increased due to outbreaks of these two species following each other which has detrimental effects for local livelihoods.

Selikhovkin, Andrey V.

Saint Petersburg State University Universitetskaya nab. 7-9 St. Petersburg 199034
Russia and Saint Petersburg State Forest Technical University Institutskiy per. 5 St.
Petersburg 194021 Russia

A.Selikhovkin@mail.ru

Boris G. Popovichev, Saint Petersburg State Forest Technical University Russia;
Dmitry L. Musolin, Saint Petersburg State Forest Technical University Russia; Yuri N.,
Baranchikov, V.N. Sukachev Institute of Forest, Siberian Branch of the Russian
Academy of Science

Dutch elm disease (DED) is caused by the fungus *Ophiostoma novo-ulmi* (Ascomycota) which is spread by elm bark beetles (Coleoptera: Curculionidae) during a period of feeding on shoots in early summer. *Ophiostoma novo-ulmi* was accidentally introduced from Asia into North America and Europe in the 1940s. It devastated elms on both continents starting from the late 1960s (Spooner Roberts 2010). Shortly after the invasion more than 25 million of trees died in the United Kingdom whereas France lost over 90 % of its elms. The disease spread to all directions and reached Stockholm in the late 1980's. Approximately 300–400 trees were removed annually to stop the spreading of the pathogen but nevertheless in 2009 more infected trees than ever before were removed in Stockholm. In St. Petersburg the first decline of elms was recorded in 1995 in Tsarskoe Selo (the city's southern suburb). Both the most common elms in St. Petersburg (*Ulmus laevis* and *U. glabra*) are declining now in all types of the city greenery objects because of the elm bark beetles *Scolytus multistriatus* and *Scolytus scolytus* and DED. These beetles were not significant pest in St. Petersburg before DED was recorded in the city (Venkova 1938). Interaction of bark beetles and pathogen gave a catastrophic effect. Now more than 1500 loci of mass propagation of the pests and pathogen are known in all urban greenery objects in St. Petersburg including historical parks and squares. Recently another elm bark beetle *Scolytus pygmaeus* known to interact with the fungus was detected for the first time in St. Petersburg (Selikhovkin et al. 2014; Sherbakova Mandelshtam 2014). Elms are popular in Northern urban greening because of their resistance to low temperature and urban stress. Spreading of the pests and fungal pathogen can dramatically impoverish the quality of the urban green decoration.

Structure of Arctic local floras and the problem of invasive species

Sidorova, Oksana

Northern (Arctic) Federal University named after M.V. Lomonosov Severnaya Dvina
Emb. 17 Arkhangelsk Russia\$ 163002

o.v.sidorova@narfu.ru

Elena Churakova, Institute of Ecological Problems of the North Ural Branch of the
Russian Academy of Sciences Archangelsk Russia

Arctic Floating University is one of the largest scientific and educational projects of the NArFU. Important direction of research of this project is to study the local flora in the Arctic territory. Area of investigation is very extensive and includes primarily the Arctic island territories. In 2013-2015 six local floras were studied in the East European Arctic: three of them were situated in the northern tundra (Bugrino White Nose Varnek) and two in the arctic tundra (Bolvansky Nose Matveev) and one in the polar desert (Cape Sedov). Territory of local floras Bugrino Varnek include Nenets settlement. On the other territories meteorological stations are located which have been operating for many years. Therefore all these areas are transformed to some extent. Even so any adventitious synanthropic species are not recorded in these local floras although the share of apophytes (species are located in naturally eroded and poorly sodded areas) is high significantly. It ranges from 37 to 55 percent of the total number of species of flora. According to reports this parameter is lower and varies between 30 to 40 percent for more southern continental tundra coastal floras. Proximity of the sea coast widespread cryogenic erosion the presence of large colonies of birds and mammals explain high share of apophytes in the floras of high-latitude Arctic. The main difficulties for penetration of invasive synanthropic species on Arctic territory therefore are not only a deficit of diaspores of these species and extreme climatic conditions but also a considerable number of species of native flora are well adapted to the development of disturbed areas. As a result only native eroziophytes and nitrophytes identified in the human habitation and other buildings trails roads. In the same time the species composition of plant communities and microgroups of transformed habitats differs from those native.

Suominen, Otso

Kevo Subarctic Research Institute University of Turku FI-20014 Turku Finland

otso.suominen@utu.fi

Piippa Wäli, University of Oulu Finland; Anna Liisa Ruotsalainen, University of Oulu Finland; Karita Saravesi, University of Oulu Finland; Maarit Kaukonen, Metsähallitus Finland; Karoliina Huusko, University of Oulu Finland; Heini Koivuniemi, University of Oulu Finland

Winter moth (*Operophtera brumata*) has expanded its range into northern continental areas in Fennoscandia. The first known outbreak of this species in Finnish Lapland occurred in 2005-2009. It led to defoliation of 400 km² of mountain birch forests at the northern treeline in Finland. We have followed several biotic variables after the outbreak. The amount of alive birches and the coverage of dwarf shrubs declined dramatically during the outbreak. Especially crowberry (*Empetrum nigrum*) suffered badly. If the outbreak lasted only one year approximately half of the birches died and *Empetrum* dominated field vegetation recovered mostly during the first five years after the outbreak. If the outbreak continued for two or more consecutive summers the death of birches was often total grasses took over the field vegetation and the recovery of the dwarf shrubs was very slow. By 2015 it seems evident that parts of the damaged areas will turn from forest to treeless tundra. The berry production of *Empetrum* and *Vaccinium* shrubs ceased after the moth outbreak. In forests defoliated once berry production had recovered in 2012. In forests defoliated during several summers berry production of shrubs recovered only in 2014. Fruitbodies of ectomycorrhizal fungi of birch were virtually absent on damaged plots whereas saprophytic macrofungi increased their fruiting along the moth damage gradient. Arbuscular mycorrhiza and shoot endophytes of the grass *Deschampsia flexuosa* lightly benefited of the moth damage whereas the impact on root endophytic community was negative. Population densities of three vole species and the total rodent abundance increased with the increased moth damage after the outbreak. Only one vole species favored the undamaged forests. These differences were noticeable even in 2015. Snow track counts revealed that winter densities of willow ptarmigan and mountain hare crashed in the damaged forests after the outbreak.

Invasive alien pests as the major threat to European woodland ecosystems: ash and elm as the examples

Rimvys Vasaitis

Swedish University of Agricultural Sciences

In recent years, a number of invasive alien pests caused severe damage to woodlands of Europe. Those include *Dothistroma*-, *Diplodia*-, *Fusarium circinatum*- and pinewood nematode, each causing dieback of pine, *Phytophthora* diebacks on deciduous trees and larch. Chestnut blight caused by *Cryphonectria parasitica* and plane blight caused by *Ceratocystis platani* are typical examples of invasive aliens formerly and currently observed in southern Europe. More recently devastating disease of *Buxus* has emerged, the agent of which is *Cylindrocladium buxicola*, infections of which are often followed by a secondary infestation from *Volutella buxi*, another fungal blight. It is currently acknowledged, that due to increasing international trade with (potted) plants for planting, more alien pests are to come. In this presentation, lethal diseases caused by invasive alien fungi to ash and elm will be discussed, that are much actual to northern Europe. Recently and nowadays, severe Ash DieBack (ADB) is observed in most European countries. This is an emerging disease caused by invasive alien fungus *Hymenoscyphus fraxineus* originating from Far East Asia. The disease results in massive ash mortality, and currently threatens the existence of tree species on a continental scale. Also Dutch Elm Disease (DED) is a lethal disease, which during the last 100 years has led to a massive mortality of elm trees in Europe, threatening the existence of the species over large geographical areas. DED is caused by invasive alien fungi from the genus *Ophiostoma* originating both from Asia and North America. However, data from European clonal seed orchards of ash have demonstrated that different tree genotypes exhibit different levels of susceptibility to ADB. Reports from numerous countries indicate that there are individual ash trees without any symptoms in otherwise ADB devastated areas. Due to the fact that the massive amounts of pathogen spores are distributed by wind, all ash in such areas must have been about equally exposed to the disease. Therefore presence of symptomless ash would suggest tolerance or resistance to the disease. Consequently, breeding programs of ash against ADB have been recently initiated in many European countries. Moreover, it has been known for decades ago that different elm genotypes are not equally susceptible to DED, and trials for breeding of elms against DED in Europe have historical roots. As a result, recently a number of DED-resistant elm clones were developed and registered for practical use in horticulture and forestry, and are to be continued and expanded. Therefore, the objectives for long-term strategy to control and restrict impact of those tree pests are: i) to create (GPS-mapped) pan-European database of ash and elm resistant / tolerant to ADB, respectively DED; ii) to exchange genetic material of resistant / tolerant between research groups; iii) to initiate breeding for resistance trials on a continental scale; iv) to establish pan-European network of seed orchards by planting available resistant genotypes of ash and elm; v) to initiate silvicultural trials by replanting resistant trees in affected ecosystems / woodlands; vi) to initiate the experiments for biological control of DED with viruses; vii) to continuously perform biodiversity studies in areas devastated by ADB and DED (focusing also on introduced Siberian ash and elm which are apparently resistant to ADB and DED), and mediate the results to society; x) to conduct demonstration meetings and seminars for stakeholders and general public.

1.8 Novel approaches to communicate research facts and predictions of the future of Arctic marine biota to non-scientific stakeholders



Environmental changes, such as ocean warming and acidification, as well as sea-ice decline, are significantly affecting Arctic marine systems at variable scales in space and time. Increasing human activities, such as resource exploration/exploitation, ship traffic, and tourism, add further pressures. Substantial effects on marine biota from sea surface to seafloor are expected, leading to shifts in all ecosystem functions and services.

The session aims to provide a forum for (i) reviewing ongoing/planned efforts of developing information systems for both scientific and non-scientific users, (ii) pinpointing fields/opportunities of international and transdisciplinary collaboration in such efforts, (iii) showcasing advantages and possible applications, (iv) discussing technical aspects of publicly accessible information systems, (v) exploring implications for the development of appropriate ecosystem-based management measures and identifying priority decision-making issues that are at the interface of science and environmental management, and (vi) identifying priority issues (technical, legal, etc.) to be solved yet. The session will demonstrate the huge benefits of promoting international pan-Arctic data-integration efforts and developing publicly accessible information systems for education and outreach purposes.

Convener: Dieter Piepenburg, Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Germany

Bobylev, Leonid

Scientific Foundation “Nansen International Environmental and Remote Sensing Centre” (Nansen Centre NIERSC) ADDRESS 14th Line 7 Office 49 Vasilievsky Island
199034 St. Petersburg Russia

leonid.bobylev@niersc.spb.ru

Stein Sandven, Nansen Environmental and Remote Sensing Centre Norway; Vladimir Volkov, Nansen International Environmental and Remote Sensing Centre Russia; Victoria Khmeleva, Nansen International Environmental and Remote Sensing Centre Russia; Anna Vesman, Nansen International Environmental and Remote Sensing Centre Russia & Arctic and Antarctic Research Institute Russia; Denis Demchev, Arctic and Antarctic Research Institute Russia & Nansen International Environmental and Remote Sensing Centre Russia; Mohamed Babiker, Nansen Environmental and Remote Sensing Centre Norway; Alexandra Mushta, Nansen Environmental and Remote Sensing Centre Russia; Kirill Smirnov, Nansen Environmental and Remote Sensing Centre Russia

Northern Sea Route (NSR) is becoming more and more perspective region for navigation oil and gas industry fishery and tourism from year to year. Sea ice conditions at this route are variable. Location of the fast ice edge polynyas ice drift characteristics are different in every year. Therefore the operational ice management at the NSR is crucially important. The main goal of presented research is creating the consolidated daily updated system for sea ice management at the Northern Sea Route as an interactive online tool based on satellite and modelling data for sea ice condition analysis. The created system includes collecting and archiving satellite data and data of numerical models as well as their processing for obtaining information about ice characteristics. One of the major components of the system is acquiring Synthetic Aperture Radar (SAR) and high-resolution optical satellite images from various satellites. Core information is provided by SAR data (e.g. Sentinel-1 satellite). Then these images are processed by developed at the Nansen Centres in St. Petersburg and Bergen techniques for ice-water and ice types classification sea ice drift retrieval to map mesoscale ice motion and deformation fields as well as iceberg detection. This system is created for supporting marine operation. Particularly it can help to find sailing routes through open leads or thin ice and avoid areas with ridges and other difficult ice conditions. Key user groups of created system might be shipping companies oil and gas companies operational met-ocean services coastal and ship traffic authorities risk management and environmental organizations working in the region of the Northern Sea Route. This work is supported by the subsidy from the Ministry of Education and Science of Russian Federation for the implementation of project “Ships and Waves Reaching Polar Regions” (Agreement No. 14.618.21.0005).

Factors dominating bacterioplankton abundance and production in Norwegian and Chukchi Seas in summer

HE, Jianfeng

Polar Research Institute of China 451 Jinqiao Rd. Shanghai 200136 P. R. China

hejianfeng@pric.org.cn

Yuan GAO, Xiamen University Xiamen 361005 P. R. China; Min Chen, Xiamen University Xiamen 351005 P. R. China; Ling Lin, Polar Research Institute of China Shanghai 200136 P. R. China; Fan Zhang, Polar Research Institute of China Shanghai 200136 P. R. China.

Bacterial abundance in Norwegian Sea is from 0.75×10^8 cells/L to 15.12×10^8 cells/L with an average of 3.31×10^8 cells/L. Bacterial production is between $0.13 \text{ mg C m}^{-3} \text{ d}^{-1}$ to $0.84 \text{ mg C m}^{-3} \text{ d}^{-1}$ averaging $0.46 \text{ mg C m}^{-3} \text{ d}^{-1}$. In Chukchi Sea bacterial abundance is between 0.56×10^8 cells/L and 6.41×10^8 cells/L. The average is 2.25×10^8 cells/L. Bacterial production is from $0.042 \text{ mg C m}^{-3} \text{ d}^{-1}$ to $1.92 \text{ mg C m}^{-3} \text{ d}^{-1}$ averaging $0.54 \text{ mg C m}^{-3} \text{ d}^{-1}$. Bacterial abundance in these two seas shows a significant difference mainly caused by temperature while production shows no difference. High temperature results in high bacterial abundance but the response of bacteria is insensitive. Bacterial production in both Norwegian and Chukchi Seas is far less than primary production which means that these two areas are autotrophic. Based on the slope of lg bacterial biomass versus lg bacterial production bacterial communities in Norwegian and Chukchi Seas are mainly dominated by top-down control which means grazing pressure and viral lysis are constrained factors. And this is partly reflected by the multivariable linear regression in which bacterial production is only correlated with Chl a. Under this conclusion environmental change in polar areas appears to be more influential to microbes in Chukchi Sea than Norwegian Sea.

Importance for education and outreach to comprehend synergy between management efforts and climate changes for the status of commercial fish stocks: a case of northern Russian fisheries

Lajus, Dmitry

St. Petersburg State University 7/9 Universitetskaya nab. St. Petersburg 199034
Russia. 7/9 Universitetskaya nab. St. Petersburg 199034 Russia.

dlajus@gmail.com

Daria Smagina, St. Petersburg State University Russia; Julia Lajus, National Research
University Higher School of Economics Russia

Until the 1970-80s role of climate in changes of stock abundance of commercial fish species was not clearly recognized and these changes were mostly explained by effectiveness or inaccuracy of management efforts. During the last decades significance of climate fluctuations and global climate change for fish stocks status had been increasingly recognized. It became clear that in most cases serious changes in large fish stocks were due to interaction of management efforts and climate changes. In particular now most researchers agree that a decline of Atlanto-Scandian herring stock in the beginning of the 1970s and collapse of Atlantic cod fisheries in the north-western Atlantic waters in the 1980s were caused by unfavorable climate conditions which were interacting with inadequate management. Last years it is observed a good status of important commercial fish stocks in the Russian Northern seas in particularly cod fisheries in the Barents Sea and salmon fisheries in the North Pacific. Our interviews with stakeholders who are involved in fisheries management of these stocks conducted in the framework of the study of process of ecological certification according to standards of the Marine Stewardship Council showed that managers believe that the improvement of status of these stocks is mostly due to effective management decisions although most of other stakeholders who are not directly involved in the management often consider climate changes as a main factor of increase of commercial fish populations. We consider that good understanding of mechanisms of dynamics of commercial fish stocks is only possible while taking into consideration various drivers of their population dynamics not only management decisions. Now in a period of global warming climate changes evidently play an important role especially in high latitude areas such as northern seas of Russia. We argue that they have to be considered in a synergy with management efforts and that it is very important to take this into consideration in educational programs and stakeholder outreach to enhance resilience of marine ecosystems.

Concept of hierarchical structure of large marine ecosystems zoning in Arctic shelf seas of Russia

Petrov, Kirill

Saint-Petersburg State University Institute of Earth Sciences 33/35 10-th line
Vasilievsky Island Saint-Petersburg 199178 Russia

k.petrov@spbu.ru

Andrey Bobkov, Saint-Petersburg State University Institute of Earth Sciences 33/35
10-th line Vasilievsky Island Saint-Petersburg 199178 Russia

Principles of biogeographical regionalization of World Ocean are widely discussed in the literature. In works of Spalding et al (2007) for lower unit of regionalization adopted ecoregions - large marine ecosystems. These are very large water areas as a rule the whole sea basins analogs of physiographic countries on the land. In our view large marine ecosystems comprise a hierarchical system of smaller units' regionalization which corresponds to a natural distribution of hydrobionts\ communities. In the continuing process of regionalization of large marine ecosystems is proposed to use the bionomic approach that takes into consideration the link of communities of marine organisms with habitats that allows a meaningful comparison of areas at different levels of hierarchy. System of biogeographical regionalization should be based on natural historical and bionomic features of water areas (Petrov 2004). Originality of bionomic area in view of authors is determined by its position in system of units of latitudinal zonality (zone area province) vertical (depth) differentiation (vertical zone layer) and azonal one which is controlled by geological and geomorphological factors that determine the uniqueness of marine basin region and district. Principles of hierarchical system of units of bionomic zoning are discussed on example of Arctic seas of Russia. Detailed zoning of marine basins: 1) is a necessary condition for understanding their current state through monitoring 2) allows to extrapolate recommendations on rational environmental management for similar ecoregions and 3) helps to prevent negative consequences of anthropogenic effects on vulnerable water areas of the Arctic.'

Ontology-Based Models and Techniques in Multi-Subject Intellectual ISs for Cognitive Human-Machine Communications in Heterogeneous Environments

Shishaev, Maxim

Murmansk Arctic State University

shishaev.maxim@mshu.edu.ru

Alexander Vitsenty, Institute for Informatics KSC RAS Russia; Pavel Lomov, Murmansk Arctic State University Russia; Vladimir Dikovitsky, Institute for Informatics KSC RAS Russia

Arctic marine systems are the subject of the interest for different kinds of researchers. A lot of heterogeneous information should be presented for different users in appropriate manner to facilitate its perception and interpretation. Information system addressing such issue have to collect and store information in non-contradiction way. Another crucial problem is to select appropriate information to solve given task and to represent it in most efficient way. We call such a system a 'multi-subject' one (MSIS). For recent years we have developed a set of the models and techniques aimed to construct and control multi-subject information systems for different domains. Mentioned models and techniques are based on number of artificial intellect technologies in particular on the formal knowledge representation with ontologies: technique for ontologies creation and integration based on common thesaurus and continuing feedback named 'user as an expert'. This approach allows to exclude expensive and time-consuming efforts in searching the information; technology of cognitive interface synthesis that is grounded on the user's mentality models which are automatically formed by continuously monitoring of user's activity; "semantic-space-time" data model allowing to form visual images of researched objects and phenomena setting up the mapping data according to end-user needs taking into account the characteristics of the subject area and perception of graphical information; special search technique based on extendable request user's mental models and subtractive relations; methods of the cognitive visualization of the Arctic marine biota. By delegating part of human's cognitive functions to machine and by taking into account users mental stereotypes within mentioned technologies we can improve the perception of the research facts predictions and other specific information by different kinds of stakeholders.'

Vargina, Ekaterina

St. Petersburg State university Faculty of Philology department of English philology
and linguocultural studies Universitetskaya emb. 11 St. Petersburg Russia
(812)3289515

kvar63@gmail.com

Social media are playing a special role in convincing the decision makers and forming public opinion on such topical issues as development of the Arctic region and environmental concerns. Nowadays social media not only shape our minds but also organise people for practical activities. This article concentrates on rhetoric devices and strategies used in social media (Facebook) devoted to the Arctic region. Accounts of both major companies involved in research and construction in the region and environmentalist public organisations have been studied. They demonstrate both similarities and differences in the approach to the information and the rhetoric devices used. The study enables us to make the following conclusions: 1) Unlike in quality newspapers within one post information about facts is combined with opinions of the writer. 2) Commands and requests to the readers are mostly expressed by indirect speech acts. These might include forecasts of what might happen if something is not done expressions of gratitude for the work done already questions to the readers encouraging them to make up their minds. 3) The main arguments used are non-verbal (videos and photos). There are several patterns of interrelations between the text and the visual content yet in all of them there are examples of the so called band wagon device (when the author uses the picture to prove something very different from what it actually shows). 4) Texts about Arctic contain a lot of scientific and technical terms. Explanation of these terms to non-specialists is an instrument used not only to increase their awareness but also to form their opinions.

Theme 2: Vulnerability of Arctic Societies



Shismaref Erin, Alaska. 2015. (Bering Land Bridge National Preserve, Wikimedia Commons)

2.1 The role of law and institutions in Arctic transformation process



Legal systems are of much importance from the viewpoint of how Arctic regions develop, given that almost any issue-area is governed by law in various levels. Contemporary social and economic processes evolving in the North call for legal regulations; community of scholars should conduct research for fruitful cooperation ensuring its consistent development. This session aims to identify what is the role of law in the vast transformation process that is facing the Arctic region from a multitude of drivers and addresses studies devoted to control and use of Arctic social innovations.

Conveners:

Timo Koivurova, Arctic Centre/University of Lapland, Finland

Natalia Prisekina, Far Eastern Federal University, Russia

The role of law in the relationship between the local people and the oil industry in the Komi Republic Russia

Britcyna, Ekaterina

University of Lapland Rovaniemi Finland Yliopistonkatu 8 96300 Rovaniemi Suomi

katya-bricyna@yandex.ru

Minna Pappila, University of Turku Finland; Soili Nystén-Haarala, University of Lapland Finland

Oil industry is an important part of the economy of the Komi republic in the Russian Federation. In addition to its benefits for the local regional and especially federal economy there are also serious ecological disadvantages - mainly oil leaks - that affect the lives of local people and erase the oil industry's social license to operate in the region. Our case study is located in the Izemskii district in Komi where we have interviewed both the local people local authorities and representatives of oil industry. We concentrate in our presentation on the role that legislation has in enhancing corporate environmental responsibility towards the local people in Komi. We look at the relationship between the local people and the oil industry especially from the point of view of participatory rights of the local people. Russian environmental legislation offers minimal amount of participatory rights. They only have a right be heard in a environmental impact procedure of a new project but they have no rights related to ongoing projects. Continuous oil spills affect the living conditions of the local people and are considered a serious threat to living conditions in villages yet there are no official ways to participate; e.g. to get information on oil leaks and recovery works of polluted land areas or rivers. In this sense Russian legislation has only got worse during the last 15 years. There is however some regional legislation or practices that alleviate the situation somewhat. Local people do not get any compensation either as the polluted forest lands or rivers are owned by the state. CSR is considered to consist of social agreements between the oil company and authorities and there is practically no role for the local people unless they have the status of indigenous people which somewhat improves their situation.

Optional Ways for Enhancing Arctic Heritage in Russia

Filin, Pavel

Deputy Director at the Krassin IceBreaker World Ocean Museum Subdivision. Russia
St-Petersburg Naberezhnaya Leitenanta Schmidta str. 23

science@krassin.ru

Tamara Semenova, Heritage Institute Russia

Major Russian strategic documents (such as National Programme for Action for the Protection of the Arctic Marine Environment) do not include preservation of tangible and intangible heritage. Nonetheless heritage is recognized as the essential driver of the sustainable development the ultimate goal of such progress plans. In accommodating modern transformation focus on allowing change while protecting the heritage values is most important. Practical solutions are based on comparative analysis of the various legal instruments and their operational use in the contemporary Russian policy. Managing change is a participated responsibility with a need to define heritage qualities that transfer values into legal protective systems; to identify heritage attributes as physical manifestations against which it is possible to measure impacts; to clearly state authenticity as a baseline quality against which to monitor change; and to safeguard cultural landscapes and seascapes. Existing instruments such as Environmental Impact Assessment have incorporated social and cultural factors through public involvement when it is possible to consider impact of heritage on projects rather than of projects on heritage. General impact assessment methodology and its expansion to Strategic Environmental Assessment (SEA) marks a transition to screening social process from identification and evaluating to mitigation of effects (e.g. the EU Scoping Directive includes heritage factors; management tools; objectives and best practice principles). By discussing alternative strategic options SEA methodology encourages political will towards integrated approaches placing sustainability at the heart of decision-making: from technical solutions to strategic options institutions and governance; from projects to policies and to a strategic thinking culture. Methodology for World Heritage sites selection and management is another tool for managing change it can be specific in the remote areas and particular in the lands where indigenous peoples live. Integrated Territorial Conservation Programme and the Living Heritage Programme are the other instruments to be elaborated for heritage practitioners.

Gavrilov, Viatcheslav

Professor of International Law School of Law Far Eastern Federal University D346
Building D FEFU Campus 10 Ajaks str. Ostrov Russky Vladivostok 690922 Russia

gavrilovfirst@gmail.com

While the significance of the Arctic is increasing in the modern world the international community is facing some challenging tasks which nowadays determine the essence and main areas of cooperation between the Arctic States and other interested actors in the region. The most important among them lies in determining basic characteristics of the multilateral governance of the Arctic and improving mechanisms and procedures that already exist within the Arctic Council and other regional institutions and are intended to ensure its effective implementation. It is impossible to complete those tasks without increasing the role of universal and regional legal norms in the Arctic governance system. This statement is based on objective factors of social political and economic nature accompanied by the gradual formation of a broad consensus among the Arctic States concerning the list of and solutions to the Arctic Region issues and the creation of improved international projects and programs required for the completion of such tasks. Therefore the main goal of this topic is to determine key prerequisites and prospects for the improvement of the legal regime existing in the Arctic and for the institutional support of international cooperation between States and other entities in the use of various possibilities of the Arctic Region while ensuring its comprehensive safety. The main attention in the paper is given to the following issues: 1) Identification of promising areas of international cooperation in the Arctic Region that require legal and other regulation and the role of legal and non-legal regulators in that process; 2) Significance of universal and regional acts and their correlation for increasing the effectiveness of the Arctic governance; the role of the Arctic and non-Arctic States in solving that issue; 3) Analysis of potential of the Arctic Council and other international institutions to support the further development of the legal regulation of the Arctic use and preservation.

Gorbunov, Stanislav

Northern Institute of Entrepreneurship (Non-Governmental Institution) Arkhangelsk

RF stanley@atnet.ru

stanley@atnet.ru

The development of Russian colonial Law never stops for more than 200 years. The paternalistic approach in legislature is still common from the beginning of the 19-th Century. One of the latest Acts reflecting the Trend is the Concept of Sustainable Development of indigenous people\`s in Russian Federation adopted by the Government in 2009. The Article deals with a short summary and some comments on the Document. The Author presents his view on preferable steps in development of indigenous Law applicable to the Arctic Region.'

The Dynamics of Trade and Technology in Long Run Inuit Economic Development

Kaiser, Brooks

Department of Environmental and Business Economics University of Southern
Denmark Niels Bohrs Vej 9-10

baka@sam.sdu.dk

Alexej Parchomenenko, University of Southern Denmark Denmark

We use a model of socio-ecological systems to investigate how early trade between Inuit and non-Inuit communities affected long run opportunities for Inuit. The effects of trade include both direct changes e.g. in the population and in the resource base and indirect changes through institutional gaps and shifts in the returns to Traditional Ecological Knowledge (TEK) and new introduced technologies. A change in the terms of trade within the existing socio-ecological systems accompanied new desirable goods like tea and tobacco. What held value came to change over time with its ability to be monetized or traded for non-Inuit goods. Examples include Arctic fox and Bowhead whales. Early trading seemed relatively innocuous -- unlikely to affect Inuit communities' ability to thrive within their limited but balanced socio-ecological system exchanges. Both Inuit and outside traders saw trades as mutually beneficial. Further trade introduced new technologies (e.g. guns) that increased resource pressures and diseases that reduced human populations sometimes rapidly. These introduced technologies and diseases and the changes in the relative value of marketable goods shifted communities away from a set of equilibrium conditions under which Inuit communities had been generally capable of sustained operations at or near carrying capacity for the environment and technology available. These transformations changed the potential role of the top layer of the socio-ecological system. In the dynamic system the shift in values lowered the returns to many components of TEK and depreciation of this human capital accelerated as the relative investment costs increased. We examine the dynamics of our model in the context of variations in historical technological transformations through trade (e.g. whale hunts differing by species) and how the rate of change can lead to institutional gaps such as common property governance mechanisms that limit overharvesting.

Contemporary Arctic policy of the Republic of Korea: political collaboration in the region

Kharitonov, Anton

Saint Petersburg State University

cdaddice@inbox.ru

Topic will touch upon the questions of providing new ways of implementation of politics of the Republic of Korea in the Arctic region and its interpretation of establishing proposals in sustaining environment system of the Arctic region as necessary as developing new ways of cooperation within economic partnership. Another words it imposes the problem of dividing in case of understanding political interpretation between maintenance of the ecology and economical interests. The Republic of Korea has its goals throughout the Northern Sea Route passage to develop its capability to provide new possibilities for transporting goods from Asia to Europe bypassing common route of shipping across the Indian ocean. As non-regional country the Republic of Korea doesn't have much influence in the Arctic region standing along with other non-regional states as an observer of the Arctic Council. In this regard this topic is scheduled to shed a light on relations of the Republic of Korea with actual arctic countries. However the Korean Government urges to conduct policy which comprises current and further national interests of the Republic of Korea in the Arctic region. Such implementation of the Republic of Korea would also lead to investment of building new ports and new infrastructure along the arctic ocean which may be only considered as a positive contribution to the development of international collaboration in the Arctic.

Loukacheva, Natalia

Canada Research Chair in Aboriginal Governance and Law Department of Political
Science University of Northern British Columbia 3333 University Way Prince George
BC Canada V2N 4Z9

Natalia.Loukacheva@unbc.ca

To enhance Arctic marine safety the Arctic States within the framework of the Arctic Council have done substantial progress in addressing a number of issues associated with Arctic shipping. These activities materialized in cooperation of the Arctic Council with several relevant international organizations. Special focus was made on collaboration of the Arctic Council with the International Maritime Organization (IMO) in the development of the mandatory Polar Code. Now that the Polar Code is expected to enter into force in January of 2017 a question can be asked about further role of the Arctic Council (if any) in the implementation of the Polar Code and any relevance of the work of the Council in addressing existing gaps in this document. In an attempt to show the role of law in dealing with major transformation and challenges in the Arctic and to reflect on the nexus between law and policies my presentation shall look at the role of the Polar Code in improving the legal regime for shipping in the Arctic and the role of the Arctic Council in the implementation of the Code.

Law and flexibility in governance of the Arctic?

Soili Nysten-Haarala

University of Lapland & Luleå University of Technology

As the Russian experience of transition to a market economy shows, law can be applied as a spearhead of reforms. However, formal law, which changes too quickly and does not correspond to informal rules of society, may not be applied in practice. Transition is not the last huge challenge for developing Russian law, since there are now additional challenges, which all the national legal systems in the Arctic are struggling with. These challenges are globalization, climate change, multi-level governance and implementing the ecosystem approach to law. The Law, however is an inflexible system by nature. As system theory explains, law is a closed subsystem of the state and lawyers function as its efficient gatekeepers. The closed nature should keep law coherent benefit legal certainty, but it can also form a serious obstacle in creating modern law, which could protect the vulnerable Arctic and enable solving problems, which do not recognize borderlines of national states. Since attempts to modernize law and make it more evolutionary and responding to modern challenges have failed, national law is loosing at least parts of its earlier self-evident role in regulating to private governance. The growing amount of global standards and agreements with global and local stakeholder groups is an example of the strength of private governance. Companies as drivers of economic activities should proactively navigate in the pluralistic environment of different private and public sets of regulation and multi-level governance. They can avoid conflicts and settle disputes with skillful choices of application of different sets of regulations in cooperation with stakeholders.

IOC and its interests in the Arctic

Oliounine, Iouri

UNESCO/IOC 7 place Fontenoy Paris 75007 France

i.oliounine@unesco.org

With the increased geo-political attention given to the Arctic and with a dramatic climate change bringing rapid environmental and social transformations the role of international organizations dealing with ocean matters is being considerably increased. Founded in 1960 Intergovernmental Oceanographic Commission (IOC) operated as an autonomous body within UNESCO is considered today by the United Nations as a focal point for ocean observation ocean science ocean services and data exchange. A vital role in addressing some of the major challenges facing the world and the Arctic in particular such as global monitoring of climate change that affects the Arctic (sea temperature rise sea level change acidification) protecting marine biodiversity against different types of pollution and establishment and coordination of an operational ocean observing system will be discussed and services to society from an IOC sustained ocean observing system demonstrated. Special attention will be paid to the role of IOC in capacity development of polar scientists and practitioners and in creating awareness by the general public regarding the global importance of the processes going on in the Arctic and of the need to address them in a coordinated sustained planned timely and resourceful manner. Examples of the IOC mechanisms to achieve these objectives will be given. Finally a short retrospective will be given of large international scientific initiatives targeted to monitoring and research which have been implemented in the Arctic and of the progress achieved in planning a new polar initiative which will address emerging challenges caused by existing opportunities of melting ice.

“Seals are cute!” – A legal tale of emotion and morality

Sellheim, Nikolas

University of Lapland Faculty of Law PO Box 122 96101 Rovaniemi Finland

nikolas.sellheim@ulapland.fi

Ever since the adoption of the EU seal regime in 2009 the seal trade has experienced increasing drawbacks due to an adverse global trade environment. While animal welfare stood at the fore of the early phases of the adoption process this paper shows that the role emotion plays in the legislative process trumps the moral claims of animal welfare. This is caused by the significant differences between the characters of animal welfare laws in the EU and the expressive function of the EU seal regime. Drawing from hermeneutic legal analysis and empirical case studies the paper furthermore untangles the differences between a law based on a moral standard such as animal welfare and a law based on emotional opposition that is not rooted in morality. With the legislative process of the EU seal regime serving as the legal-political backdrop the paper allows for a broader discussion on the role of ‘charismatic megafauna’ such as whales and seals in the legal developments in and for the Arctic. The moral and emotion landscapes in a seal hunting community vis-à-vis EU policy-makers enable for conclusions on the degree to which moral relativism causes hardships for Arctic governance. The paper thus includes proposals to overcome moral and emotional barriers and serves as a forum for discussion in a highly emotional discursive environment on the marine mammal hunt.

Adaptive Governance of Mining – Is It possible?

Similä, Jukka

Arctic Centre University of Lapland P.O.Box 122 FI-96101 Rovaniemi Finland

Jukka.Simila@ulapland.fi

Asta Kietäväinen, Arctic Centre University of Lapland Finland; Veera Salokannel,
Arctic Centre University of Lapland Finland

Our presentation aims to assess whether law governing mining projects have been adaptive and could it be made more adaptive to support sustainable development. The analytical framework is drawing from adaptive law literature and it consists of three main components namely structure capacity and process. Structure means for us simply the basic features and functions of various regulated processes and decisions. In modern societies governance structure tends to be “nested” which means that processes and decisions are interlinked but still have certain degree of independency. Capacity refers both to the resources and authority to respond to change. Process the way how issues are carried out determine who can participate how participation is done and what are the means to reduce future uncertainties and resolve conflicts. The first of our analysis step is build up a picture what is the general legal structure of processes and decisions and how they are formally interlinked. This will be completed using interviews to identify how implementation practice has modified the interlinkages between processes and decisions. The analysis of capacity namely resources and authority as well as processes require the use of both legal analysis and interviews. While law gives general frames practices may vary sometimes even considerable. The empirical material gathered for research consists of around 35 interviews and documents related to five mining projects in Northern Finland at various stages of the life cycle of mining project starting from exploration and ending to operating mines. We interviewed also national level actors who are not directly related to the any of the cases but who are assumed to have general overview of the structure and functioning of governance system.

Arctic policies as poor instruments to promote sustainable development policy coherence and more integrated regulations in the North

Stepien, Adam

Arctic Centre University of Lapland PL122. 96101 Rovaniemi Finland

astepien@ulapland.fi

Contemporary legal and governance systems are often criticized for being fragmented and departmentalized. That is a challenge as the pursuit of sustainable development calls for policy integration co-ordination and enhanced coherence of states' actions. Scholars and analysts encourage policy-makers to apply a holistic approach to governance to cut across sectors and to take account of multidimensional interconnections within social-environmental systems. In the context of Arctic regions one instrument to achieve greater coherence are Arctic policies adopted by Arctic and non-Arctic states as well as by the European Union. These policies in most cases originated from the need to produce an Arctic foreign policy stance. Nonetheless they ultimately serve as coherence-enhancing practices aiming at making state activities within (or directed towards) the Arctic to be more integrated synergetic or consistent. The paper examines whether the process of making of Arctic policies can "bring together" various strands of actors' presence in the region and contribute to the sustainable development of the Arctic. In particular the policy documents and activities of Canada the EU and Finland are considered. The conclusions are discouraging. The notion of sustainable development in Arctic policies is used rather to obscure the contradictions than to support a clearer course of action. Too many aspects and sectors are included in Arctic policies for them to be focused and operationalizable. They are usually more about labeling various issues as "Arctic" than introducing tangible coordination or integration. Arctic policies are generally marginal within policy-systems which makes them collections of existing actions with very limited influence on sectoral policy-making. Eventually the pursuit of coherence is an intensely political act of choosing how sustainable development is understood which priorities and interest groups are dominant and around which issues coherence is being built.

Tiainen, Heidi

University of Eastern Finland Dep. of Geographical and Historical Studies Metla/
Room 1101 Yliopistokatu 6 80130 Joensuu Finland

heidi.tiainen@uef.fi

Governance frameworks for mining are an especially topical issue as the industry is entering new regions throughout the world. Mining sets excessive demands for the institutional framework but good governance can promote the contribution of mining to sustainable development. However especially emerging mining countries have been noted to face difficulties in mining governance. One of the countries with vast resource potential and ambitions for mining development is Greenland - the autonomous Inuit country of Denmark. In 2009 Greenland received greater autonomy with the right to elect government and parliament the former having sovereignty and administration over a number of areas including mineral resources. Since the development of mining industry has been forcefully promoted by the national government and Greenland. The general political discourse of the decision makers has stressed the importance of social sustainability in mining development. The article analyzes the social sustainability approach of national mining policy and the rapidly evolving governance framework in Greenland. The findings suggest that Greenland has adopted a proactive approach to governance and established a framework for mining with a set of policy tools emphasizing social sustainability. Mining is perceived with potential to contribute to social sustainability through increased employment and skills development. The governance framework with the key tools environmental impact assessment (EIA) social impact assessment (SIA) and impact benefit agreement (IBA) draws from international best-practices mixing regulation and softer mechanisms while seeking to remain considerate to the local context. However as Greenland is inexperienced with mining and the capacity of government authorities is relatively humble implementation of the tools is challenging. Further the approach of national policy and governance framework towards social sustainability is somewhat biased and the processes of governance have been argued limited in terms of true dialogue.

Towards Sustainability of Local Communities: Interaction between State Authorities Oil Companies and Indigenous People

Tulaeva, Svetlana

University of Lapland (Finland) Russian Presidential Academy of National Economy
and Public Administration, Russia

svett07@mail.ru

The intensive industrial development of most countries at the close of the 20th century focused attention on the problem of preservation of pre-industrial traditions and customs. This was reflected in the burst of interest in the problems of interrelationships between the state corporations and indigenous peoples sticking to their traditional way of life. This paper describes the features of the interaction between indigenous peoples oil companies and public authorities in Russia. I examined two cases representing different models of interaction: reindeer-herding communities in the Nenets District and Nivkh fishing communities on Sakhalin. The special attention was paid the role of global standards in the formation of the patterns. The first case demonstrates the paternalistic mode of interactions. The state is dominant in this mode and global standards are not taken into account. The company adds to or substitutes for the state's efforts providing in-kind support to indigenous people. This paternalistic mode originates mostly from the lingering effects of the Soviet past and creates a dependency of indigenous people on the oil companies. The second case represents a partnership mode where the global standards play a significant role. Tripartite partnership agreements – among the state the company and indigenous people – are based on global standards and implemented on the ground. I analyzed the factors affecting the formation of these patterns of interaction. Also I described the impact of these modes on the sustainability of local communities.

Vetrova, Elena

Northern (Arctic) Federal University

Vetrovaelenik@gmail.com

Liudmila Lapochkina, Northern (Arctic) Federal University Russia

The paper presents the study of the role the mining sector in the Russian economy and proved its raw materials. An analysis of global value chains in the industry has shown a low added value of Russian companies. Analysis of changes in the structure of the economy based on the coefficients of an advancing revealed no significant changes in the structure of the economy over the period analyzed. On this basis the authors concluded that the ineffectiveness of industrial policy of the Russian Federation as a whole and in the Arctic region in particular. The authors identified the problems of formation and realization of the state industrial policy in the Arctic region analyzed the shortcomings implemented at this stage the state policy in the industrial sector of the Russian Federation. On the basis of studies formulated conceptual approaches to change state policy in the Arctic by the example of its European part. The basic idea is to regulate the production chains so as to increase the added value created by the Russian companies involved in the development of the Arctic. At the same time solve another problem - the development of the manufacturing industry in the southern regions of the Northwestern Federal District. In addition the necessity of harmonization of the purposes of state regulation of production chains and goals of the company by the criterion of increasing national economic efficiency.

2.2 Resource development and building capacity in Arctic communities



Resource development is becoming more important to Arctic communities. In the past these developments have often resulted in an increase in environmental, social, and economic problems in the region. Increasingly new systems of governance and new forms of relationships between Arctic communities and industry mean that communities have a greater opportunity to use resource development to improve capacity and general well-being. Over the past five years a number of new research networks have arose to examine how best to ensure mining and oil and gas developments benefit rather than endanger Arctic communities. ReSDA, ArcticFROST, and the UArctic Arctic Extractive Industries Thematic Network and others have been working on this issue, often in partnership. This session is devoted to highlighting the results of this research.

Convener: Chris Southcott, Lakehead University, Canada

Inuit Arctic Governance Model in Nunavik

Arteau, Jean-Francois

Kesserwan Arteau 1298 de la Galène Quebec, Quebec, Canada

Jfarteau@kesserwan.com

My presentation will focus on a governance model developed for and by the Inuit of Nunavik in collaboration with the Governments of Canada and Quebec. It will touch upon the objective of a real representation to the government structure the issue of ethnic and non-ethnic bodies Inuktitut language protection. It will also explain why the presented model was refused through a referendum held in Nunavik and what should be done in a next negotiation phase to make it successful. Finally I will speak about what is ahead for the Inuit in terms of governance while massive economic and resource development is coming with the Plan Nord presented by the Premier of Quebec.

People and Nature in the North of Siberia in XX-XXI: ecology, economy and government

Gololobov, Evgeniy

Surgut State Pedagogical University

gololobov.eig@yandex.ru

The North of Siberia is a region which was developed in a very short period of time from the very beginning of land development when it was necessary to control resource production till the entire industrial land development demanding environmental protection. The Siberian North is the key point to future economical developing of Arctic. This factor makes this region interesting for analyze models on interaction between ecology, economy and government. The idea industrial developing and realization of this idea was base model for including Siberian North in geographical, social and economy space of USSR. Industrial developing means rational using of natural resources. The theory "Conquest of Nature" was main theory for industrial developing Siberian's North. The regional variant of this theory we can define as "Offensive of North", "Subjugation of North", "Conquest of North". The resources approach was main. The main way of developing was create large-scale extractive industry and heavy industry. This way needs in more and more resources. The government and economy was dominate in ecology. The main object for management and transformation must be nature which can transform in any sphere. This stereotype existed in soviet society and science. It is obvious that technological, social and economical sphere is more flexible than nature. The role of people in the system "people-nature" is very small. In modern Russia importance of the solution environmental problems, developments of traditional system's environmental management, preservation of biological diversity of northern territories is recognized at the state level and fixed in official documents. Nevertheless, practice of "conquest of the nature of the North" continues to exist, aggravating already difficult ecological situation in the region. The above aspects dictate need of complex judgment of historical experience of environmental management in the north of Siberia in the XX-XXI centuries in which center there will be a person, the person as the user of nature. At such approach one-dimensional vision of the person from different point of views (political, psychological, cultural, social, economic) with aspiration to find a certain dominant of human essence is overcome. Consideration of the person as user of nature gives the chance of his complex studying, in which "nature" not only something external in relation to the person, but also considerable part him.

Preservation of Territories and Traditional Activities of the Northern Indigenous Peoples in the Period of the Arctic Industrial Development

Gladun, Elena

Tyumen State University

efgladun@yandex.ru

The northern regions are rich in mineral resources and all the Arctic states are interested in their exploration and development. Development of mineral resources of the Arctic region is one of the priorities of Russia's economic policy in the new century, the basis of its powerful energy potential. However, the Arctic is not only a resource base but it is primarily a home and area of traditional life, economic and cultural well-being of indigenous peoples. The Arctic is one of pristine and fragile ecosystems of the world; 40-50 indigenous peoples inhabit its territories. The Arctic is the area where indigenous peoples live, preserve their culture and develop their own management system, traditional values. The intensive industrial development, carried out today in the Arctic regions of the Russian Federation and other Arctic countries, brings positive economic and social changes, but also adds to climate change, environmental problems, and the destruction of lifestyle and traditional activities of indigenous peoples. The existing problems of indigenous peoples include harsh living conditions, dependence on the state protection, economic instability, loss of ancestral lands and natural resources, bad assimilation with the "migrant population". Experience of indigenous peoples and their role in the sustainable use of the Arctic territories are rarely taken into account in the process of the Arctic industrial development. There are gaps in federal and regional legislation regulating the environmental and natural resource rights of indigenous peoples, ensuring their traditional way of life and economy. To preserve the environment and traditional activities of indigenous peoples new legal regulations should be adopted aiming at protection and preservation of indigenous peoples territories. The researchers and public authorities should examine the international experience, use the best practices applied in the northern regions of the Russian Federation (for example, in the Yamalo-Nenets Autonomous District).

Collaboration between business local authorities and science as instrument of building capacity in Arctic communities

Klyuchnikova, Elena

Institute of Industrial Ecology Problems of the North Kola Science Center Russian Academy of Science Akademgorodok 14A 184209 Apatity Russia

e.klyuchnikova@gmail.com

The paper presents results of studying network collaboration of science business and government (Triple Helix Model) as approach of creating economic sustainability in Arctic communities. The basic research was made in the frame of international project “Efficient Energy Management in Barents region” (ENERU) and used the data of 2014 year. The main method of the research is case – study (the case: collaboration organized in frame of ENERU project). The research objects are the mechanisms which assist in cooperation development between the participants of the model and effects of such cooperation on building capacity in local communities. The paper discusses opportunities for broadening links between local authorities science and business and reveals the advantages of using the TH approach in creation of economic sustainability in Arctic communities. The interaction between science government and business is analyzed using the concepts of the “institutional knowledge infrastructure”. The capacity building in local communities is analyzed using the concept of “sustainable development”.

Sustaining resource development sustaining Arctic communities? The 'social' and the 'sustainable' in the Arctic energyscape

Lempinen, Hanna

Arctic Centre University of Lapland Finland PO Box 122 96101 Rovaniemi, Finland

hanna.lempinen@ulapland.fi

Growth in global energy demand dwindling reserves warming climate and technological developments are pushing energy extraction further towards the previously inaccessible North. At least on the level of rhetorics the Arctic region is on the brink of becoming the world's "new energy province" the "treasure chamber" for Arctic states and energy companies. In political and popular debates the region is reserved the role of oil and gas storehouse which will feed the "energy-hungry world". Also in the Arctic energyscape sustainability is a key argument both for and against individual energy projects as well as developing the Arctic energy province as a whole. While economic and environmental sustainability dimensions are frequently highlighted any social aspects associated with the regional energy concern remain silenced sidelined and simplified. Against the backdrop of academic debates over the notions of both 'energy' and the social in this presentation I argue that the ways in which both energy and (social) sustainability are conceptualized in the Arctic energyscape are fundamentally inadequate. Narrow understandings of energy as a hydrocarbon commodity exported from the region and social sustainability as socioeconomic indicators and/or safeguarding indigenous livelihoods are not sufficient in terms of grasping the regional energy concern nor for promoting a more energy equal north.

How to secure indigenous capacity building in new industries?

Nygaard, Vigdis

Northern Research Institute –NORUT Norway PB. 1463 9506 Alta

vigdisn@norut.no

Elisabeth Angell, UNI Research Bergen Norway Per Selle University of Bergen
Norway

Northern Norway is rich on natural resources like minerals windpower petroleum and fish. Resource extraction can improve the capacity and wellbeing of the population particularly in the peripheral areas where industrial development is low and the lack of jobs cause migration. Land based resource extraction in Northern Norway and particularly in the region of Finnmark takes place in the core area of the indigenous Sami people using the land for reindeer herding and harvesting. This paper looks into processes of new industrial development affecting different Sami interests and livelihoods. Drawing on data collected from the research project “Sami interests in new industrial development” this paper focuses on how stakeholders with different attitudes on industrial development in the Sami areas may influence the policymaking processes. The bargaining power of the Sami people in Norway has increased as new laws and agreements has improved the possibility to influence and affect the industrial processes in the core Sami areas. The Sami parliament shall of course protect Sami interest but it is far from always clear what the Sami interests are in different areas and to what extent they are common to most Samis. This puts the Sami parliament and specific Sami interest groups in a challenging position between the Sami people the State and new industrial actors. The Sami parliament and different interest groups are increasingly in direct contact with new global industrial actors and have even signed cooperation agreements in cases in which the legal framework for an important industry like the mining industry is disputed. The position of the Sami parliament opens up new opportunities to form new forms of cooperation and governance structures to discuss and influence upon the future sustainability of local Sami communities in pressure between traditions and modern industries. In this paper we analyze how new forms of governance and cooperation can enhance or restrain capacity building among the Sami indigenous people. We are particularly interested in how the political processes involving the Sami parliament on resource extraction through mining and wind power in local communities affects the possibility for future Sami generations to live in and find work in local communities.

Ocean Wealth and Value of Arctic Resources

Oliounine, Iouri

UNESCO/IOC 7 pl. Fontenoy 75007 France

i.oliounine@unesco.org

Oceans and coasts are the key to sustainable development of the world as they can offer us food resources jobs and many other things contributing to all three parts of sustainable development namely environmental protection economic sustainability and social justice. The wealth of the ocean is immense! An integrated list of the diversity of the ocean wealth will be demonstrated and its limitations identified. To improve understanding of marine/coastal resources use and socio-economic factors there is a need for sustainable sound policy for the oceans and coasts which should recognize the value of ocean resources. The estimates of the combined value of the ocean-dependent and ocean-related industries will be presented and comparison will be made of the input of the coasts and ocean economies to the global economy with the terrestrial input. Special attention will be given to one area of ocean economy that has not been collectively managed or examined. It is the contribution of marine science/research technology development and education to enduring social environmental and economic wealth from oceans and coasts. The second part of the presentation will be dedicated to Arctic resources and its value with a focus on values of non-living (oil and gas minerals) and living resources (fishery mammals) shipping and tourism. Estimates will be given and risks of investments discussed. Need to explore and develop strategies to understand the far-reaching negative impacts of over exploitation of resources of climate change impacts and calculate risks of increased pressures on environment and sustainable development of the Arctic will be emphasized.

“Second Wind” Resource Peripheries: Second Chance or Double Jeopardy?

Petrov, Andrey

University of Northern Iowa 205 ITTC 1227 W 27th Street W Cedar Falls IA 506104

andrey.petrov@uni.edu

Vera Kuklina, Sochava Institute of Geography RAS, Russia; Natalia Krasnoshtanova,
Sochava Institute of Geography RAS, Russia

A stylized notion of the resource frontier as a region with no or little industrial development that preceded an influx of extractive activities is becoming less relevant and adequate. Many current resource peripheries have witnessed one or more cycles of resource development in the past. Each of these cycles left its own legacies (infrastructure population institutions etc.) forming a social economic political cultural and physical “layer” upon which the following development cycles overlaid. In most cases such layering became a manifestation of deeply rooted path dependency that locked in resource communities by perpetuating development trajectories based on resource extraction. As many regions in the North are becoming spaces of re-industrialization due to renewed interest to northern natural resources it becomes more relevant to deepen our understanding of “second wind” (or “third” or “forth”) resource regions which are arguably the most prevalent group among 21st century’s resource peripheries. This paper builds on the cases of Irkutsk Oblast in Russia and North Dakota’s Bakken Region in the USA to explore the dynamics of community characteristics institutions and capacities under the resource re-industrialization scenario. We seek to develop a more nuanced model of “second wind” community development trajectories and trace the role of past legacies in cementing path dependency and regional lock in. We argue that re-booming communities with limited institutional capacities (as most of them are) risk to experience even a more devastating bust if left to their own devices in respect to planning and fiscal resources. This process can be described as a “double lock-in” mechanism: (1) past boom/bust experiences impede the ability of local institutions to adequately respond to the new boom and (2) weak institutions are unable to secure proper benefits for municipality that results in lock-in propagation.

From Narrative to Evidence: Resource Development in Remote Inuit Communities of Canada

Rodon, Thierry

Université Laval Département de science politique Pavillon Charles-De Koninck
Université Laval 1030 Avenue des Sciences-Humaines Québec QC G1V 0A6 Canada

thierry.rodon@pol.ulaval.ca

In Canada resource development is often portrayed as a means to improving the well-being and the quality of life in Northern Aboriginal communities. This narrative makes the assumption that the benefits from employment the creation of local businesses and resource revenue distribution will improve the social circumstances in these communities. However little research has been conducted on the socio-economic impacts of mining on remote Inuit communities. In this communication using data from Statistics Canada health surveys and interviews conducted in both regions we will analyse the socio-economic impact of two nickel mines Raglan and Voisey's Bay on the neighbouring Inuit communities. The Raglan Mine located in Nunavik Northern Québec has been in operation since 1997 following the signature of the first Canadian IBA. Voisey's bay located in Nunatsiavut Labrador started its operation in 2005 following the signature of an IBA with the Nunatsiavut government that was created in the same year. In spite of these similarities it appears that the Nunatsiavut government and Inuit communities from Nunatsiavut have been able to capture a more important share of the mining benefits than the Inuit communities of Nunavik. In order to explain the important differences between the two regions in their capacity to capture the benefits from the mining development we apply the analytical framework developed by the Harvard Project on American Indian Economic Development and test the applicability of these findings in case of remote Arctic communities.

Extractive Resource Development and Subsistence Harvesting: A Complex Relationship

Southcott, Chris

Lakehead University Thunder Bay ON Canada P7B5E1

Chris.Southcott@lakeheadu.ca

Any attempt to ensure increased capacity building from resource development to northern communities must try and understand the relationships that exist between this form of development and subsistence activities. As others have pointed out one of the unique aspects of most northern communities is that they depend upon a “mixed economy” which includes an important place for traditional subsistence harvesting. Yet the relationship between resource development and especially extractive developments and traditional Indigenous economic activities is not well understood. For many mining oil and gas and other large-scale industrial developments represent a threat to the continuation of hunting and gathering traditions. At the same time over the past 30 years we have seen communities start to claim that extractive resource development actually serves to ensure the continuation of traditional subsistence lifestyles. This paper will first look at the place of subsistence activities in northern communities and try to understand current conditions. We will then examine some of the research dealing with the impact of resource development on subsistence activities. Finally we will look at the evidence existing in the socio-economic monitoring activities that are part of current extractive resource developments. Findings indicate that there is no definitive answer as to whether resource development is good or bad for subsistence activities. The impacts of mining or oil and gas developments will depend largely on local conditions and the ability of local communities to have some degree of control over the relationship.

Stepanov, Ilya

National Research University Higher School of Economics

ilstepler@yandex.ru

In political and economic debate of the last decade the Northern Sea Route (NSR) has gained a lot of attention and is considered to be a promising initiative of the coming decades. Officials of various states and international companies stick more attention to the Arctic capable to bring new resource and transit opportunities for intensifying world economy. The development of Russian Arctic will be closely tied to the redevelopment of the Northern Sea Route (NSR) which is considered to be both strategic project for Arctic and non-Arctic states as well as commercial opportunity for international cargo transports. Russia see particular gains not only in development the NSR as a transit route bridging Asia and Europe but in integrating its northern regions rich in mineral resources into the world economy as well as in fostering the development of Siberia and the Far East. This research focuses on the main factors helping and hindering the development of the Arctic transit and resource potential and attempts to build some projections for the future. It is revealed that the NSR is commercially viable only for transportation of some types of cargo – primarily for bulk cargos in warmer months from and to ports located not far from the NSR. In the long term the effectiveness of the NSR can increase under certain conditions such as further ice melting in the Arctic development of Russian Arctic regions and in particular development of the infrastructure along the NSR oil price growth and increasing political and other risks along the traditional trade routes between Europe and Asia. On the contrary the slowdown in Asia-European trade and the suspension of a number of oil & gas projects on the Russian Arctic shelf worsen to some extent the NSR position at the present day.

Development of the Far Northern Regions of Russia

Tabata, Shinichiro

Slavic-Eurasian Research Center Hokkaido University Kita-9 Nishi-7 Kita-ku Sapporo
060-0809 Japan

shin@slav.hokudai.ac.jp

We analyze recent socio-economic developments of the Far Northern regions of Russia using macro statistical data of GRP industry investments foreign economic relations public budgets and demography. These regions are classified into three (or four) categories (clusters) according to their patterns of development. First category is regions where oil and gas is a driving force of their development. Second is regions where their development are based on other mineral resources. Third is regions that are taking advantage of their foreign economic relations with neighboring countries. Some policy analyses both at federal and regional levels are made as well. Final goal is to consider sustainability of socio-economic development of these regions.

Tarasov, Ivan

Institute of Social and Political Sciences NARFU. Arkhangelsk Dzerzhinskogo st. 29-32

tarasovivanan@gmail.com

The problem of definition and fixing northern territories in the scientific and regulatory terms is typical for circumpolar countries including Russia. Nevertheless there's no clear and harmonized interdisciplinary decision of this problem. Different methods from insolation to geobotanic exist. Canadian scientist Louis-Edmond Hamelin made an attempt to unite various approaches. He created Nordic index that includes geographic climatic and social criteria. The main feature of this index is that it's intended to evaluate namely human settlements and towns rather than territory. In this work we apply Nordic index to more than 40 largest cities in Circumpolar region. Analysis of the final results of VAPO (polar units or valeurs polaire) showed cities ranking with min in Juneau (Alaska) and max in Longyearbyen (Svalbard Norway). But distribution of cities between min and max has some anomalies: Reykjavik has relatively large VAPO 252 but Boden and Kiruna - only 212 and 174 VAPO. This and some other anomalies and the fact that we can't distinguish any typology in ranging cities by Nordic index isn't accidental. It's a system error that occurs when we transfer Canadian Nordic index to all Circumpolar world. Each Arctic region has its own characteristics and Canadian conditions aren't average or typical. So we need to rebalance Louis-Edmond Hamelin index. To identify criteria which application causes deviations we analyzed mean values of each criteria and the weight of the total amount. It showed that criteria "Summer heat" "Total precipitation" "Accessibility other than by air" and "Air services" have a relatively small value. According with these and several other refinements original Nordic index was adjusted. After recount VAPO for some Arctic cities we recognized six groups with lots of similar characteristics. This allows us to create typology of Northern cities by their key features. It may promote to reveal northern cities' peculiarities displaying their common characteristics. So the next scientific aim is to elaborate economic and social parts within this typology which help us to explain patterns in social and economic processes inside Northern cities.

Oil extraction and benefit sharing in the illiberal context of the Russian Arctic: The case of the Nenets and Komi-Izemtzi indigenous people

Tysiachniouk, Maria

Environmental Policy Group at Wageningen University and the Centre for Independent Social Research in St. Petersburg
Centre for Independent Social Research Ligovski 87 office 301 St. Petersburg Russia

tysiachn@yandex.ru

Laura Henry, Bowdoin College US; Machiel Lammers, Wageningen University; Jan van Tatenhoove, Wageningen University

What role do transnational networks play in indigenous efforts to manage the effects of oil development in the illiberal context of the Russian Arctic? This paper provides a comparative analysis of the development of benefit sharing arrangements between the Russian oil company Lukoil and the indigenous people of the Russian Arctic i.e. the Nenets and the Komi-Izemtzi informed by the concept of governance generating networks. The Nenets people are recognized by the Russian state as indigenous and receive compensation for land extraction and damage to the environment. The Komi-Izemtzi are not recognized domestically in contrast to their global recognition by liberal institutions such as the United Nations and the Arctic Council; they received no compensation despite suffering from oil spills and oil infrastructure development. In response the Komi people partnered with local NGOs and global environmentalists to pressure Lukoil. Lukoil eventually signed a socio-economic agreement on benefit-sharing and compensation with a Komi-Izemtzi NGO In an effort to coopt the indigenous group and prevent further transnational environmental mobilization. Ultimately the cases show how cooperation across scales within a global network can empower indigenous people in an illiberal state to influence resource distribution although these agreements may weaken broader demands for environmental protection.

Resource demand and human capacity as determinants of sustainable development in single-industry communities (Murmansk region)

Zaika, Yulia

Khibiny educational and scientific station Faculty of Geography Lomonosov Moscow State University Address: Zheleznodorozhnaya str. 10 184250 Kirovsk Murmansk region Russia

yzaika@inbox.ru

Dr. Elena Golubeva, Faculty of Geography Lomonosov Moscow State University Russia

Murmansk region is one of the regions within the Arctic zone of the Russian Federation; and is one of the most heavily industrialized territories. Among other Arctic territories of Russia region holds the first place by the number of single-industry cities (8: Polyarnie Zory Kirovsk Nikel Zapolyarniy Tumanniy Monchegorsk Revda Kovdor). At present 23% of the region's population (over 150000 people) live and work in single-industry cities and set up the greatest industrial potential for further socioeconomic and sustainable development of this area. The most part of regions' single-industry cities has a mining profile. The resource role of the Arctic is strong and doubtless. Resource stocks are expansive due to the new exploration possibilities opened by the human-driven climate and environmental change. But resource markets dictate their own demands. These demands place the new economic reality to the industries allocated in the region. Some of the cities and mining communities (e.g. Nikel Zapolyarniy Monchegorsk) are connected to each other through the technological chains: mine site processing plant and chemical enterprise. These chains make these cities along with other resource communities in the region even more vulnerable to any factors both socio-economic and environmental which influence their development and human capacity. The rapidly changing resource political and military role of the Arctic and its economy nowadays brings in new challenges and benefits to the sustainable development of the region. An ineffective governmental strategy for social services human capacity building urbanization planning and protection of the environment are major milestones for sustainable development of the region and the mining communities of single-industry cities.

The International Energy Cooperation in the Barents Euro-Arctic Region: the Case of Oil and Gas Industry

Zuevskaia, Anna

Saint Petersburg State University of Economics Institute of Master Studies 103
Moskovskii Ave. St. Petersburg Russia

apzuevskaya@gmail.com

The Russian Federation has a great potential to develop international economic cooperation in Arctic as it has promising oil and gas fields and technologies although they need improvement qualified for works people. Now Russia is interested in the consolidation of efforts with possible partners for natural resources development. The distinctive features of international cooperation in the region of the Barents Sea were studied. We concluded that the institutional structure of international energy cooperation is shaped in accordance with tasks and the delineation of authority among the institutions and the regulatory frameworks. Also the dedication to cooperation was defined as the governments of the region understand the advantage of joint resource development in the region. International energy cooperation as a part of international economic cooperation is realized on 4 levels which are global (universal international organisations) regional (regional international organisations and the associations of states) intergovernmental and the level of international non-governmental cooperation. As consisted with the results of analysis there is a lack of political will to work in the declared directions because the parties need to overcome the historical and modern political obstacles to their cooperation. More than that there is a necessity to develop and follow the unified ecological standards at least in the territory of the Barents region. The prioritized projects are the development of sea transport and oil and gas procurement infrastructure seismic surveys in the shelf. The profit of international economic cooperation in these spheres is proved. There is one more point to consider. Given the proven gas stock we can suppose the shaping world gas market to become the key point of agenda for international economic cooperation in the region. The market-shaping actors should be gas exporting countries the majority of which are arctic countries (Russia the USA Norway and Canada).

2.3 Current infrastructural Challenges, extreme weather and natural hazards and the effects on northern communities



It is well established that unforeseen consequences are emerging from the current rate and magnitude of climate change in the Arctic, manifesting in increased temperatures, precipitation, extreme weather events, thawing permafrost causing infrastructural damage, and changes in precipitation affecting the frequencies and the size of landslides and avalanches. These factors create new social challenges that affect mobility, services, limitation of daily activities, disconnection of internet, telecommunication, and electricity. This session will focus on how Arctic communities experience and respond to the uncertainty from increased extreme weather events, and perceive the risks associated with infrastructure challenges and climate change. The session examines how uncertainty about risks influences local well-being, adaptive responses and adaptive capacity.

Conveners:

Grete K. Hovelsrud, Nord University, Norway

Marianne Karlsson, Nordland Research Institute, Norway

Julia Olsen, Nord University & Nordland Research Institute, Norway

The Cost of Temporary Traffic Flow Interruptions for Transport in Arctic Areas

Bardal, Kjersti Granås

Business School Nord University Universitetsalleen 11 8026 Bodø Norway

kjersti.g.bardal@nord.no

Terje Mathisen, Nord University Norway

Harsh weather frequently causes temporary transport flow interruptions in Arctic areas. The context of this study is the road transport system in the northern parts of Norway a rural region located north of the Arctic Circle. The combination of rough weather and a mountainous topography challenge the road transport system. Some road stretches are exposed to avalanches triggered by heavy precipitation that blocks and ruins the roads while other road stretches are preventively closed in stormy weather. In addition the roads are frequently closed because of accidents particularly during winter when the weather and driver conditions are unfavourable. People and business located in this area are affected by these interruptions in various ways. This paper is concerned with the delays and the corresponding increase in transport costs the interruptions cause. Studies have shown that the time costs usually constitutes the major cost component (approximately 70%) of the socioeconomic costs of road closures. Since the access to alternative transport modes and routes are often limited in rural regions the costs of detours can be extensive. Cost-benefit analysis is a well recognized assessment tool for evaluating transport projects. However the existing framework for calculating the magnitude of the socioeconomic costs of weather related road closures is limited. The benefits of reducing these costs are therefore poorly disclosed in the analyses. The aim of this paper is twofold. First the existing literature on calculating the risk and costs of road closures due to avalanches will be compiled and modified in order to develop a framework which may be used on all kinds of weather related road closures. Second the developed framework will be applied on three different cases – one road stretch exposed to avalanches one mountain pass with frequent preventive road closures and one road stretch with frequent accidents.

Challenges to sustainable urban underground space use in northern regions: infrastructure and spatial planning

Bobylev, Nikolai

Saint Petersburg State University Postal address: P.O.Box 45 195267 St.Petersburg
Russia

n.bobylev@spbu.ru

Arctic regions have a special interest in using urban underground space: on the one hand it offers excellent protection and energy efficiency in extreme weather conditions on the other construction of underground structures and infrastructure represents significant investment and not always viable given towns size and population densities. Permafrost including its alteration associated with climate change poses challenges to long term infrastructure resilience as well. Research on planning and using underground space resources accelerates globally. While combating extreme external climatic conditions has been long the main driving factor for using underground (e.g. Montreal underground pedestrian networks); nowadays underground space is more and more used to help creating sustainable cities addressing density and infrastructure efficiency problems. Presented research is revisiting basic challenges and opportunities for urban underground space and infrastructure use applied to the northern context. The paper will discuss strategic decisions on a sustainable spatial arrangement of a northern city taking into account underground space use aspects and address a broader perspective of underground resources (water energy geomaterials and space itself) use.

Mobility and Sense of Place among Russian Arctic Youth

Bolotova, Alla

European University at Saint-Petersburg Russia

alla.bolotova@gmail.com

Valeria Vassilyeva, European University at Saint-Petersburg; Anastasia Karaseva,
European University at Saint-Petersburg

In this joint paper we analyse how mobility of youth influences on their sense of place in different parts of the Russian Arctic. The relation between mobility and sense of place has been studied for more than two decades within the globalization framework. In these studies increasing mobility has been often seen in opposition to people's belonging to place diminishing of local connections and bonds (Giddens 1990; Castells 1996; Bauman 2000 Appadurai 2003). Recent studies show the relation being not so straight and mobility having its part in shaping sense of place (e.g. Fallov Jorgensen Knudsen 2013 Milbourne 2014). The Russian Arctic is often described as a remote area hard to access though the local population here has always been very mobile and transport connectivity differs significantly in various parts of it. In our paper we analyse fieldwork materials from 3 diverse case studies with an aim to show the differences in the ways of how mobility is shaping sense of place for young inhabitants in these regions. Three Russian Arctic regions namely Murmansk region Central Kolyma (Magadan region) and Eastern Taimyr differ in terms of population (urban/rural polyethnic/monoethnic) and access to transport infrastructure and thus provide good examples for comparing the relation between mobility and sense of place among Russian Arctic youth.

Arild Gjertsen

agj@nforsk.no

Merethe D. Leiren

The main responsibility for civil protection and crisis preparedness in Norway is placed at the local administrative level, while national authorities are responsible for coordinating, mentoring and controlling such activities. Previous research has shown that the local level has a limited capacity to adapt to changes that impact civil protection issues, like climate change. The local level awaits instructions, information and measures initiated from “above”, and local risk- and vulnerability assessments leaves a lot to be desired in terms of coordination and integrative thinking. Given this situation, we ask: *To what extent is there a conflation of interests, problem perceptions and adaptive scope between administrative levels in Norway when preparing for infrastructure disruptions caused by climate change?* Furthermore, while several operational means are available to the various public governance institutions, parts of the operational responsibility are outsourced to more or less devolved agencies or private contractors – which could be expected to further exacerbate the challenges of coordination. This study’s point of departure is an analysis of two local communities in the Troms region in arctic Norway; both regularly subject to isolation, closed roads and power failures related to snow avalanches during winter, highlighting the need for integrated contingency planning. Data is sourced from interviews with representatives of various governance institutions as well as inhabitants of the two local communities.

Hendriksen, Kåre

Arctic Technology Centre DTU Byg Technical University of Denmark Brovej Bygning
118 2800 Kgs. Lyngby Danmark

krhe@byg.dtu.dk

In socio-economic terms Greenland belongs to the world's most complex and challenging - and therefore expensive - communities. In practice all 75 Greenlandic towns and settlements more or less operate as isolated island economies and consequently as island-operated societies. This presents some unique management and engineering challenges. Every town or settlement has its own power plant water supply system etc. Based on the limited transport infrastructure it is not possible to commute on a daily basis between the settlements. During the period of independence (Home-rule) the previous colonial infrastructure system run by the Greenland Technical Organization (GTO) and the Royal Greenlandic Trade (KGH) has been transformed into segmented public owned companies. The individual companies have restricted their focus to their individual fields of competence. Over the years this has resulted in a general loss of competences on a series of cross-sector areas. The tendency of sub optimizing in the individual company combined with the wish to run on market conditions have resulted in an increase of services and lowered prices in the larger towns. In contrast the smaller settlements and remote districts have experienced a decrease in services as well as growing prices. The general technical and economical consequences of the Greenlandic island operation will be discussed and coupled to the settlement pattern and utilization of local natural resources and the local development dynamic. The applicability of using market mechanism as a management tool will be questioned. Additionally the consequences of the sectorialisation of infrastructure and lack of coordination between different companies will be problematized.

Karlsson, Marianne

Nordland Research Institute P.O. Box 1490 NO-8049 Bodø Norway

mka@nforsk.no

Grete Hovelsrud, Nord University Norway; Julia Olsen Nord University & Nordland Research Institute Norway

The steep topography in Troms County Northern Norway combined with weather and settlement patterns create conditions for avalanche risks. The risk and occurrence of avalanches lead to road closures that disrupt the transportation of people goods and services and may isolate communities. Climate change is altering the timing frequency and spatial range of avalanche risks. The importance of reliable and predictable infrastructure for rural communities has increased as both businesses and social life are highly interconnected with urban areas and other settlements in the region. At the same time growing demands for personal safety from government authorities result in longer periods of road closures. While avalanche risks and infrastructure disruption are most often assessed in technical and economic terms this paper focuses on the localised experiences of living with and responding to such risks This paper presents findings on how local residents businesses and public service providers in two avalanche exposed settlements experience perceive and adapt to risks related to avalanches infrastructure disruption and isolation. Based on qualitative interviews with local residents and government officials the paper shows that perceptions of risks and what constitutes 'acceptable' levels of disruption vary between and within the two settlements. Further the findings illustrate that residents have developed a range of response strategies to the disruptions caused by avalanche risks. Everyday responses include keeping an extra set of clothing toiletries and medicine on the other side of the avalanche points reducing social commitments during peak season and relying on local knowledge and social networks. More far-reaching responses seek to influence politicians and authorities to implement measures that reduce avalanche risks. The paper argues that the current adaptation strategies might be challenged under climate change and increasing societal demands related to safety and connectivity.

Meitz, Alexander

Department of Social- and Cultural Anthropology University of Vienna/ Austria T:
0043 1 4277 49523 C402 NIG Universitätsstraße 7 1010 Vienna (Austria) APECS
Austria

alexander.meitz@univie.ac.at

Karoline Ringhofer, Department of Social- and Cultural Anthropology University of
Vienna/ Austria

Concrete modes of adaption and local responses to increasing challenges in the Arctic such as changing weather conditions thawing permafrost and infrastructural damages are offering informative strategies towards resilience in the times of uncertainty. Moreover it seems indispensable to us to have profound theoretical knowledge of the concepts and keywords underlying current discussions. (1) Alaska a US-State where half of its population lives in 'urban' areas faces far-reaching demographic changes as thawing permafrost forces remote communities and residents from suburban areas to move to urban centers. At the same time Alaska faces considerable migratory movements from Southern regions. In our research we focus on sustainable transport and the infrastructure connected to it. Alternative transport modes to cars and other motorized petrol powered vehicles are gaining in importance as crucial adaptive responses to infrastructural risks in the face of uncertainty. In this context bicycling is identified as a local practice in reacting to increasing infrastructural disruptions and offers a key strategy towards resilience in the times of global warming and its associated challenges. An increasing number of Arctic urban communities affected by exacerbated weather conditions respond to these new challenges according to their social capital and start to create their identities and lifestyles around the bicycle. We are particularly interested in the question of if and how climate change can lead to unprecedented opportunities to establish new infrastructures. (2) In the second part we will examine the theoretical and conceptual embedding of the research results into interdisciplinary sustainability research highlighting in particular the relationship of the concepts of sustainability and resilience with regard to their respective epistemological and theoretical position within the framework of philosophy of science as well as their potential to foster concrete solution approaches in the face of pressing environmental challenges in the North.

2.4 Art, Design, Media and the Arctic - Marginalization, Power and Manifestations for Change



Media representations and marginalization have a strong impact on different societies and minorities, not to mention the meanings that are attached on the Arctic and geographically or culturally distant locations and peoples. The focus of session is in the relationships and manifestations within the themes of Arctic, media, design and marginalities. How can media and design participate in these discussions through artwork, intervention or performance? Can this have an impact for transformational change? The session provides a forum for research, art works, design projects and discussion on the Arctic, including the questions of marginalization and the problems of periphery/center -dichotomies.

Convener: Glen Coutts, University of Lapland, Finland

Art and Design on the Edge: Challenge change and opportunity in the Arctic

Coutts, Glen

University of Lapland

glen.coutts@ulapland.fi

Timo Jokela, University of Lapland, Finland

This presentation will be in three parts the first part will address the central theme of the session: challenge in the Arctic as viewed through the lens of contemporary art as the agent for change. We will present art developments at the University of Lapland and in particular a thematic network called Arctic Sustainable Arts and Design (ASAD) that focuses on innovative ways of using contemporary art to address socio-cultural issues in diverse cultural contexts. In the second part the theme of change will be addressed we will reflect on developments in art education in the North and a new initiative located at the intersection of art and design practice that draws on the key strengths of both the art and design disciplines. Referred to as Applied Visual Arts the studies require students to work on issues related to the Arctic and the circumpolar north thus creating a challenging environment for students to create innovative solutions with community groups. The third part of the presentation will consider some of the opportunities that the unique socio-cultural and ecological conditions that exist in the Arctic afford. In presenting selected case studies we examine the role of art and its potential benefits when operating in the field and in collaboration with local partners. How might the techniques and methods of art and design be used to the benefit of local people and businesses?

Gostyaeva, Maria

Ural State University of Architecture and Art 23 K.Liebknecht str. Ekaterinburg
620075 Russia 240/10 Lunacharskogo str. Ekaterinburg 620026 Russia

maria_gostyaeva@mail.ru

The tourism sector is the industry of producing and consuming myths stories and experiences (Burns and Novelli 2006). The present-day shift “from society of information to society of dream” (Jensen 2004) and “from consumption to experience” (Pine and Gilmore 1999) indirectly justifies tourism as one of the most important activities in many economies. Therefore the main task for a designer is to “satisfy intangible needs” (Manzini 2004). It leads us to a clear understanding of a new designer’s role: designer as a teller of materially expressed stories. A new approach to the process of creation and consumption of touristic product might be offered by a conceptual design which aims at “creative problem solving” (Brown 2009). Besides synthetic cognitive and integrative capabilities design wields important predictive feature that provides a holistic view of the touristic product “in the hypothesis”; this is particularly actualized in organizing tourist activities in the extreme conditions of the North. As a result the predictive model of the future tourist product could contribute to the development of methods for stabilizing interaction between man and nature in order to prevent the destructive impact on the fragile northern ecosystems and relict culture of the region and provide safe coherent and harmonious human entering in the North. Moreover the predictive capability of design allows us to consider the tourist product not only “horizontally” setting structural elements and internal connections between them but also “vertically” i.e. over time connecting temporary life-cycle analysis of the product (from the period of emersion to its full implementation). One of the main design tools with “time-dependent” setting is the method of scenario- making. A scenario determines the possible sequence of events (actions) that reflects some aspect of the system behavior in the whole. In other words a scenario is held to imply a phased process planning of creation and consumption of the future touristic product as well as eliminating or preventing negative consequences of its use. Therefore design and its synthetic tools (in particular the systems approach and method of scenario- making) are considered in this context as the viable and efficient instrument of managing tourism activities in the northern territories. So there is a need for new experimental approaches to development of tourist products and services. And for these purposes Western Siberia is a great “test-bed” due to its undeveloped recreational appeal along with high saturation of potential tourist attractions.

Create Awareness of Ocean Pollution in the Arctic: Using Community Art as an Action for Change

Gårdvik, Mette

Nord University Campus Nesna Norway 8700 Nesna Norway

mette.gardvik@nord.no

Karin Stoll, Nord University Campus Nesna Norway; Wenche Sørmo, Nord University Campus Nesna Norway

The international community is becoming aware of the growing pollution of our oceans and beaches especially it is found in huge amounts in the Arctic coastal area. In recent years environmental organizations and associations have initiated beach cleanup campaigns with volunteers and school groups to clean up garbage and hazardous waste along the shorelines. National and international artists with backgrounds in echo-art sustainable art and environmental art have created awareness about the problem with their artwork. However there are few activities where art education is used systematically and purposefully in lessons about the environment and sustainability. Community art can be an effective way addressing and exploring socially relevant environmental issues. Hicks & King (2007 332-335) point out “Art education is well situated to address environmental problems that emerge at the point of contact between nature and social life.” Community art in an educational context can help students to raise their own awareness of real world problems and develop social responsibility and critical thinking skills. Art can contribute to increased awareness of these concerns especially given widespread interest in connections with the Arctic. This presentation highlights several community art projects focusing on art and natural science both in Norway and Alaska. These experiences had provided participants a lasting foundation in art education and a positive impact in their understanding and shared responsibility for the environment. We believe that the experiences from these community art projects will give students and the entire community the knowledge of how they can meet and cope with current and future challenges while interacting with others and how they can live a sustainable life. The purpose of this session is to share these collaborative learning experiences from diverse disciplines in the context of practice sustainable and environmental art.

Picturing Arctic Health Disparities: Engaging with Arctic Youth Through Visual Media to Transmit and Translate Knowledge About *Helicobacter pylori* Infection

Highet, Megan

CANHelp Working Group Division of Gastroenterology Department of Medicine
University of Alberta 5-033 Edmonton Clinic Health Academy Edmonton Alberta T6G
1C9 Canada

meganz@ualberta.ca

Karen J. Goodman, University of Alberta Canada; The Fort McPherson H. pylori
Project Planning Committee Canada; The CANHelp Working Group University of
Alberta Canada

Youth represent an important but under-represented group in community-based health research particularly with regard to studies situated in arctic regions. Connecting with this age group is essential for successfully addressing health disparities such as the elevated prevalence of *H. pylori* infection and associated digestive diseases observed among Aboriginal residents of arctic Canada. Yet researchers have nevertheless been hesitant to engage in participatory research with youth in this context. Literature on the topic of involving youth in ethnographic research often attributes this underrepresentation to researchers' misconceptions regarding the capacities and competencies of non-adults as active research participants. The resultant marginalization of youth was addressed by members of the Fort McPherson H. pylori Project Planning Committee who requested that local youth be provided with opportunities to participate in research being carried out by the Canadian North *Helicobacter pylori* (CANHelp) Working Group within their community. Consequently a photovoice project was developed to explore local knowledge of the impact of *H. pylori* infection upon health and wellness. A capacity-building component was also incorporated into this project wherein youth who complete training in basic photography skills and ethnographic methodology will receive a certificate in recognition of their achievement. The photographs produced through this project will have multiple applications. As rich visual texts these images can be 'read' as primary data sources for academic research; however photographs are also particularly well suited for knowledge translation activities. Given the power of visual media to condense information and meanings and thereby facilitate mental imagery of varied perspectives outputs of photovoice projects (often showcased in gallery style presentations) also support the transmission and translation of diverse views and values in a manner that transcends cultural socioeconomic and geopolitical divides. Thus this methodology has furthermore proven effective for conveying local perspectives and priorities to a wide array of stakeholders.

Hiltunen, Mirja

University of Lapland P.O. Box 122 FI-96101 Rovaniemi Finland

mirja.hiltunen@ulapland.fi

The presentation will explore specific strategies and approaches to socially engaged art practices by describing practical examples with community-based projects with elderly people. Art education and Social work at the University of Lapland have collaborated several years by organizing art workshops for elderly people. The presentation is based on question what could be the special role that use of contemporary art can have in promoting elderly people agency and what are the principles of art's effect on wellbeing. The main body of the presentation focus on the use of the contemporary art practices and the possibilities and challenges when connecting multidisciplinary approaches different generations and working cultures in the elderly care home context. The residents must be given the opportunity to participate participation and actorship must be allowed and the possibilities have to be seen instead of the obstacles. The traditional working culture can lead into excluding elderly people from the participation. Facilitators need to receive training specifically for working with older adults to include the inappropriateness of holding 'deficit' models of aging which can lead them to underestimate the capabilities of older people and not offer them sufficient challenge. The participants need to be given learning goals and opportunities to use multiples mediums opportunities need to be made available for intergenerational work too. The presentation will conclude to the notions how complex the question of ageing is. The findings from the collaboration between art education and social work underline that art can serve communal and participatory values and can stimulate everyday routines by providing opportunities to see and think about matters in a new and different way. The central conclusion is that the collaboration with community-based art education and social work could contribute to changing the status of older people from exclusion to inclusion.

Jokela, Timo

Faculty of Art and Design University of Lapland Box 122 FIN 96101 Rovaniemi

timo.jokela@ulapland.fi

The paper presents the development of winter art design methods in Finland. Winter in North is an impressive phenomenon as such. The solid states of water in winter - snow and ice - are central aesthetic elements in the northern landscape. For Northern people practical connection to winter also included a rich tradition of storytelling. To create new innovation we combined art and design expertise of the Faculty of Art and Design of the University of Lapland with cold climate engineering expertise of the Lapland University of Applied Sciences. We were aiming to create new services based on design approach which helps to utilize the multi-disciplinary snow and ice expertise in various events and tourism services in local and international forums. Development does not limit to technical dimensions instead it also strengthens the connection between contents of winter art and local culture. Artistic know-how and craftsmanship of the local men support each other and engage in productive dialogue. Working with winter art has increased young men's trust in that even during the transformation of livelihoods knowledge coming from their own northern culture and familiarity with natural conditions has a future. Winter art has offered a new chance for men who have run out of work in their traditional livelihoods of exploiting natural resources. We are now able to support the development work of winter art design by action research based training in different areas such as educational institutions cultural and social sector and particularly the tourism sector. The research activities may focus on areas such as reinforcing local identity visualise cultural heritage supporting psychosocial wellbeing preventing social exclusion and participating in community empowerment activities. Winter art is seen as environmental community culture and education oriented activity which seeks to strengthen its expertise in the field of regional competitiveness and wellbeing.

Arctic journey – design experiments in the north

Miettinen, Satu

University of Lapland, Finland

satu.miettinen@ulapland.fi

Jylkäs, Titta, Jeminen, Jaana; Tikkanen, Heikki; Vuorikari, Tytti, University of Lapland, Finland

This research paper is focusing on describing research outcomes of an Arctic Journey, a moving exhibition about personal human experiences. The exhibition experiments different forms of concretizing invisible elements and pursues to create a tangible experience of our Arctic lives. The exhibition aims to evoke thoughts about how each of us experiences and copes with our living conditions and qualities, and how we relate to others in this sense. The exhibition is a platform for creating the arctic experience. The works of the exhibition are a collection from HumanSee -project team in University of Lapland and from the participatory workshops organized as a part on HumanSee -project. The project is focusing on service design research around the human experience. Exhibitions study alternative and unconventional forms for exhibitions and co-design processes that they enable. This research paper asks what is the role of co-design process when constructing the Arctic Journey? Further it asks how the use of multi-sensory production can enhance the representation of the arctic experience? The works incorporate both new and more traditional media in digital and printed form as well as with paper and textile. The exhibitions aims to gather information from the visitors on how the medias could be used as service design probes or other participatory means to improve businesses' knowledge about their customers. The use of different media and service channels enable us to study the online and person to person interaction as well as audio part of the user experience. Exhibition has toured some of the main art and design universities Parsons the New School for Design, New York, Finlandia University, Hancock, MI, Emily Carr University of Art + Design, Vancouver BC V6H 3R9, Stanford University Campus, Palo Alto and University of California, Berkeley Campus, CA and Arctic Design Week in Rovaniemi, Finland.

"North Art-Bridge"

Turin, Alexander

Alexander Turin, Docent of Architecture, Member of the Union of Artists of the Russian Federation; Inventor; Reward Diploma of International Exhibition

alexanderturin695@gmail.com

The Co-Author of Educational programs and Projects of Art pieces is Maria Turina, Member of Union of Artists of Russian Federation; Reward with Diploma of the Competition of Carl Faberge for Young Jewelers and Diploma of the First International Biennial of Graphic Art in St. Petersburg.

The Project provides cultural assembly of mammoth tusck its protection against cracking 3D cutting (sawing) of vase-form vessels on the new invented machines and the subsequent artistic processing of work pieces by Nordic Folk Artists to produce Art / Craft Pieces whith distinct National character. Authors have own Educational Programs target to educate Artists - leaders of future National Art-Firms own Craft Techniques also Patent RF 2074810 & PCT WO 2004/108378 A1.

2.5 Geopolitics and Security of the Arctic



The session is organised by UArctic Thematic Network on Geopolitics and Security. The network, established in 2009, is a joint network by the University of the Arctic and the Northern Research Forum (NRF), and its aim is to draw up a holistic picture on Arctic geopolitics and security. Another aim is to promote interdisciplinarity and the interplay between science and politics, as well as to implement the interplay between research and teaching, between young and senior scholars, and students. The sessions will evaluate and discuss on Arctic geopolitics and security in the context of the globalized Arctic theoretically and holistically from many angles and disciplinary approaches; from the perspectives of the past, present and future; and from global, international, Arctic, national and regional/local context in the Arctic region.

Convener: Lassi Heininen, University of Lapland, Finland

2.5.A Geopolitics and Security

The main aims of the TN Geopolitics and security are combined here, and discussed theoretically and holistically from several angles, as well as in international, national, regional, and particularly pan-Arctic contexts. The spectrum of the themes of the presentations is wide from military power and boundary disputes to food security.

Moderator: Prof. Lassi Heininen, University of Lapland, Finland

2.5.B Oil and Gas Drilling in the Arctic

The session is organised in cooperation with the Northern Research Forum (NRF) and the GlobalArctic Project. On the one hand, due to the strategic importance of energy security and the melting sea ice, the Arctic has become a theater of natural resources extraction. On the other hand, the (offshore) exploitation of these resources causes big environmental and societal risks, and extends the life of industrial civilization as we know it, characterized as it is with its unsustainability. Among a few relevant questions of the expert discussion will be, e.g. “Whether ‘industrial civilization’ is capable and willing of slowing down, and stopping fossil fuel-based development?”.

Moderator: Prof. Nikita Lomagin, European University in St. Petersburg, Russia

The nexus of environmental responsibility and economic development in the corporate strategies

Huotari, Jussi

Aleksanteri Institute University of Helsinki Finland

jussi.a.huotari@helsinki.fi

This paper examines environmental responsibility as a part of the corporate social responsibility (CSR) in the Russian energy companies operating in oil and gas sector. Furthermore the emphasis of the paper is on corporations who participate in the fossil fuel exploration and exploitation on the continental shelf and waters of the Arctic. Utilization of the Arctic hydrocarbons causes a complex and manifold threat to the regions fragile nature. Alternatively large-scale energy projects do not only create jobs for local residents but also enable other industries to develop. Hence the challenge is how to adjust environmental risks and economic development sustainable manner? To respond to the stated question this paper explores and analyses the environmental reports of the State-Owned Enterprises (SOEs) and Transnational Corporations (TNCs) which operate in the Russian Arctic.

Kobza, Piotr

Counsellor at the Embassy of Poland in the Hague (the opinions presented in the abstract are of the author and should not be attributed to the Polish MFA) Embassy of Poland in the Hague Alexanderstraat 25 2514JM Den Haag Netherlands

piotr.kobza@msz.gov.pl

The last decade has been marked by an effort by the European Union to assert its position in the Arctic area. From the analytical perspective the Arctic region is one from the category of territories situated on the frontiers of the EU which have blurred affinities. Its governance is still dominated by the “local powers”: the Arctic Council members and run despite official statements along traditional “Westphalian” sovereign states model. Recently this state of affairs has been more and more subject to various sub-state and intra-state forces. The European Union could in theory become one of the entities interested in transforming this model into more of a network nature. The very fact that the EU/EEA territory extends to the Arctic gives the EU a mandate to have a stake in loosening of the present model of the Arctic governance. To this end it would need to develop a clear-cut Arctic policy. The attempts to date were quite ambiguous – an Arctic policy like any EU policy would have to be conceived and then promoted by an identifiable driving force and this is apparently lacking. Neither the European Commission nor the Nordic EU member states nor for that matter the European Parliament have been much interested after some initial attempts in allowing the EU go beyond a supplementary role in the Arctic governance. Even though the European Union is presently in the course of finishing its third programmatic document on the Arctic likely to be published in the spring 2016 for the reasons mentioned above along with the current preoccupations of the EU in terms of its external action it is likely that the EU institutions will prefer to keep the emerging EU Arctic policy as it is: a supplementary technical programme with no ambitious funding and still programmed so as not to arouse any controversy inside the Arctic club. However the future EU role in the Arctic may in the future go far beyond the role of a financial donor. It has to be remembered that the EU is the standard setter for the internal market not only for its member states but to a big extent also the EEA member countries. If the economic development of the to date sparse Arctic economy accelerates it would be not before long that a recourse to the European Commission will be needed for more developed and possibly more tailored approach to the needs of the Arctic territories of the member states in terms of application of the EU acquis in terms of regional policy but also competition taxation and working standards as well as environment to name a few policies in which the EU has a say. The European Union role in the development of the Arctic may thus come from an unexpected angle and in the issues which are quite concrete and not much addressed in the European Commission documents to date.

Krivorotov, Andrey

Shtokman Development AG Malaya Pirogovskaya ulitsa 3 119435 Moscow Russia

a.krivorotov@shtokman.ru

Over the past decade international approaches to offshore Arctic prospects have become sufficiently more realistic and reserved. Global macroeconomic turmoil pertaining low oil prices and structural transformations (shale development emerging shelf areas etc.) affect marginal hydrocarbon provinces worldwide. Arctic policy stakeholders shift their focus towards the numerous challenges in the global South and creation of giant trade blocks. Western sanctions on exports of Arctic and deepwater drilling and production equipment to Russia have further hit the industry by splitting the international market for advanced offshore technologies and thus jeopardizing return on investments in the relevant R&D. Besides after the Macondo oil spill in 2010 offshore HSE regulations have globally turned more stringent and are pursued rigorously. There's no return to 'oil vs nature' dichotomy but reconciling sustainability and industry goals seems complicated for any Arctic nation. As our country-by-country analysis shows each government has to weigh the potential gains of Arctic offshore development (enhancing energy security foreign policy effects regional and industrial spin-offs) against complex considerations like Paris Agreements domestic policy agenda budgetary impacts and environmental risks. As the result Arctic licensing and exploration do go on but actual development is largely pursued by national champions or risk friendly medium-size companies. If left to private investments only contemporary oil rush may turn into yet another 'tidal wave' (like former quests for furs whales gold or military presence) which hit the Arctic and then retreat leaving few remnants. This situation represents a challenge to both oil&gas companies central and local governments urging them to improve their mid-term planning enhance mutual cooperation and maximize ripple effects of any offshore project.

Ohnishi, Fujio

College of International Relations Nihon University 2-31-145 Bunkyo-Cho Mishima-Shi Shizuoka-Ken 411-8555 Japan

fu.ohnishi@gmail.com

International relations have been stable and peaceful for the last twenty five years. The stability of region was a result of concert of Arctic or Arctic concert system based on Arctic regional order which formed during the 1990s and developed in the 2000s. However geopolitical changes caused by climate change gradually influenced concert of Arctic which now faces three key challenges. First challenge has been the issue of securing marine safety such as search and rescue operation and for training with possible oil spill incident. These kinds of marine safety are incorporated into the Arctic concert system when the Arctic eight concluded the search and rescue agreement in 2011 the oil spill agreement in 2013 and the establishment of Arctic Coast Guard Forum in October last year. However whether the existing system is able to provide effective and practical cooperation is still to be seen. The second challenge is more intangible but rather intrinsic one. Purely in economic sense opening-up of Arctic region to global market witnessed gradual emergence of a new political camp between 'steward states' and 'user states' irrespective of whatever states recognizes themselves. In order to maintain the Arctic concert system steward states needed to position new players within their system and thus allocated some political benefits to them. Admitting non-Arctic states AC's observer status was seen as this sort of effort done by steward states however since political allocations were so limited within the system this might not constitute long-term solution. When business card will be superior over science card there is no assurance that new players would continuously follow and act under the existing system. The third challenge is impacts of the deterioration of the West-Russia relationship on the system. In the worst scenario Russian alienates from the concert system which undermines the regional stability.

Permanent Participants and the Arctic Council process

Peter, Evon

Arctic Council Indigenous Peoples\ Secretariat Fram Centre Postboks 6606 Langnes
NO-9296 Tromsø Norway

espeter@alaska.edu

The Arctic may belong to 8 Arctic states but at the same time the intergovernmental cooperation between those 8 states the Arctic Council is distinguished by a certain recognition: that there are peoples that are indigenous to the Arctic region. Peoples whose homelands have been in the Arctic for longer than anyone can remember. The participation of the indigenous peoples is one of the main reasons behind the success of the Arctic Council. As Permanent Participants to the Arctic Council they offer valuable contributions as the principal trustees and protectors of their Arctic heritage. Traditional knowledge has been an important element in preparing the assessments put forward for consideration to the Arctic Council. Furthermore the indigenous peoples have served as an essential link in communicating the evolution of the Arctic to the rest of the world. How the Arctic Council has changed in the last twenty years and what was the role of Permanent Participants in the Arctic Council's strengthening process? Does the Arctic Council really managed to successfully change the course things in the Arctic and what more is needed to be able to have Permanent Participants actually designing policy along with states? The University of the Arctic (UArctic) has a Vice-President for Indigenous Issues and through its mandate has developed a strong link with the indigenous peoples of the Arctic. At a meeting in Stockholm in March 2012 UArctic and the Permanent Participants signed a Memorandum of Understanding to further improve the cooperation. It was recommended by the Arctic Council stakeholders that there should be more opportunities and abilities of using UArctic through its members to assist the Permanent Participants in their important role and mission.'

Safe operations in Arctic waters - the Polar code and the need for vessel capacities and competence in SAR emergencies

Schmied, Johannes

High North Center for Business and Governance Business School at Nord University
Post box 1490 8049 Bodø

johannes.schmied@nord.no

Tor Berg, Marintek Norway; Odd Jarl, Borch Nord University Norway; Kay Fjørtoft, Marintek Norway; Andrey Kazakov, Nord University Norway; James R. Parsons, Memorial University of Newfoundland Canada

The High North and its seas provide great opportunities for different businesses from SME all the way to multinational enterprises. However operating in these highly remote areas under extreme conditions means a substantial increase of challenge for maritime safety management. Several studies have analyzed the range of potential incidents as well as highlighted the requirement for ongoing development in Arctic maritime emergency preparedness and prevention. This study maps some of the most important current activities to decrease the likelihood of worst-case outcome in case of incidents on sea. One major measure is the implementation of the Polar Code as well as other guidelines. This leads to changes on demands for preparedness- and emergency management. Increasing the overview on requirements for specialized equipment tailor made trainings and education as well as on other means of competence-building in Arctic SAR and maritime preparedness management such as exercises may substantially contribute to a well developing safety strategy. Special focus is on preparedness building for key personnel including ship-masters. Design/method/approach: The study elaborates a thorough review on innovation in preparedness management and a revision of the latest standards and guidelines including requirements by the Polar Code. Primary data among others will be generated from participation in several exercises focusing on maritime preparedness and safety management in the High North. Recommendations on requirements for vessel capacities for safe shipping operation and competence in case of SAR emergencies are given. Relevance: The study is both relevant for industry for High North preparedness strategy as well as for SAR institutions. Having maritime safety management catching up with the fast increase of activity in the High North is crucial.

Changing role of military power in the Arctic

Sergunin, Alexander

St. Petersburg State University School of International Relations 1/3 Smolny St. St.
Petersburg 191060 Russia

sergunin60@mail.ru

This paper argues that the nature and roles of military power in the Arctic have radically changed since the Cold war era. Instead of being a coercive instrument in a global military confrontation between two superpowers and capitalist and socialist systems now military power basically has three major functions. First to ascertain coastal states' sovereignty over their exclusive economic zones and continental shelves in the region. Second to protect the Arctic countries' economic interests in the North including mineral and bio-resources fighting smuggling poaching and illegal migration. Third to carry some symbolic functions. For example in the case of the Nordic countries military power can symbolize their Nordic solidarity (NORDEFCO project). For Sweden its armed forces and a rather developed military-industrial complex are symbols of self-sufficiency and self-reliance in security affairs the guarantee of its non-aligned status. For Russia deployment of significant forces in the region and development of the military infrastructure in the High North is a demonstration of the fact that it retains its great power status and still has world-class military capabilities. These new roles however do not preclude military power from fulfilling its traditional function such as power projection deterrence containment etc.

Natural Gas Projects in the Russian Arctic: The Interplay of Environmental, Commercial, and Geopolitical Factors

Sharples, Jack D.

European University at St Petersburg

jsharples@eu.spb.ru

This presentation will compare two Russian Arctic gas production and export projects – Shtokman and Yamal LNG – as assess them in terms of the environmental, commercial and geopolitical challenges, in order to assess the reasons for the (probable) success and failure. In particular, this presentation will argue that the Shtokman project failed due to a combination of the environmental difficulties (and expense) of offshore Arctic natural gas production and the loss of its intended export market (the US), when a combination of commercial and geopolitical factors led the US to self-sufficiency in natural gas. Conversely, the Yamal LNG project will likely succeed due to less environmentally challenging (and therefore cheaper) nature of onshore gas production, coupled with Chinese investment and China's geopolitical desire for a diverse natural gas import portfolio, despite the financial challenges posed by international sanctions. In short, while both projects face different (yet significant) environmental challenges due to their Arctic locations, the different strategies pursued by the United States and China in order to ensure their own energy security had a significant impact on the successes and failures of these two projects. This comparison illustrates the extent to which the development of hydrocarbon production and export projects in the Russian Arctic depend upon a combination of environmental, commercial, and geopolitical factors.

The European Union an Arctic Actor? Strategy interest and challenges

Thieffry, Alison

Laval University 810 rue des zouaves app. 1 Québec Qc G1R 2P5 Canada

alison.thieffry.1@ulaval.ca

In recent decades the Arctic has been the center of many scientific media politic studies and debates. With the ice melting new economic and maritime perspectives emerge mainly in the sector of navigation and exploitation of natural resources bringing the arctic states and many other countries around the world to make it a priority in their external actions agenda. The interest of the international community has materialized mainly from the 1990s - including the creation of the Arctic Council in 1996 which includes Russia Canada the United States Iceland Norway but also some European countries such as Sweden Finland and Denmark. However the European Union has shown a more proactive position since 2008. In recent years Brussels has mobilized a lot to learn about the area and the number of meetings and conferences on Arctic issues has increased considerably. Within the EU instances this has resulted in a desire to focus the debate on regional governance toward the Arctic affairs and with pressure coming from the Parliament manifested especially through various resolutions and a vote in favor of the creation of an Arctic Treaty. Pressure was also issued on the Council side especially under the Finnish Presidency in 2006 and the Swedish one in 2009. Finally the publication of the first Communication on a European Arctic policy from the Commission formalized this more determined position on Arctic issues. Furthermore this research aims to study the evolution and the development of an European Arctic policy and the reasons and interests that underlie it. It will also analyse the main obstacles encountered by the EU in this process and evaluate its relationship with the various Arctic states. Finally an update of the current situation will be made to understand the various opportunities and challenges it may encounter in this new role as an Arctic player.

Food security monitoring in the Arctic: multi-scale interdisciplinary and transdisciplinary approaches

Vlasova, Tatiana

Institute of Geography Russian Academy of Sciences. Moscow Staromonetny 29

tatiana.vlsv@gmail.com

Andrey Petrov, University of Northern Iowa USA; Sergey Volkov, Institute of Agricultural Economy Russian Academy Science; Alexander Khropov, Institute of Geography Russian Academy of Sciences Russia; Ivan Lytkin, Soil Science Institute by V.V. Dokuchaev Russian Academy of Sciences Russia

In the last few years due to the global trend of rising food prices as well as climate changes impacts the food security issues are becoming of increasing concern in the Arctic and need developing appropriate solutions. The aggravation of the food situation in the villages of the indigenous peoples of Canada and Alaska is analyzed in several reports and papers in which special programs to identify the factors that determine food security and food sovereignty especially in the territories of traditional economic activities were developed. The food security issue needs interdisciplinary approaches for understanding and transdisciplinary activities for identification of key variables to monitor in different regions of the Arctic states such as Canada the USA Greenland and Russia. Indicators for food security transdisciplinary socially-oriented observations (SOOs) have started to be developed within the international “ASUS: Arctic sustainability: synthesis of knowledge” project co-funded by the Russian Foundation for Basic Research National Science Foundation and other funds. Approaches for such problem and solutions-oriented observation network construction are discussed in the paper. One of the main principles of such SOOs network construction is bringing together different agencies and stakeholders involving traditional and local knowledge its integration with the science as well as political decisions and building education capacities. The preliminary list of key indicators for food security SOOs is provided including: mixed cash/subsistence economy government subsidies access to traditional food and its harvest access to markets health of wildlife and biophysical environment changes in sea ice rights of indigenous and local people to access land and to protect the land and water sharing community systems and others. Special attention is paid to variables of the entire socio-ecological systems resilience and sustainability important for food security SOOs.

Theme 3: Local and Traditional Knowledge



Traditional qamutik (sled), Cape Dorset, Nunavut. 1999. (Ansgar Walk, Wikimedia Commons)

3.1 Arctic Human-Rangifer Communities: Vulnerability, Resilience, Adaption to Global Changes



The world of reindeer herders and wild reindeer hunters is an holistic system incorporating indigenous people of the circumpolar North and their landscapes. However, the stability of this relationship is threatened by a variety of external factors related to global climate change, large-scale mining projects, the development of tourism and its infrastructure, as well as information technologies. The session will focus on (i) human-rangifer co-evolution in the Arctic, (ii) old and new challenges of reindeer herders and hunters societies in the Circumpolar North, (iii) creativity and adaptation of human-rangifer communities to rapid changes of social and cultural contexts, (iv) field research of human-reindeer relations in the Arctic with new themes and approaches in the analysis of socio-cultural contexts, and (v) the impact of innovations on human-reindeer-landscape relations.

Convener: Konstantin Klovov, Saint Petersburg State University, Russia

Reindeer as a symbol of Arctic Identity

Burnasheva, Daria

North-Eastern Federal University (Russia) University of Warsaw (Poland) ul.
Krochmalna 2 609 Warsaw 00-694 ul. Petrovskogo 21/1 11 Yakutsk 677000

daria.burnasheva@mail.ru

A mixed-methods approach was undertaken to assess different types of Arctic symbols using quantitative methods and to understand their meaning through qualitative approach. Young Russian Sakha (Yakut) Evenki Even and Yukaghir representatives aged between 15 and 29 years old in three urban settlements of Yakutsk Srednekolymsk and Tiksi were asked to answer a question about Arctic symbol (sample size – 108). The locations were chosen so that the answers could represent a wide diverse area from central subarctic zone of Yakutia to its coastal arctic territories. The survey collected a wide range of answers but the most popular symbols were polar bear and reindeer. The results of survey show that there is a correlation between the chosen symbol and ethnic background. This article focuses on the reindeer as a symbol of Arctic identity thus its indigenous perspective.

Davydov, Vladimir

Peter the Great Museum of Anthropology and Ethnography (Kunstkamera) Russian Academy of sciences. 199034 St. Petersburg Russia Universitetskaia nab. 3 MAE RAN (Kunstkamera)

anthropolog@rambler.ru

It is doubtful whether domestication is a process which can be linked with certain place. Evenki reindeer herders rarely stay in one particular place for a long time; reindeer dogs and people move together. At the same time these movements imply periodic returns to the same places where reindeer herders actively use different kinds of self-built objects such as fences gates dwellings storage platforms sheds. They employ a number of small-size constructions which are nevertheless play an important role in the process of human-animal interaction. These are feeding-racks where they put salt different kinds of poles and stakes for binding animals dog shelters and frames for smoking smudges. At the same time constructions are not just practical tools for completing everyday tasks. Rather they help to frame certain social relations. These relations are always spatial. Classical ethnographic accounts often represented architecture as something rigid rather than flexible. At the same time architecture exists in the context of life. People and animals (both wild and domesticated) are always in contact with structures they constantly change their shape condition and location. These objects are always in use in the context of human-animal interaction. In this sense architecture is full of life; it is a part of environment of humans and animals. By providing examples from the recent fieldwork among Zabaikal Evenkis this presentation aims to discuss how does Evenki reindeer herders' architecture-in-the-landscape build and transform social relations between human and non-human persons such as animals master spirits predators and landscape.

Ornithomorphic and zoomorphic elements on ritual clothing of Koryak reindeer herders

Khakhovskaya, Liudmila

The N.A. Shilo North-East Interdisciplinary Scientific Research Institute Far East
Branch of the Russian Academy of Sciences [NEISRI FEB RAS] (Magadan Russia)
685000 Magadan Portovaya str 16

khakhovskaya@gmail.com

Igor Vorobey, Magadan Museum of Regional Studies (Magadan Russia)

The research is based on the field materials collected among the Koryak reindeer herders of Verchniy Paren' and Gizhiga villages. We analyze specific ornithomorphic and zoomorphic elements on shaman and funeral garments in comparative and interpretative keys. Also we examine their actual and/or relict morphological and semantical features. We track a double opposition between upper and shoulder levels of ritual clothing of Koryaks. Hat that is made of animal's scalp presents itself as a part of shaman costume though kukhlyanka with tail is an element of funeral wardrobe. Clothing is also divided due to "bird/animal" token. When hats are always presented as predatory or grass-feeding animal kukhlyankas are tied to bird semantics. The usage of shaman and funeral garments leads to the ideas of reincarnation and mutual reversibility of human and animal. Funeral costume transforms the departed into bird (raven) returning him back to the world of progenitor – Big Raven Kuikynnyaku. The funeral rite in turn is held as a raven performance during which participants temporary transform into ravens. Shaman transformation is reflected in the wolves' hats morphology which we see as a werewolf sign. Archive documents dated with XVIII century show "lycanthropy" in real Koryak actions during battles with Russian parties: for example signal wolf howl before attack or ritual drink of human blood for strength gain. Military and predatory meaning of reincarnation is observed in the Koryaks' ideas of wolf as a wealthy herd owner. This is though not an ordinary ownership: wolf possesses the herd to kill reindeers thus he is an owner and a predator simultaneously. We assume this idea as a pre-herder hunting level of human-reindeer relationship. A wolf and a raven are similar in their confinement to ritual clothing and at the same time are divided as belonging with separate worlds: live and aggressive (a wolf) versus calm and dead (a raven). It is also possible that in the Koryaks's worldview these characters were categories of ethnocultural (perhaps totem) classification that reflected attitude between two enemy societies.

Klokov, Konstantin

Saint Petersburg State University Gorokhovaia street 41 app.8 Saint-Petersburg
Russia 190031

k.b.klokov@gmail.com

The analysis of statistic data revealed that changes in demographic characteristics of the indigenous communities in Siberia were related with regional reindeer livestock number trends. The Polar Census data (1926/27) make it possible to detect 3 main models of Human-Reindeer co-existence in Western Central and Eastern parts of the Russian Arctic. In 1930-1980 the reindeer husbandry developed steadily in all regions but in the 1990ies its position in Eastern part of Arctic worsened and in Western Siberia on the contrary improved. The changes in demography and wellbeing of indigenous communities were similar. The reasons of this correlation depended on many factors and conditions including the ecological type of reindeer husbandry ethnic traditions and regional politics. A methodology of contextualization has been used to examine the co-evolution of Human-Reindeer communities in different Arctic regions. For example in the demographic context the number of nomadic Nenets population was directly correlated with the reindeer livestock amount. As the nomads had a higher level of birthrate than villagers reindeer herding development resulted in the Nenets total population increase in several districts. Besides reindeer livestock growth added to herders' social standard rise as from the Nenets' standpoint "being wealthy" means having a lot of reindeer. In many Arctic areas reindeer herding evolution was directed by political contexts simultaneously influencing demography and well-being of indigenous communities. In these districts trends of indigenous population (between Population Census 1989 2002 and 2010) were determined by ethnic self-identification change not by the balance between birth and mortality rates. However the reindeer husbandry has been perceived there as an important aspect of ethnic self-identification. Recent reindeer livestock reduction in some regions was relevant in the economic context but at the same time the role of traditional reindeer husbandry in cultural and political contexts was increasing.

Biegganjunážat -The joint education and development Interreg project for young sámí reindeer herders 1.8.2015-31.5.2018

Näkkäljärvi, Janne Oula

Sámí Education Institute Pb 50 99870 Inari, Finland

janne.nakkalajarvi@sogsakk.fi

Purpose - strengthen cooperation between young sámí reindeer herders and academies across borders - develop education of sámí reindeer husbandry - providing the young generation with a positive future when keeping indigenous livelihoods viable (such as reindeer husbandry) Action - Develop and implement 8 different education packages in reindeer herding districts of Nordic countries (NOR; Kautokeino SWE; Jokkmokk and FIN; Inari and Enontekiö) - Produce training materials to benefit of sámí reindeer herding academies - Organize seminars for current challenges of sámí reindeer husbandry - Applying new technological innovations on reindeer husbandry - Practical cooperation between students teachers and other experts of the reindeer schools - Result - Level of sámí reindeer education is developed - The importance of traditional knowledge and sámí language in sámí reindeer husbandry is strengthened cultural awareness and identity are preserved and strengthened - Keeping the young generation in the North and enabling the youth to continue to work with the reindeer herding despite of challenges - Active involvement in developing applications of new innovative technologies to be used in everyday work among the traditional livelihoods of the Sápmi and also in teaching - Cooperation between schools and young sámí reindeer herders will naturally continue.

Reindeer in the structure of social relationship of Nenets and Evenks reindeer-herding communities in the 20-21 centuries

Volzhanina, Elena

Institute of problems of the Northern Development Siberian Branch Russian Academy of sciences

nyabako@mail.ru

I propose to present a comparative anthropological study of two indigenous reindeer herding peoples (Nenetses and Evenkis) who live in two Siberian regions and traditionally kept separate. They are the most numerous among the indigenous peoples of the Russian North and the leading reindeer herders of the country. This research will include modeling the social relationships between herders (humans) reindeer and territory (non-human persons and landscape); and the dynamics of so-called traditional occupations (practices). One of the main aspect of the work is analysis of the role of reindeer in the social relations within two ethnic groups: Nenetses and Evenks. Domestic reindeer and pastures are the main values in these communities different kind of meaningful relationships and contacts are built around them (sacred marriage friendly mutual aid neighbourly family). Preservation of reindeer husbandry among Nenetses and Evenks supposes the retention and function of the traditional relations within them in the 21 century.

Reindeer herder's diary: a new perspective on the daily life of Arctic nomads

Yarzutkina, Anastasia

Chukotka branch of North-Eastern Federal University. Russia Anadyr

Studencheskaya st. 3.

jarzut@yandex.ru

Many researchers who have lived for months among reindeer herders have disclosed almost all aspects of their lives to us. But do we know everything about nomadic reindeer herders? We'd like to introduce a new source for the study of the reindeer herdsman's everyday life feelings sensations mobility and their perception of novelty. This diary has been kept for several years (1988 1989 1990 1993) by a Chukchi reindeer herder from a camp within the Polar circle. Roaming across the tundra with his deer this man recorded his daily movements actions feelings and the things and people around him in a notebook. The realism and frankness of these diary entries give us a rare opportunity to look into the private life of the reindeer herder who has learned all the blessings and harm of civilization. The diary entries of the reindeer herder and interviews with other arctic deer herdsman serve as a basis for several new issues relating to changes in the daily lives of reindeer herders and their changing interpretations of the traditional aspects of their world which was at its peak in the Chukchi Peninsula in the 1980s and 90s. Daily records in the reindeer herder's diary highlighted problems such as changes in time management. Thanks to technical innovations new tools and foodstuffs reindeer breeders got extra time off free from survival deer care and welfare tasks. This extra time proved unnecessary in the strictly scheduled and regular traditional scenario of daily life. As a result according to his diary he spent this time seeking alcohol drinking heavily playing cards or dragging himself to the village to watch TV. We also raise the question of spirits in the lives of reindeer breeders as we deem alcohol to become an emblematic product of changes in the daily lives of Arctic nomads.

3.2 Local and traditional knowledge in supporting business and community development in indigenous regions of the North



Local and traditional knowledge acts as a resource for a socio-economic development of indigenous communities of the North. Such knowledge evolves and preserves at the same time, transmitting from one generation to the next on the level of an ethnic community. This knowledge also forms a basis for cultural and spiritual identity. At the same time, traditional knowledge is not only a guarantee for preservation of a cultural heritage of the Northern communities, not only an ecological buffer for protection of an environmental balance, but it can also be a foundation for development of production and entrepreneurship. The session will discuss, does local and traditional knowledge contribute to a preservation of an indigenous way of life? What impact local and traditional knowledge has on development of small business in indigenous communities? How implementation of innovations in development of local indigenous communities of the North takes place in modern conditions?

Convener: Oksana Romanova, North-Eastern Federal University, Russia

Traditional Way of Living as a Life Strategy of Youth of Northern Communities

Barashkova, Klavdiia

Finance and Economics Institute NEFU the Republic of Sakha (Yakutia) Yakutsk Lenin prospekt 1

bardka@mail.ru

Research of youth socialization problems studying its values cultural conditions as a factor of personality formation and development in the context of preservation of traditional way of living identity development and preservation of ethnic integrity is especially relevant. In the Republic of Sakha (Yakutia) there are 70 areas of compact living of indigenous people of the Northern Yakutia. 38 schools (including nomadic) of 67 general education schools in areas of compact living of indigenous people of the North have conditions for teaching indigenous languages and traditional culture. Our sociological research on the topic "Socialization particularities of high school students of the arctic uluses (regions) of the Republic of Sakha (Yakutia) in modern conditions" covers the period from 2005 to 2016. The main research goal is to monitor socialization factors of high school students in the context of changing traditional way of living of indigenous people. The empirical basis for research are surveys undertaken in cities of Yakutsk Nerungry Yengrinskiy evenk national district of Nerungry region Belletskiy evenk national district of Aldanskiy region Momskiy even national district of the Republic of Sakha Yakutia. Research objects were school youth of ages from 15 to 17 from indigenous people of the North. One of the main tasks of the sociological survey is the need to purposefully forecast the ways for restoration and development of sociocultural values and traditions of northern communities. The research also aims to reveal life strategies of youth and how the youth sees its perspectives in the changing world. During the course of the research the influence of the state family and media on the youth as main social institutes are updated. The research of high school students' values shows that for the most part the youth of northern communities preserves national identity continues to adhere to the culture and traditions of their community and is ready to continue traditional activities of their parents.

Using Local and Traditional Knowledge to Define a Digital Library for the Inuvialuit Settlement Region

Campbell, Sandra

John W. Scott Health Sciences Library 2K3.28 Walter C. Mackenzie Health Sciences Centre University of Alberta Edmonton AB Canada T6G 2R7

sandy.campbell@ualberta.ca

Dinesh Rathi, University of Alberta Canada; Ali Shiri, University of Alberta Canada; Cathy Cockney, Inuvialuit Cultural Resource Centre Canada; Sharon Farnel, University of Alberta Canada; Elaine Maloney, University of Alberta Canada; Robyn Stobbs, University of Alberta Canada; Anastasia Piltingsrud, University of Alberta Canada

The Inuvialuit Settlement Region is located in the northwest of Canada's Arctic. The Digital Library North (DLN) is a collaborative project between the Inuvialuit Cultural Resource Centre (ICRC) and researchers at the University of Alberta. It is designed to make documentary resources held by the ICRC in Inuvik available to the geographically dispersed population of the Inuvialuit Settlement Region (ISR). The incorporation of local and traditional knowledge to guide the design implementation and sustainability of the DLN is fundamental to the project. In addition to the direct contributions of the Inuvialuit collaborators to the development of the project a unique environmental scanning model is being developed that is suitable both for application in the field of information services and for the social cultural and geographic contexts of the ISR. The environmental scan will be ongoing and iterative throughout the project. In its first phase key users communities stakeholders information providers and information resources have been identified and data gathered about them. In the second phase these data will be interpreted and applied to the development of the DLN infrastructure. All facets of the project will be guided by the information gathered from people in the ISR through the environmental scanning process. In addition to the importance of local and traditional knowledge in the development of the project this knowledge will also be critical for the attainment of another of the project's goals that of ongoing sustainability of the DLN by the people of the ISR.

Healthy Families a key factor for sustainable indigenous communities in the circumpolar North?

Carlsdotter Schjetne, Eva

UiT the Norwegian Arctic University Institute of Child Care and Social Work Campus
Alta N-9509 Alta Norway

eva.c.schjetne@uit.no

Nadezdha Melnikova, Institute of Psychology North Eastern Federate University
named after Ammosov Yakutsk Russia

Background We present the development work introducing family work and communicational psychology principles into the innovational economic processes during the realization of the project "Innovative Development of the Northern Territories" (2009-2014) under the leadership of N.V. Okhlopko. There was a close cooperation within the UArctic network Local and Regional Development between Finnmark University College Alta Norway now UiT the Arctic University of Norway Institute of Finance and Economics North Eastern Federate University named after M. K. Ammosov (NEFU) Yakutsk Russia and Development Psychological Aid Centre (NEFU). The main goal for the project was to create a social partnership which brings together scientists locals and administration. In those community development projects the contribution from the field of Psychology was System Theory Community Work and Family Therapy. To include the psychological dimension in business development has proved to ease the working processes. Research method Action research interview analysis of psychological seminars and training sessions. Results Confronted with the problems presented when we meet both administrative staff and villagers we saw the need for family work and communicational family therapy. Drinking problems depression and suicide are not only great personal tragedies but seriously threaten the development of human capital. The families are important because through the extended family systems traditional cultural and spiritual traditions as well as traditional knowledge are passed on to new generations. At the same time family life is an ongoing dynamic process constantly interacting with the environment and take in influences from modern conditions. Thus they are active in contributing to production and entrepreneurship. **Conclusions** The experience of the project has shown that the psychological and economic development are two inseparable components of rural development. Methods of family therapy and communicational psychology are the most important tools for extending the family competence and building of social capital.

Self-Governance and Economic Self-Sufficiency: Success Factors for Sustainable Economic Development in Indigenous Communities of the Circumpolar North?

Gjertsen, Tor

UiT The Arctic University of Norway Campus Alta

tor-arne.gjertsen@uit.no

The question I would like to raise is how Indigenous peoples and communities can move toward economic prosperity and still retain their traditional cultural practices that they view as essential parts of their lives? The first and foremost function of a culture indigenous or non-indigenous peoples is to satisfy their basic needs for living and surviving. "If Indians are to live and survive as Indians in the modern economic political and social environment then they must adapt and develop their traditional cultures with reference to that environment" (Bolt 1993 179). Cultural adaption and development cannot be constrained by prescriptive customs and traditions conceived in another time and place. The first priority for cultural adaption and development according to Bolt must be; "to derive a framework of traditional fundamental philosophies and principles that will serve as a guide in adapting and developing their cultures for surviving and living in the contemporary world" (Bolt 1993 184). Bolt is warning against revivalism that we can observe in some Indigenous societies where they are striving to find back to their traditional cultural identity after years of oppression and assimilation by central government and administration. Traditional culture and values does not always support the social and economic change and development they need. Going back to 'the land' and traditional way of life will usually not secure economic self-sufficiency and independence. Overall economic development within the concept of tribal traditional economies has very limited potential for contributing to Indian economic well-being. "Those that cling to 'false hope' that their traditional economy can be restored through aboriginal rights treaties or land claims are inhibiting the survival of Indians as Indians. Without cultural adaption and development to fit the new world Indians are doomed to continue living and surviving in a culture of dependence with its associated sense of apathy and defeatism" (Bolt 1993 197). The researchers behind the Harvard Project on American Indian Economic Development (HPAIED-project) partly agree with Bolt in that the governing institutions of Indians or Indigenous peoples "must be suited to the contemporary challenges tribes face and to the world in which they operate". (Begay Cornell and Kalt 1998 45). However they disagree on the importance political sovereignty and self-governance have for social and economic development. According to them; "The improvement of socioeconomic and political conditions of Indigenous peoples is inextricable linked to issues of self-governance management and leadership" (Begay Cornell and Kalt 1998 43). Putting in place effective governing institutions is a crucial first step in any society's effort to establish and sustain economic growth and to assert control over their own affairs. The HPAIED-researchers claim that economic development in Indigenous communities and regions is primarily a political process. Sovereignty and its effective exercise will play a determinative role in whether or not economic and social well-being is attainable and sustainable. In my presentation I will focus on the importance local and regional self-governance has for economic development in Indigenous regions of northern Norway and Russia based on our experiences with the R&D-project for local and regional development workshops and partnerships and the findings in studies of economic development in Indigenous communities and regions of Canada and the US referred to above.

Goto, Masanori

Slavic-Eurasian Research Center Hokkaido University Kita-9 Nishi-7 Kita-ku Sapporo
060-0809 Japan

goto@slav.hokudai.ac.jp

It has long been discussed in the fields of economics and business administration that entrepreneurship of actors in the market should be a kind of engine of economic growth. It is usually regarded as one of indices of economic development and sometimes its level is statistically worked out from the number of enterprises as legal units. Such an approach is also applied to Russia as well as other former socialist countries all the more because it has experienced a radical change of economic structure. Some argue that fragility of institutional base and inelastic energy-dependent economy prevent Russia from growing legal entrepreneurship in the sound market. Anthropological approach provides an alternative way of looking at entrepreneurship. According to the pioneer work of Fredrik Barth *The Role of the Entrepreneur in Social Change in Northern Norway* (1963) entrepreneurs play the role of broker who can capture the channel of value change in relations. She or he can make profit by expanding short-circuiting and creating new flow of values from one sphere to another. Entrepreneurship like that from anthropological point of view is found among the indigenous people of the Arctic Russia. A study of entrepreneurship in the local context will not only provide another viewpoint on the living of indigenous people but also suggest a possibility of intermediary position between them and industrial development.

Scholastic Enrichment in Indigenous Reindeer Communities

Hrabok-Leppäjärvi, Jackie

Saami Education Institute Menesjärventie 4 PL 50 99871 FINLAND, University of
Alaska Fairbanks Northwest Campus P.O. Box 400 Nome Alaska 99762 USA

jhrabok@alaska.edu

Liisa Holmberg, Saami Education Institute Finland; Bob Metcalf, University of Alaska
Fairbanks Northwest Campus USA

Reindeer husbandry is a family based activity preserving traditions languages and cultures among Arctic peoples. Traditional knowledge or rather indigenous knowledge preserves the cultural heritages of northern communities and provides the foundations for development of production and entrepreneurship. Globalization and climate change are two factors transforming these foundations. The Saami Education Institute in northern Finland in collaboration with the University of Alaska Fairbanks Northwest Campus offers a specialized program in reindeer range management at high latitudes. It promotes traditional ways of life of the indigenous Saami Yupik and Inupiaq with a modern curriculum to encourage healthy communities. Values matter and the education system should reflect that. The overall goal is to develop sustainable indigenous cultures with economy from reindeer herding as a modern day livelihood. The development of the 'value added reindeer education concept' encourages multitasking in cultures languages crafts nutrition science and tourism. We must fuse these with modern technology design and media to create innovative products and services. Partnerships with local reindeer herders associations and institutions will aid in the development of community based reindeer research. Applied projects concentrating on localized needs would be conducted by indigenous students and field technicians. Outreach research product development and training benefit all actors and indigenous groups in the region. Reindeer husbandry remains vital. The culture connected to it remains a respected way of life worth pursuing.

Factors influencing the creation of enterprises and success of young indigenous entrepreneurs in Quebec and Labrador Canada

Iankova, Katia

University of Greenwich Business school Senior Lecturer in Tourism and Hospitality
QA 244 Greenwich Campus Old Royal Naval College Park Row London SE10 9SL UK

ik08@gre.ac.uk ; katia.iankova@gmail.com

The proposed work is targeted at better understanding the mechanisms of economic development in Northern Native communities via the activities of young entrepreneurs. The objective is to identify the barriers and the key factors of success for start-up businesses owned by Indigenous young entrepreneurs in Quebec and Labrador including interactions among family friends and community that determine choice of businesses and the strategies that they apply to succeed. The results of the research point out that main factors of success for the young Native entrepreneurs of the two Canadian provinces: Quebec and Labrador are: family and friends support and encouragement; education and skills development; appropriate business network; good understanding of the function of the funding bodies; good relationships with three levels of government – local provincial and federal; training opportunities in and out of the communities; and last but not least the creative and innovative spirit of the young Native businessmen and businesswomen.

Qaumanig: Beam of Light- Technology Opportunities for Cultural Preservation and Indigenous Self Determination

Kowalski, Karl

Office of Information Technology University of Alaska Fairbanks 910 Yukon Drive
Fairbanks Alaska 99775 USA

karl.kowalski@alaska.edu

According to Indigenous legend throughout the Arctic in the beginning the world was in darkness and light was hidden in the lodge of the Old Fisherman. Raven wishing access to this treasure turned himself into a leaf or spruce needle and was swallowed by the Old Fisherman's daughter. Then born as her son Raven pleaded with his Grandfather to bring out the box holding the light. Worn out by the child's whining the Old Fisherman unwrapped eight boxes one inside the next until the last lid was lifted and the lodge was flooded with light. Entranced the boy ran around the house playing with the ball of fire. He asked for the roof boards covering the smoke hole to be taken off. No sooner were they removed than the child changed himself back into Raven jumped to the roof and flung the ball of light into the sky where it exploded and filled the sky with the sun and the stars. That was how Raven brought light to the world. A new light is coming to the Arctic. Qaumanig an Inupiaq word roughly translated as "beam of light " is appropo as major telecommunications leaders implement their plans for laying fiber optic cable throughout the pan-Arctic region. The Arctic one of the last places on earth not yet impacted by ever-growing presence of fiber optic cable along its seafloor is about to change. The development of new pathways for telecommunications infrastructure and broadband access throughout the Arctic region offers unlimited potential for scientific discovery research improvements in healthcare and education economic development cultural preservation and indigenous self-determination. Broadband availability varies widely throughout the Arctic. An examination of infrastructure and community perspectives and needs provides a platform for discussion of the long-term role of technology innovation in cultural preservation throughout the Arctic.

Acknowledging local knowledge and voices in supporting socio-economic and community development in Indigenous communities: experience from two northern regions of Russia

Loginova, Julia

The University of the Arctic's Thematic Network on Local and Regional Development in the North
The University of Melbourne Carlton Australia VIC 3010'

loginovajm@gmail.com

Julia Yushkova, Komi Business Incubator Syktyvkar

There has been a growing interest in the role that local (traditional Indigenous) knowledge can play in participatory approach to sustainable community development. In general such knowledge refers to knowledge systems based on accumulations of empirical observation and interaction with the environment embedded in the cultural traditions that are crucial for the subsistence and survival. However little understanding has been developed of what is meant by local knowledge when socio-economic development and well-being of Indigenous and rural communities are concerned. This is especially important in the context of developing alternative options to extractive industries. The paper conceptualizes local knowledge in supporting socio-economic and community development in Indigenous and rural communities and defines the ways and instruments of how local knowledge and local voices can be incorporated into policy and decision-making process. It does so based on the extended literature review and case studies of development workshops in Komi-Izhma people's villages in northern Komi Republic and Evenks Indigenous communities in southern Yakutia. The discussion has implications for the understanding of instruments for incorporation of local knowledge into community development efforts in remote communities and open the space for consideration of alternative ways of imagining the future.

Aleut Leadership & Knowledge

Mack, Liza

University of Alaska Fairbanks & Aleut International Association 2121 E. 75th Unit 3
Anchorage Alaska 99507

lmack2@alaska.edu

I will be presenting preliminary results of my dissertation research that focuses on the leadership of the Unangan people in the Eastern Aleutians and how natural resource management is learned about and understood. This research is interdisciplinary in nature. It looks at leadership traditional knowledge subsistence practices and culture. Adaptation and change are often talked about in the sense of natural connection to the land sea and air; this paper takes those ideas a step further by also discussing the politics and the social capital needed in order to participate at the multiple levels of governance that facilitate those relationships with the natural environment. This research will contribute to the discourse about the ways traditional knowledge plays a role in leadership positions outside of the villages and in roles of governance within our Native communities. Further it will provide a sharing and listening opportunity that allows people from multiple backgrounds to be see an illustration of how multiple layers of governance in a community are experienced by individuals.

Mikhailova, Anna

North-Eastern Federal University in Yakutsk (NEFU). 58 Belinsky str Yakutsk Republic of Sakha (Yakutia) Russia 677027

av.mikhailova@s-vfu.ru mikanya23@mail.ru

It is indisputable that the main factor of economic development of the North is human potential. Key indicators of all strategy and programs of development of the Arctic and the North of regions finally put the mission improvement of quality of life of the population creation of conditions of development and accommodation. The biopolitics gets into the scientific sphere directing on search of answers to actual calls. The global climate change menacing with thawing of ices permafrost forces to pay attention of science to a phenomenon of the person since ancient times living in kriolitozona conditions. Human capacity of territories of the Arctic can't be estimated and developed without identification of a phenomenon of the person of a kriolitozona. Yakutia is characterized as the most occupied territory among cold regions of the planet. All territory of the republic is in a zone of permafrost and is located between the North Pole planets the Polar circle and the recorded zones with record-breaking low air temperatures in the Northern hemisphere. Need of formation of effective northern policy demands a quality and quantitative standard of interrelation between the human potential and economic development of the North and zones of the Arctic an assessment of influence of economic growth and the income of the population on dynamics of the population change of educational level life expectancy. The quantitative assessment of social consequences of economic social and institutional reforms concerning the North and the Arctic and also creation of the effective models allowing to predict human development in northern regions taking into account change of social and economic factors is necessary. The detailed analysis of evolution of northern social policy is necessary for the account and effective use of the saved-up experience of management of development of the human capital. It is necessary to generalize experience of research of concepts of management of human development of the North and the Arctic providing efficiency of the realized social policy in the conditions of formation of the new social and economic and socio-political relations important ensuring development of productive forces in the conditions of cold the merzlotnykh of soil studying of biological and technical problems of a kriolitozona is. At the moment there are no the indicators of an assessment of human potential and the human capital reflecting aspects of human life in the conditions of a kriolitozona in conditions of the North and the Arctic. Actually to develop techniques of calculations of social indexes of a human kapiatal of human potential introduction of correction coefficients forecasting of social and economic development of territories of a kriolitozona development of educational health saving cultural and environmentally safe programs of the North and the Arctic.

The Role of Indigenous Peoples in Khabarovsk Territory Economy

Romanov, Alexey

Far Eastern State Transport University 680021 47 Seryshev Str. Khabarovsk Russia

arfestu@gmail.com

Odzyal Ljubov, The Association of Indigenous Peoples of the Khabarovsk Territory
Russia

Active economical activity in the Arctic has a direct impact not only on region's ecology and biodiversity but also to the people mainly living in the area. Today the question of involvement of people living traditional way in to the economic processes of the Northern regions for the sustainable development of their communities is one of the main issues in Arctic. Nine major indigenous people's communities reside in the Khabarovsk Territory are engaged in economic activity including extraction and processing of water biological resources wood tourism production of traditional goods and objects of art. This work gives you the analysis of the indicators of economic activities of indigenous peoples understanding of the dynamics of its changes in the today's economic reality. Contribution of the communities in the economy of the Khabarovsk Territory evaluated and "unique" market segments given by the state to indigenous peoples for development are also described. In addition the main directions of long-term projects planned for implementation for indigenous people's communities in cooperation with the Government of Russian Federation are given.

Traditional Knowledge as a Resource for Development of Local Communities of Indigenous people

Romanova, Oksana

M. K. Ammosov North-Eastern Federal University 58 Belinsky str Yakutsk Republic of Sakha (Yakutia) Russia 677027

oxanadmit@mail.ru

Local and traditional knowledge acts as a resource for a socio-economic development of indigenous communities of the North. Such knowledge evolves and preserves at the same time transmitting from one generation to the next on the level of an ethnic community. This knowledge also forms a basis for cultural and spiritual identity. At the same time traditional knowledge is not only a guarantee for preservation of a cultural heritage of the Northern communities not only an ecological buffer for protection of an environmental balance but it can also be a foundation for development of production and entrepreneurship. Traditional knowledge as a resource for socio-economic development of local communities of indigenous people contributes to: - Preservation of “we” in the context of multiculturalism; - “Soft” adaptation to changes in external environment; - Preservation of surrounding nature and ecology; - Formation and development of small and medium entrepreneurship around traditional activities such as deer farming fishery and hunting; - Creation of new “economic culture” in mutual relations; - Finally redesign of traditional way of living of indigenous people. Analysis of the modern way of living of indigenous people of the Yakutian North in recent years clearly demonstrates two tendencies. The first tendency – preservation of isolation of indigenous people’s lives based on traditional types of activities at the territories of their compact living. The second tendency is traceable in integration of indigenous people of the North (voluntarily or involuntarily) in the process of globalization through implementation of new kinds of activity use of modern technologies in education state and municipal services and other spheres.

Creating an Innu Centred Enviromental Policy

Sable, Trudy

Saint Mary's University 923 Robie St. Halifax Nova Scotia Canada B3H 3C3'

trudy.sable@smu.ca

Helen Andrew, Innu Nation Office Sheshatshiu Labrador Canada

In 2012 the Office of Aboriginal and Northern Research at Saint Mary's University entered into a five-year partnership agreement with the Innu Nation of Labrador as part of an international project entitled the Community Conservation Research Network (CCRN). The proposed project was to assist the Innu Nation in the development of an Innu-centred environmental policy in the face of a multi-year multi-faceted land claims process they are currently negotiating within their ancestral lands Nitassinan. This process includes the signing of an Agreement in Principle and a "land use" plan for designating different levels of land use practices once the land claims are settled. As well the Innu are and have been for years involved in numerous negotiations concerning resource development projects within Nitassinan and with provincial and federal government agencies to deal with multiple levels of land-use e.g. forestry fishery and caribou and migratory bird management. Having only been 'settled' in communities since the 1960s the Innu have faced many lifestyles changes but are strong in their conviction that their traditional values and knowledge be incorporated into any environmental policies and that these values and knowledge systems be the basis for all protocols relating to land use and conservation. This presentation will delve into the challenges and issues that have arisen during the project including the multi-generational perspectives of community members including elders who grew up on the land and the youth who are growing up in the community.

Living in Nunavik Quebec: The challenges of sustainable architecture and planning in Inuit villages

Vachon, Genevieve

School of Architecture Laval University 1 Cote de la Fabrique Quebec City (QC)
Canada G1R3V6

genevieve.vachon@arc.ulaval.ca

Myriam Blais, School of Architecture Laval University Quebec City Canada; Andre Casault, School of Architecture Laval University Quebec City Canada; Denise Piche, School of Architecture Laval University Quebec City Canada

This paper presents the results of design-research explorations into culturally territorially and climatically appropriate architectural and urban adaptations north of the 55th parallel for Inuit villages in Nunavik Quebec Canada. The work is conducted as part of the larger 'Living in northern Quebec: Mobilizing Understanding Imagining' partnership tackling Inuit built environments through participative interdisciplinary and intersectoral research. The Inuit of Nunavik are facing significant challenges related to their living environments. As recent sedentary communities they have had to deal with housing that is often designed and planned according to models imported from the south. Housing is insufficient in number overcrowded standardized ill-equipped to cater to local and traditional practices representations and aspirations and contributes to social familial and health problems. Current housing policies and programs often lead to hasty construction in order to respond to the most basic of needs. The Inuit communities regret not being consulted during the decision-making process and thus being not involved in planning and building housing that would be better adapted culturally and in terms of land use. Furthermore the effects of climate change – such as permafrost prematurely degrading habitable territories -- threaten prevalent development patterns. Four intertwined challenges emerge as the basis for preliminary architectural and urban design proposals: 1/ addressing the sustainability and cultural responsiveness of living environments at different scales (home street village territory); 2/ finding alternatives to sprawling urban forms by way of consolidating existing areas and building on rock; 3/ developing simple energy efficient and locally resourceful construction strategies; 4/ involving Inuit citizens and local stakeholders in the planning and design of their built environment. The presentation aims to discuss a developing approach to collaborative / interdisciplinary research on northern indigenous habitats through design which tackles the different aspects -- cultural spatial environmental and administrative -- that give it cultural meaning.

Selling walruses. Marine Hunters of Chukotka in market conditions

Yarzutkina, Anastasia

Chukotka branch of North-Eastern Federal University. Russia Anadyr
Studencheskaya st. 3.

jarzut@yandex.ru

Nikolay Kulik, Chukotka branch of North-Eastern Federal University Russia

Indigenous residents of the Asian part of Bering Strait coast have been nourished by the very ancient marine mammal hunting for centuries. The 20th century has brought tremendous political and economic changes in Russia which entailed the transformation of this customary activity of indigenous peoples of Chukotka. Marine mammal hunting has experienced both comprehensive government assistance during Soviet times and the absolute indifference of the State in post-Soviet nineties. In the early 21st century the preservation of this extincting traditional activity has become a political slogan of the regional authorities of Chukotka. The financial assistance of the State and public efforts made the functioning sea fishery along the coast of the Chukchi Peninsula possible. Currently it exists as activities of eight Indigenous communities. About 230 sea hunters – members of these communities – procure about 2 500 tons of marine mammals a year. These people are paid from the State but this support stipulates that meat skins and tusks of marine mammals are to be sold under the specified tariffs. The business model proposed by the regional government is not always consonant with traditional attitudes and economic stereotypes of indigenous people. For example selling the meat for money to the villagers many of whom are related to the hunters contravenes the tradition of free sharing and distribution of the catch. However new economic conditions and financial needs focus the sea hunters on search of the additional sources of income. Tourist hunting shows and walrus tusk souvenirs are the most common ways of earnings conforming to the traditional value system of indigenous people. The cultural products but not gifts of nature are for sale in this case. The report will consider the organization of daily activities of marine mammal hunters' community corporate culture and informal rules governing the activities of hunters in the context of traditional Chukchi and Eskimo ethical norms of human interaction with nature and society.

3.3 Vulnerability and resilience of Northern Languages: ways to move forward



The vitality of Arctic languages today varies greatly, and can change rapidly. Knowledge of language is intimately linked to well-being, including both cultural well-being and mental health. This session takes special focus on the indigenous languages of the Russia's North, Siberia and Far East. The session addresses core issues of culture and traditional knowledge through the lens of language, and a wide array of methods to build capacity among indigenous peoples, ranging from traditional school-based education to the use of media and social media.

Convener: Lenore Grenoble, The University of Chicago, USA

Northern Selkup communities and their ways to support and promote Selkup: achievements and failures

Kazakevich, Olga

Lomonosov Moscow State University Research Computing Centre Laboratory for computational lexicography Leninskiye Gory 1 Build. 4 NIVTs 119992 Moscow Russia

kazakevich.olga@gmail.com

In the paper I am going to present a panorama of activities aimed at supporting and promoting Selkup in the settlements of Krasnoselkup and Pur districts Yamalo-Nenets autonomous area and in Turukhansk district Krasnoyarsk territory and analyze achievements and failures of these activities. The activities include Selkup classes at school and kindergardens Selkup radio and TV broadcasting Selkup pages in the Krasnoselkup district newspaper. I'll also present some activities of linguists working in the area in cooperation with communities members and trying to excavate cultural and linguistic heritage of the communities and to contribute to supporting and promoting Selkup (creating textbooks and dictionaries developing multi-media teaching resources consulting school teachers). Finally I'll present my understanding of the linguistic situation in the communities and of possible ways of its improvement.

Langgård, Karen

Ilisimatusarfik / University of Greenland P.O.Box 1061 GR-3900 Nuuk Greenland

kala@uni.gl

Kalaallisut / Greenlandic the Inuit language spoken in Greenland is polysynthetic pro-drop and morphologically an ergative language. It is not a threatened language but L1 the mother tongue for the large majority of the population of Greenland. It became a written language in the 18th century – and both newspapers literary works etc written by Greenlanders in Kalaallisut have been published since the 19th century. Today reading and writing in Kalaallisut is not in high esteem even among L1 speakers of the language. The majority of the newspaper articles are no longer conceived in Kalaallisut but translated into Kalaallisut from Danish. On the other hand Kalaallisut is the single official language of Greenland and thus it is supposed that Kalaallisut should cover all domains. In such an ambiguous linguistic market the language usage among young Greenlanders becomes a very important and relevant research object. All languages undergo changes all the time and they ought to in order to develop. Changes found in the language spoken / written by young Greenlanders are they just such normal changes or are they warnings against future language decay? The presentation will present some results from an on-going research project about young Greenlanders' language usage: the syntactical structures of their Kalaallisut their code-switching to Danish and English and the degree of cohesion of their language – both in spoken language and in written language.

Language Technology for Arctic Minority Languages. An unavoidable tool in Safeguarding against Language Death in the Arctic

Langgard, Per

Greenland\ University Per Langgard P.O.Box 980 DK-3900 Nuuk

pela@nanoq.gl

The all too common belief that language technology is a prerogative of only the more widespread of the world's languages is not only unfounded but utterly harmful to all minority languages. They are in fact more in need of the technology's services than the majority languages are. The concomitant belief that development of advanced technology for minority languages is prohibitively expensive both in terms of money and human resources is similarly wrong. In Greenland with less than 50 000 speakers of the national polysynthetic Inuit language a few linguists with limited resources but with strong political and lay support have over half a dozen of years managed to provide advanced language and speech technology for almost as many aspects of modern society as one would expect to find in much bigger linguistic societies. Greenlandic language technology is in high esteem everywhere in Greenland and solves or facilitates already quite a number of language needs in everyday Greenlandic life. Maintenance and further development is a key element in Greenlandic language preservation policy. The Greenlandic example proves that it is doable also in small societies with limited resources and a case will be made to invite other minority languages to exploit the Greenlandic models and results to establish their own programs locally all over the Arctic.

Toivanen, Reetta

Erik Castrén Institute of International Law and Human Rights Faculty of Law
Yliopistonkatu 3 00014 University of Helsinki

reetta.toivanen@helsinki.fi

Janne Saarikivi, Helsinki Collegium for Advanced Studies University of Helsinki

The languages of the world represent a complex diversity that reflects human culture thought mentality and history in a variety of ways. Generally linguistics anthropology social sciences and law have treated languages as more or less closed systems. At the same time scholars have been interested in the variation in language and the linguistic behavior of the people that speak particular languages. Some scholars have postulated that all languages are “invented” and questioned the very existence of languages speech communities and ethnolinguistic groups. This paper argues that denying the existence of a particular language may also represent denying the identity of members of minority communities many of which fight for recognition as an independent ethnic and linguistic identity and stresses that in order to understand the processes leading to language attrition and loss of minority linguistic heritage one has to create theoretical models that join the perspectives of contact linguistics and variation studies with a framework of careful ethnographic study of social identity and status position and critical research into power relations in a context of changing language use. The empirical materials stems from interviews in Finnish Lapland.

Theme 4: Building Long-term Human Capacity



First day in school for the new pupils in first grade at the Prinsesse Margrethe School in Upernavik, Greenland, 2007. (Kim Hansen, Wikimedia Commons)

4.1 Lifelong Professional Education in the Present Context of Transformation and Their Impact on the Quality of Life



Today, the changing and transforming world challenges mankind to face a vibrant process of the constant professional development and skills improvement. Lifelong Professional Education, traditionally defined as Continuing Education, needs to respond to external factors including the political and economic changes in the world. This session will examine the current state of the quality of life in the North, discuss offered job opportunities, employment issues, vocational training services, and other topics. The session describes several studies looking at these issues from different perspectives providing international background, thereby functioning as a platform for discussions, debates, networking, and a source for further collaborations and joint projects.

Convener: Olga Chorosova, Ammosov Northeastern Federal University, Russia

Artemev, Nikolai

Ammosov North-Eastern Federal University 58 Belinsky St Yakutsk 677000 Russia

nf.artemev@s-vfu.ru

Ammosov North-Eastern Federal University is one of ten federal universities of Russia and the largest multi-disciplinary university in the northeast of Russia. Students from 40 countries and 37 Russian regions are enrolled in 407 educational programs of higher and vocational education at four campuses of NEFU. The NEFU Institute of Lifelong Professional Education (ILPE) has set its goal to provide the northeast of Russia with qualified personnel starting from education business and healthcare to engineering by offering lifelong learning programs and courses delivered by high-level national and international experts. Today more than 7 000 students including about 5000 educators have their academic and professional advancement and graduate from ILPE with degrees of 57 programs and certificates of 86 courses annually. The Institute is in a constant process of developing and redesigning its courses and programs in a dialogue with students employers and market. The study shows the experience of NEFU as a model for improvement of quality of life in the North.

Continuing Professional Education and Issues of Adaptation of Yakutian Teachers in Contemporary Conditions

Chorosova, Olga

‘M.K. Ammosov North-Eastern Federal University’ Federal State Autonomous Educational Institution of Higher Professional Education Institute of Continuing Professional Education

chorosovaom@mail.ru

Diane Hirshberg, Center for Alaska Education Policy; Research Institute of Social and Economic Research; University of Alaska Anchorage; Ute Kaden, University of Alaska Fairbanks

Relevant issues of adult education in current conditions are linked to understanding education as a value as well as with definition of its role and place in intercultural collaboration; its adaptive properties in the context of globalization IT development intensive industrial development of the Sakha Republic (Yakutia). Education is also interpreted as a component of culture. The features of geo-educational policy of the Sakha Republic (Yakutia) are affected by objective factors that are characteristic for the Russian educational space: recognition of the leading role of additional professional training in the context of continuing education in relation to socio-economic transformations occurring worldwide and others. We are interested in comparative approach to studying current state of the system of continuing professional education for adults in the North-East of the Russian Federation the Sakha Republic (Yakutia) and the countries of the circumpolar North (Alaska Canada): educational institutions that are members of the University of the Arctic. Among the main directions of research in the context of current transformation processes taking place in additional professional education domain the following in our opinion are of doubtless scientific interest: - paradigmatic orientation of contemporary education given that both individuals and society are oriented towards life-long learning (LLL): comparative aspect (the Sakha Republic (Yakutia) Alaska (USA)); - studying the socio-economic realities and their impact on the professional and personal well-being of the adult working population. From this perspective a comparative study of professional and personal well-being of teachers in Yakutia in the countries of the circumpolar North (Alaska USA) in modern conditions cannot be more relevant. There is much work ahead in order to obtain the full picture of how the teachers of the Sakha Republic (Yakutia) assess their professional and personal well-being social status opportunities for self-development and the quality of their lives in general. A comparison with the results of research as well as a similar survey conducted among teachers in Alaska (USA) will identify common and specific features in the trends and prospects of continuing professional education of teachers.

Why they leave why they stay and what these choices cost: exploring decisions by teachers in rural Alaska

Hirshberg, Diane

Center for Alaska Education Policy Research University of Alaska Anchorage 3211
Providence Drive BoC 301 Anchorage AK 99508

dbhirshberg@alaska.edu

Dayna DeFeo, CAEPR University of Alaska Anchorage; Dale Cope, Independent
Researcher; Craig Kasemodel, University of Wisconsin Madison; Alexandra Hill,
CAEPR University of Alaska Anchorage

In Alaska teacher turnover rates in rural Alaska are very high averaging 20% across all rural districts and running as high as 50% in some. The impacts of high turnover are multiple; most importantly that high turnover rates are correlated with lower student achievement on standardized measures. In addition high turnover rates create significant costs to districts struggling to staff rural schools. The causes of high teacher turnover in Alaska are complex and multiple. Over 2/3 of teachers hired each year to work in Alaska's schools come from outside the state. Many come to rural Alaska unfamiliar with the cultures of the indigenous peoples as well as the challenges in living in a remote small community. Moreover in many communities there is a disconnect between parents and the school leaving teachers feeling unsupported by the community. In this paper we explore the causes and costs of high teacher turnover. We use data collected via a statewide survey of teachers on their perceptions of relationships with administrators parents and communities and their overall job satisfaction as well as information on whether these educators stayed in or left their school. We also use data gathered from school superintendents across Alaska about a wide variety of specific costs associated with teachers entering and leaving their districts. We describe the correlation between teacher perceptions and their decisions to stay or leave as well as the costs districts accrue when teachers leave. Finally we discuss the implications of our findings as well as ideas for addressing this difficult problem.

Researching Links between Teacher Wellbeing and Educational Change: Case Studies from Kazakhstan and Sakha Republic

Kurakbayev, Kairat

Nazarbayev University Graduate School of Education Astana Kazakhstan

kkurakbayev@nu.edu.kz

Olga Chorosova, Director of Institute of Continuing Professional Education of the M.K. Ammosov North-Eastern Federal University Sakha Republic

This paper discusses the background and key findings of a mixed-method research project which was designed within the context of teacher wellbeing to provide an investigation of teachers' experiences of educational change in the social contexts of the two post-Soviet countries – Kazakhstan and Sakha (Yakutia) Republic. Both countries in the study have been characterised by a flood of educational reforms as a consequence of the post-Soviet educational crisis of the 1990s. The research explored the complexities of teacher wellbeing from the perspective of educational change theory. It is worth-noting that there has been little theoretical treatment and empirical research on the ways positive and negative factors of teacher wellbeing have an influence on school performance and policy implementation in the post-Soviet context. Based on the influential work of Cuban (1998) and Fullan (2007) findings of the research suggest that the teacher wellbeing phenomenon bears an important impact on the success of educational policy enactment (Heimans 2012). Portraying teachers as agents of change the paper discusses a complex set of teacher wellbeing factors that influence both intended and unintended consequences of policy implementation. The extent of successful policy enactment can be restricted by the shifting conditions of teacher wellbeing.

Decentralized nursing education to establish a Circumpolar Northern and Indigenous workforce

Skaalvik, Mari Wolff

UiT The Arctic University of Norway Faculty of health Sciences Department of health care sciences Hansine Hansen veg 18 9019 Tromsø Norway

Mari.Skaalvik@uit.no

Bente Norbye, UiT The Arctic University of Norway Faculty of health Sciences Department of health care sciences Hansine Hansen veg 18 9019 Tromsø Norway;
Lorna Butler, University of Saskatchewan College of Nursing 104 Clinic Place Saskatoon SK57N2Z4; Heather Exner-Pirot, University of Saskatchewan College of Nursing 104 Clinic Place Saskatoon SK57N2Z4

Aim and objectives The project is aiming to improve the quality and quantity of northern nursing programs through NNEN to meet the challenge to deliver a stable culturally competent health workforce in northern areas with indigenous populations. The aim is to be achieved through sharing best practices and research. **Background** The accessibility and quality of baccalaureate nursing education in northern regions is important to address. The development of a stable local nursing workforce in the high north promises to improve community health wellness and self – sufficiency. Northern health care in the circumpolar region is typically extensive to deliver. Registered nurse compose the most numerous and widely prevalent category of health professionals across the North. It is widely accepting that education nurses in rural and remote areas will improve recruitment and retention to rural and remote areas. **Design** Through an established network partners from Canada Finland Greenland Iceland Norway and Russia will conduct research assessing pedagogics and didactics most appropriate for northern nursing education adapted to culturally conditions in areas with indigenous populations. **Methods** Within the network best practices will be shared at biannual meetings and a concomitant survey tracking northern nursing northern nursing education programs and an innovative learning institute for Circumpolar health to allow northern nursing students to meet and learn from their counterparts around the Circumpolar North. **Temporary results** The project is in the very start. So far one has found that linking quality of education socio-economic well-being cultural competence and health within a decentralized and distributed nursing program will serve as a long-term and sustainable investment in Circumpolar North.

Sergeev, Sergei

Herzen State Pedagogical University of Russia, St. Petersburg

The problem of lifelong professional education in the technogenic world becomes relevant for many years of effective professional activity of the person in terms of the evolving global man-made environment. One of the main educational problem today become a development of “complex pedagogy of professional education”, which takes to account all the aspects of inter-systemic convolution of human as a biosocial being, which self-organize all levels of his/her existence and create a professional picture of the world, includes the technobiod’s evolution as an experience manifestation. Classical teaching concepts based on common sense is not enough to create effective teaching practices that provide a high degree of interactivity of professional media training with the conscious control over the learning subject. It is crucial to create new approaches to lifelong learning, taking into account the specifics of the interface features of the mechanisms of consciousness in the process of self-learning and professional environments. Analysis of inter-system and intra-relations which arise in the process of generation of subjective reality and the worlds of conscious regulation of activity of the subject included in the artificial environment and the worlds of high connectivity and complexity, shows a constructive and autopoietic nature of all media with which one is dealing. Other environments are not available for human, and its perception are not included in subjective reality and activity. Human behavior in the technogenic world depends on a complex inter-system coordination of conscious and unconscious self-organizing physical and psychological processes. Violation of the synchronization process of subjective and objective reality (between the reality and the person’s worldview), leads to inappropriate human behavior in social and professional activities. We need take into account the reducing properties of conscious regulation of the subject and its dependence on the context and personal professional picture of the world, which due to its conservatism can block the learning processes. The problem of self-construction of the image determines the trajectory of the history of professional self-education in cycles of training and educational communications is currently not solved. We propose a postnonclassical model of professional experience generation. It is based on the evolutionary ideas of coordinates in the process of autopoietic systems joint activities of consciousness, professional communication and educational environment.

The study of the influence of contemporary transformations in the professional development of teachers Yakutia

Solomonova, Galina

‘M.K. Ammosov North-Eastern Federal University’, Institute of Continuing Professional Education

solomonovags@mail.ru

Nowadays it has become one of the most urgent problem of global urbanization - an objective process that affects all peoples nations and cultural types causes profound changes in all the aspects of human life and society as a whole. Among teachers Yakutia conducted an opinion poll. Received the first results of the survey at this time is data processing and preparation of materials for the analytical interpretation. The answers to specific questions show a picture of the general perception of life teachers. It appreciated the quality of life of 10.9% in relation to the assessment of low 7.6% and the degree of satisfaction with its quality varies by 1.1%. As a large proportion evaluation of quality of life as the average: 46.7%. Overall 29.3% are satisfied with life to a great degree - 15.2%. Given that quality of life is inextricably linked to health assessed his condition high 8.7% relative to healthy 19.6% consider themselves. Average health - more than half - 55.4%. In this worldview influence the fullness of his life meaning feeling the majority of respondents respectively average - 49 or 53.3% relatively much - 18 or 19.6% very strong - 10 or 10.9% but the question "To what extent do you feel that your life has meaning?" 35.9% of respondents answered "Average" 1 respondent indicated that his life has no meaning. Value assessment "relatively weak" and "very much" is expressed as 5:13. Sociological research among teachers Saha and representatives of indigenous peoples of the North will allow to study the effect of additional vocational training (in the context of life-long education) teachers on the attitude of Yakutia the Arctic regions to the need for self-development and continuing education; psychological and pedagogical features of training Yakut teachers; features continuous professional education of teachers in the context of the general trends of development of education as well as the formation of professional and ekstrafunksionalnyh (social) competences of teachers.

The experience of the Lomonosov Moscow State University for training specialists for the work on the Arctic shelf

Tokarev, Mikhail

Marine Research Center of Lomonosov Moscow State University 119992 Buildings
77 Leninskie Gory Moscow "MSU Science Park

tokarev@decogeo.com

Alexander B. Tzetlin Sc. D. Director of White Sea Biological Station of LMSU Russia
Grigorii G. Akhmanov Ph. D. Head of the UNESCO Department in Marine Geology
and Geophysics; associate professor of the Faculty of Geology LMSU Russia Dmitry
V. Korost Ph.

The intensification of economic and scientific activity in the Arctic requires the preparation of competent skilled professionals able to effectively carry out its activities take into account the specifics of the Arctic environment and possesses all required competencies for the rational and careful exploitation of resources in the region. Into the MSU successfully established the process of training in the field of marine geophysics geology ecology biology and oceanology. The basis for this are educational and research centers providing young professionals the opportunity of acquiring the necessary skills. White Sea Biological Station of MSU is a year-round research center with specialized small craft and modern equipment for carrying out scientific-research and experimental-methodical works in the field of marine science. The station is located beyond the polar circle. Its laboratory instrumentation and scientific potential allows to carry out comprehensive studies of the marine areas and coastal zones using it as a research center. Another important base for the training of sea experts is an educational and scientific center for marine Geology and Geophysics at the Faculty of Geology of MSU. The center's specialists perform a wide range of scientific research and conduct systematic training of specialists in the field of marine Sciences with the support of UNESCO. The center is the initiator and coordinator of many research projects in close cooperation with foreign universities and large scientific centers. The most important of these programs is the project "Floating University" which is a fundamentally new association of teachers researchers and students that form a single research team. All of this allows for the process of personnel training to attract students postgraduates and young scientists for productive activities to establish a continuous process of learning practicing improving and implementing best practices for work on the Arctic shelf.

Vinokurova, Uliana

Arctic State Institute of Arts and Culture Scientific Research Center of Circumpolar Civilization Doctor of Sociological Sciences

uottaah1707@gmail.com

Recognizing innovations in the educational system as leading resources of state and individuals competitiveness caused the need for global world-system studies covering the whole continents and civilizations. There's a trend of geo-educational research of the world educational systems. The researchers explain the problem of uneven distribution of higher education institutions on the territory of the Russian Federation because of historically uneven distribution of productive forces that doesn't work with modern requirements of accessibility and quality of education. However during development of education programs in Russia there wasn't a sufficient attention to geographic factor.

Flexible systems of engineering staff training in the Arctic

Zabusov, Vladimir

Norilsk State Industrial Institute

nii@norvuz.ru

The amount of information a graduate gets is known to be out of date every 5 years. It is obvious that the linear conception of knowledge transmission in the postindustrial society has gone out of date. The implementation of a new educational paradigm of innovation education based on the graduate skills according to the flexible educational programs is on the agenda.

4.3 Teacher Education in the Arctic, sustainable schools, and relevant learning: Towards Social Justice and Inclusion



This session will explore specific issues related to teacher education and schools in the Arctic. A consistent and qualified teacher workforce integrated into the community is critical to the learning of students, the sustainability of schools, and the vitality of Arctic and indigenous communities. A focus will be on social justice and inclusion, and how these two issues could be promoted by initial teacher education. This session will share experiences, challenges, and solutions for educating the youth of the circumpolar North; discuss possible effective strategies for teacher preparation, ongoing professional development, and retention; as well as examine the complex relationships of education policies, teacher education, social-cultural context of the Arctic, and culturally effective schooling to sustain communities and indigenous cultures.

Conveners:

Ute Kaden, University of Alaska Fairbanks, USA

Tuija Turunen, University of Lapland, Finland

Lessons from the Biomaterials Lab for Teenagers at the Alaska Native Science and Engineering Program

Amstislavski, Philippe

University of Alaska BOB 3211 Providence Drive Anchorage AK 99508 USA

pamstislavski@alaska.edu

Michael Ulroan, Alaska Native Science and Engineering Program (ANSEP) University of Alaska USA; Michael Bourdukofsky, Alaska Native Science and Engineering Program (ANSEP) University of Alaska USA; Maria White, University of Alaska USA

Background: Alaska Native Science and Engineering Program (ANSEP) at the University of Alaska provides a continuous string of educational components beginning with students in sixth grade of school and on through high school into science and engineering college programs and through the graduate school. Biomaterials Lab is a component of the residential summer program that prepares students for college. Biomaterials Lab builds on students' environmental knowledge and on the Native Alaskan Elders' wisdom and experience with natural materials. This heritage becomes a powerful toolbox for bioengineering innovation as teenagers work through the process of solving an open-ended design problem. Biomaterials Lab does so by exposing students to some of the traditional objects produced from sustainable materials and challenging them to create everyday objects of interest to them from them through biotechnology. Each team develops and designs a solution to replace a plastic object with a biodegradable carbon-neutral alternative. "Growing" an object from a biomaterial in the lab as opposed to manufacturing it from a plastic polymer in a factory radically challenges the ways students think about the material design and development cycles. Building on the ongoing research at the University on rapidly-renewable biomaterials from fungi for packaging and insulation the students grow their chosen objects in 3D molds out of the blend of sawdust and fungal mycelium. We use the resulting "Wow factor" pedagogically to inspire and motivate the teenage students at numerous times throughout this learning experience. After the teams select the objects they would like to create from biomaterial they design produce test and present their work. Last summer students designed biodegradable fish cooler boxes medicine boxes insulation board and even boots. We present our approach and discuss its transferability and potential to improve learning outcomes. We focus on lessons learned in developing the Biomaterials curriculum and building on the indigenous knowledge to teach science and biotechnology.

Building Human Capacity Through Indigenous Teacher Education

Anderson, Kirk

Faculty of Education Memorial University of Newfoundland St. John's NL, Canada
A1B 3X8

kirk.anderson@mun.ca

Sylvia Moore, Faculty of Education Labrador Institute Memorial University of
Newfoundland 219 Hamilton River Road P.O. Box 490 Stn. B Happy Valley-Goose Bay
NL A0P 1E0, Canada

As part of its ongoing struggle for self-governance and ultimately control over education the former Labrador Inuit Association now the Nunatsiavut Government settled its land claim with both Canada and the province of Newfoundland and Labrador in 2005. The land claim includes jurisdiction over education in the region. While the Nunatsiavut Government has not taken control of education system yet it has enacted a series of innovative measures to lay the groundwork for a more effective and Inuit centric schools system. The National Strategy on Inuit Education (2011) describes the vision for Inuit education. This includes education that is: founded on Inuit history culture and worldview restores the central role of the Inuit language and is community-based. IBED Faculty work with Inuit Elders community members and educators to determine how the teacher education will exemplify culturally relevant teaching in the areas of teaching resources respecting local knowledge incorporating the land as a source of learning and the celebration of language as an integral part of education. In 2011 the Faculty of Education and Indigenous partners within the province engaged in a series of discussions about related needs and aspirations. As a result in 2013 the Faculty of Education at Memorial University and the Ministry of Education for the Nunatsiavut Government in conjunction with MUN's Labrador Institute developed a partnership to offer the Inuit Bachelor of Education (IBED). The IBED will prepare teachers to carry on the task of educating Inuit youth and to play a key role in Inuit language revitalization. To paraphrase one of Memorial University Vice Presidents he described the IBED after hearing a series of presentations on this and related topics: others are talking about what needs to be done MUN's Faculty of Education and Nunatsiavut Government are doing it!

Flotskaya, Natalia

Northern (Arctic) federal University Northern Dvina Emb. 17 Arkhangelsk 163002

n.flotskaya@narfu.ru

Svetlana Bulanova, Northern (Arctic) Federal University Arkhangelsk Russia

The report will consider implementation of inclusive education at different stages as one of modern educational trends. Inclusive education became a priority of educational policy contributing to sustainable well-being of communities through creation of conditions for high-quality learning process eliminating any discrimination in education and ensuring its availability to all. In the Arkhangelsk region a number of measures were taken to meet the challenges connected with implementation of this idea. The regional legal framework was supplemented with articles defining methods and conditions for realization of citizens' right to education to ensure equal access for all pupils with respect to special educational needs and individual possibilities. An international project "School for All - the development of inclusive education" was implemented within the EU "Kolarctic" Programme. The project is aimed to study the experience of inclusive education in the Barents region to develop a general concept (model) of inclusive education at different stages of learning as well as guidelines for teachers and parents. In the project frames were established support centers on the base of participating educational institutions. On the basis of the Northern (Arctic) Federal University was opened a regional resource center for inclusive education. This innovative multifunctional structure's activities are psycho-pedagogical and methodological support for inclusive education trainings for teachers and research in the field of inclusive education. The report will also present the results of a joint international research conducted by NArFU (Arkhangelsk) and University of Lapland (Rovaniemi) on the challenges occurring in inclusive education.

Monitoring of the effects of education in the Arctic

Holmberg, Liisa

Sámi Education Institute

liisa.holmberg@sogsakk.fi

Arctic is changing rapidly. Arctic indigenous peoples live in between traditions and modern way. The education is playing a key role in the development of the Arctic. Sustainable way of living has been and it is still the base of Arctic indigenous peoples' livelihood. Sustainable way of living has meant adaptation to the hard requirements of the Arctic climate and environment. Sustainable way of living means to respect the nature. I am using Sámi Education Institute as an example of monitoring of Arctic indigenous people's education. The Sámi Education Institute's vision is to be an institution which takes the methods and knowledge from the Sámi tradition and uses them in an innovative way in order to maintain and develop the Sámi languages, Sámi livelihoods and traditions. It is important to take into account the cultural and individual Sámi needs when you are making the first decision of education. The principle of the education program of Sámi Education Institute is that the questions are well known inside the community and the answers should serve the development of the people and the whole community. Sámi Education Institute as an Indigenous organization has had a great position to implement the sustainable way of traditional livelihood for example in Sámi reindeer herders' education. SEY has adapted some of the Sámi traditional ways of land use and herding methods to the reindeer herder's curricula. The Institute is providing the education according to Sámi own cultural methods of teaching and learning. By using the cultural sensitive measurements for auditing our students this gives a better view of the effect of the education. The indicators are for example how well they recognize their own reindeer, how well they recognize different types of reindeer in order to make the success and how well they know about their own grazing areas.

Teaching in Rural Alaska- Teacher Training and Retention

Kaden, Ute

University of Alaska Fairbanks, P.O. Box 756480, Fairbanks, AK 99775

uKaden@alaska.edu

Healey, Joanne, University of Alaska Fairbanks; Patterson Philip P., University of Alaska Fairbanks

Preparing and retaining teachers for teaching in rural-indigenous communities throughout Alaska is a complex and challenging task. Presenters will share and discuss preliminary research results from a NSF funded study (Arctic Social Sciences) on teacher retention with the objective to inform participants about challenges in teacher preparation and retention in rural Alaska, discuss possible effective strategies for teacher preparation, induction, and retention, discuss the complex relationship of policy requirements, teacher accreditation demands, and rural, cultural effective teacher characteristics. A significant factor for healthy, resilient Arctic communities can be schools and teachers. A consistent and qualified teacher workforce integrated into the community is critical to the learning of students, the stability of schools, and the vitality of Arctic and indigenous communities. A persistent problem in Arctic Alaska is high teacher turnover. Approximately 60% of Alaska's teachers leave the Arctic region after less than two years, informally citing a list of reasons, many of which are tied to school and community relations. Such high teacher turnover impacts student achievement, contributes to a school climate of instability, and redirects funds for recruitment that might better be spent towards student learning. To provide equity and access to quality education, Arctic Alaska needs a consistent and culturally responsive teacher work force that is integrated into the community life. Factors that influence retention and community integration of teachers in rural Arctic Alaska schools will be discussed. The research approach utilizes a mixed method research design combining scientific activities with the expertise and traditional knowledge of the indigenous people of the Arctic. The study triangulates findings by looking at multiple qualitative and quantitative indicators related to teacher retention, comparing them and using qualitative evidence to shed light on the quantitative patterns. It also gathers and disseminates scientifically and culturally sensitive anecdotal evidence from dual perspectives: those of teachers in the field and those from community members. As a result of recent and drastic environmental changes in Arctic Alaska, this study has the potential for identifying economic, societal, and education variables as yet unexpected and unstudied. All of this data is gathered and interpreted by a diverse and highly qualified team that includes Native researchers and scholars who have explicit knowledge of Alaska Native cultures and communities.

Training teachers in the Arctic region

Kuzmicheva, Tatiana

Murmansk Arctic State University Kapitan Egorov Str. 15 Murmansk 183 720 Russia

ipmcenter@mspu.edu.ru

Vocational education can not be developed separately from the processes that take place in the socio-cultural sphere and actively influence it. One of the major challenges facing vocational education is to develop a modern vocational education strategy adequate to time social and cultural needs of the individual and society and its corresponding tactics in the context of social justice. Social justice is understood as equal opportunities for all in access to education work culture implementation of educational needs and abilities. Today the Arctic region of the Russian Federation has a multicultural social environment. Simultaneously with the development of strategically important modern industries the transformation of socio-cultural sphere takes place by sharing knowledge and experience between the Arctic region and foreign countries as well as under the influence of migration processes. These realities put forward new requirements for the preparation of professionals in the humanitarian sphere science and the field of production. Since 2015 the mission of Murmansk Arctic State University (MASU) in training teachers is determined by the context of the emergence of a new type of a northerner personality which is characterized by high professional competence professional mobility the ability to quickly process information reflect on it and produce creative ways to solve professional problems as well as susceptibility to the new realities of modernity social order and ability to generate it ability to quickly adapt to different social and cultural conditions enter socio-cultural and industrial relations. The developing theory and practice of higher education for teachers at MASU are based on integrating the concept of social justice into all types of activities of the student and teacher community which will allow to solve the following tasks: - to ensure the acquisition of a specific profession using a variety of socio-economic informational educational socio-cultural opportunities and the social and productive ways of their implementation taking into account the specifics of the Arctic region; - to create conditions for the individual's realization of social and professional functions in the Arctic; - to establish relationship of professional and personal development to the solution of the state's priority tasks of the Arctic region development. The tool to address these problems in training teachers at MASU is the model of creating an inclusive university environment involving the formation of professional competence in all kinds of educational activities to be implemented in the process of higher education: academic social educational scientific research when professional competence acts as product of integrating personal needs of students and professional spheres of their realization meaningful for the Arctic areas.

Lakkala, Suvi

University of Lapland Faculty of Education PO Box 122 96101 Rovaniemi Finland

suvi.lakkala@ulapland.fi

Outi Kyrö-Ämmälä, University of Lapland Rovaniemi Finland; Tuija Turunen,
University of Lapland Rovaniemi Finland

This paper reports some preliminary research findings from the Finnish arm of an Erasmus+ project that aims to promote equality among students with diverse socio-psychological cognitive or social needs. The SPESA project (Inclusive Education: Socio-psychologic Educational and Social Aspects) runs between 2014 and 2017 and includes four European countries: Finland Lithuania Austria and Poland. The theoretical framework is based on changes in the inclusive paradigm from segregation to integration and inclusion. In Finland the research focuses on inclusive practices in everyday school life. The study employed an ethnographic approach: the researchers visited two primary school classrooms in which they observed lessons and interviewed students parents and teachers. The classroom teachers kept pedagogical journals to record their reflections on the main elements of inclusive practices in classroom. The research question was: What are the main elements of inclusive practices in classroom? The findings indicate that the relationship between teachers and students is the cornerstone of inclusive education. The teachers displayed aspects of respect for individuality through encouragement social engagement sensitivity and approachability. They also emphasised the sense of community by organising social activities enhancing social skills promoting dialogue on ethical matters in their classrooms appreciating diversity and empowering their students. These findings exemplify that to be successful inclusive pedagogy does not necessarily require large investments in the student/teacher ratio study materials equipment etc. Rather the key factor is that teachers are willing to support their students based on individual needs and promote a sense of belonging to the school community.

Mandryka, Olga

Russian State Hydrometeorological University (RSHU) 98 Malookhtinsky prospect
195196 Saint-Petersburg Russia

omandryka@yandex.ru

Long-term experience of teaching polar-related sciences in Masters' Programmes for both "classical" and "social" ecologists at RSHU has been submitted. While the courses on Marine Polar Ecosystems along with Ecological Problems of the Arctic are forming the curriculum of Ecological Department some basic fundamentals inside them seem to be important to promote the Concept of Sustainable Development. Firstly marine nature resources are estimated not only in terms of biodiversity but also as Natural Capital which possesses its monetary value. Broad international experience especially Norwegian shows in practice the methods of ecosystem services valuation. It makes students come to deliberate decision in any given situation for instance whether or not humanity benefits from oil drilling today or from nature conservation in the future. The examples are vast enough like ecosystem-based management in the Barents Sea or planning a Weddell Sea Protected Area at the expense of fishery. Secondly talking about ecological problems of the Russian Arctic two trends regarding indigenous peoples are under consideration. It is a great conflict between traditional human communities having lived environmentally-friendly for ages without any private property in land and market economy which gathers pace nowadays. The strategy of quick industrial development in the Arctic is incompatible with adaptive potential of indigenous communities and their natural environment. To be at the cutting edge international involvement is highly important for the students. Our educational programmes are constantly applying to relevant groups in the Facebook such as: Polar Educators International Arctic Frontiers EU-PolarNet. The students not only have home tasks based on the site but also participate in polar forums and discussions.

4.4 Circumpolar Health and Well-Being



This session is organised by the UArctic Thematic Network on Health and Well-being in the Arctic. The mission of the network is to improve the sustainable development of health and well-being in circumpolar regions by promoting research projects on the health of people, and by organizing research training and by distributing scientific information. In this session various themes related to health and well-being in the Arctic will be discussed.

Convener: Rhonda Johnson, University of Alaska Anchorage, USA

We have come to live here

Aksyanova, Galina

Institute of Ethnology and Anthropology Russian Academy of Sciences Leninsky Pr.
32a Moscow 119991 Russia

gaksyanova@gmail.com

The author represents field materials of 2013-2014 on physical anthropology of two groups of the Russian Old Settlers in Siberian Arctic: indigirshchiky or "russkoustyintsy" and the kolymchane or "pokhodchane" – the Republic of Sakha (Yakutia). The resident European population is beginning to form since the end of the 17th century here and now has presented by several hundred their descendants in each area. The different family structure of two territorial samples says that now it is different populations of historically related population. The vast majority of the examined persons have the Russian ethnic identity. All population knows Russian freely. Metisation level in both groups rather high but the European gene pool Old Settlers' including nevertheless prevails. Kolymchane have higher extent of mixture with all local Asian people Mongoloid on racial type – Yakuts Chukchi Yukaghirs and Evens. Inclusion in Old Settlers group of a substratum component has canalized on ancestors of a female (mother the grandmother the great-grandmother from any parental line). Physical appearance and tooth morphology are well coordinated with historical and genealogical data on formation of special groups of ethnic Russians. The inflow of the European population which was not stopping within centuries maintained a phenotypic variety of marriage partners in Asian polar region. Mongoloid component more pronounced in the Kolyma group however two modern populations represent the general anthropological complex endemic owing to Caucasian and Mongoloid mixture. We find its analogs in the basin of Pechora in groups of the Komi – the Nenets border zone in the extreme northeast of Europe. Material illustrates the high level of biological and social adaptation of human populations to conditions of the Arctic. In addition see: Aksyanova G.A. Russkoye Ustye: anthropological study // Archaeology Ethnology & Anthropology of Eurasia 2015. 43. No 3. P. 142–155.

The landscape epidemiology of seasonal clustering of highly pathogenic avian influenza (H5N1)

Amstislavski, Philippe

Department of Health Sciences University of Alaska - Anchorage 3211 Providence Drive Anchorage AK 99508

pamstislavski@alaska.edu

Michael G. Walsh, Department of Epidemiology and Biostatistics School of Public Health State University of New York USA; Andrea Greene, Department of Epidemiology and Biostatistics School of Public Health State University of New York USA

Background: A total of 694 human infections with Highly pathogenic avian influenza subtype H5N1 (death rate 58%) were recorded during 2003–2014. H5N1 has also contributed to substantial economic loss each year since 1997. While the distribution of domestic bird H5N1 outbreaks across Europe North America Africa and Asia is extensive those features of the landscape conferring greatest risk remain uncertain. Furthermore the extent to which influential landscape features may vary by season has been inadequately described. Relationship of the proximity of domestic birds to wild birds\ flyways and to surface water which would be expected to facilitate viral transmission between domestic and wild birds is also poorly understood. Methods: The current investigation used World Organization for Animal Health surveillance data to 1) delineate areas at greatest risk for H5N1 epizootics among domestic poultry 2) identify those abiotic and biotic features of the landscape associated with outbreak risk and 3) examine patterns of epizootic clustering by season. Inhomogeneous point process models were used to predict the intensity of H5N1 outbreaks and describe the dependencies between them. Results: During October through March decreasing precipitation increasing isothermality and the presence of H5N1 in wild birds were significantly associated with increased risk of domestic H5N1 epizootics. Conversely increasing precipitation and decreasing isothermality were associated with increased risk during April through September. Increasing temperature during the coldest quarter domestic poultry density and proximity to surface water were associated with increased risk of domestic outbreaks throughout the year. Dependencies between outbreaks appeared to vary by season with substantial clustering at small and large scale identified during October through March even after accounting for inhomogeneity due to landscape factors. In contrast during April to September H5N1 outbreaks exhibited no clustering at small scale once accounting for landscape factors. Conclusions: This investigation has identified seasonal differences in risk and clustering patterns of H5N1 outbreaks in domestic poultry and may suggest strategies in high risk areas with features amenable to intervention such as controlling domestic bird movement in areas of high poultry density or preventing contact between poultry and wild birds and/or surface water features.'

Burtseva, Tatiana

Federal State Budgetary Institution «Yakut science centre of complex medical problems» Federal Agency of Scientific Organizations 677000 Russia Yakutsk
Sergelaxskoe shosse 4

bourtsevat@yandex.ru

Galina G. Dranaeva, Yakut science centre of complex medical problems; Vasily I. Orel, Saint-Petersburg state pediatric medical university; Vyacheslav G. Chasnyk, Saint-Petersburg state pediatric medical university

The main reasons for the lack of effectiveness of the health system in the Russian regions of the Far North are in particular climatic conditions transport infrastructure low population density and the associated low levels of security medical personnel. The existing legal regulation providing resources for health of the population does not consider the population density of the RF subjects and leads to a decrease in the availability of specialized and high-tech health care for the population of these regions. Due to climatic and geographical factors historically established way of life in the regions of the Far North requires a large number of sparsely populated villages located at a considerable distance from both the administrative and from medical centers. Currently the transport infrastructure is poorly developed and the trends of its improvement in our country do not give reason to expect a significant improvement in transport provision in the coming decades. This contributes to a very specific system of livelihood. As part of the organization of medical services it is - the presence of small-size medical institutions to provide access to health care the high demand of the population in emergency care including specialized and sanitary-aviation aid in the organization of on-site form of providing both primary and specialized medical care high hospitalization rate of the population. Analysis of resource and staffing of pediatric service of the Republic of Sakha (Yakutia) has identified a nationwide trend: reducing the number of beds satisfactory material and technical base a low level of improvement of health facilities lack of qualified personnel especially in the regions of the republic. One of the real approaches to solving the problem of us sees the revision of the concept of medical care in the areas of the Arctic zone aimed at improving accessibility appropriateness and effectiveness of medical services. The basic principles of our proposed model of the Arctic include the introduction of automated systems of preventive examinations and the use of mobile medical units for routine inspections of the child population. At the heart of the Arctic models pediatric services following points should be based on: 1. The widespread adoption of mobile medical units of work 2. The widespread adoption of networked information support (creation of resuscitative and counseling centers tele-consultation medical reports) 3. The training of health workers to work in areas with low population density 4. The introduction of automated systems of preventive examinations of children and adolescents. To address the issues of increasing access to health care to the population of the republic is necessary to introduce the concept of the Arctic health care model providing differentiation in terms of regulations and financing taking into account regional peculiarities. Require the development of federal regulations governing the concept of small-size health care institutions to the Far North and the Arctic regions with the establishment of regular number of standards institutions and financial capacities the establishment of mobile medical units improved on-site medical care.

Emelyanova, Anastasia

International Institute for Applied Systems Analysis World Population Program
Schlossplatz 1 A-2361 Laxenburg Austria

emelyan@iiasa.ac.at

The group of researchers under the leadership of Prof. Wolfgang Lutz (IIASA Austria) has recently made a pronounced contribution to demographic methodology creating the theoretical methodological and empirical basis for adding educational attainment to age and sex as an additional equally important dimension in analysis of population dynamics. This pioneering work on human capital resulted in the book “World Population and Human Capital in the 21st Century” (2014). Similarly wellbeing of Arctic populations and multiply aspects of regional sustainability directly depend on human capital and population achievements in education that is advocated in the new Arctic Human Development Report (2014). It states that education tremendously drives all demographic processes e.g. preferences of educated males to return to their communities while highly educated females move permanently away to cities and from Arctic regions (largely from the Danish North) migration of youth to pursue education in large urban centers healthier behaviors drop of fertility with regard to education that all reshape the capacities to respond to various regional challenges. Meanwhile planning for many public policy sectors cannot take advantage of meaningful projections of population change at the level of Arctic sub-regions. Population projections at this territorial level are often not available in a long time series vary widely between existing attempts and rarely explain the socioeconomic reasons behind demographic changes. In this study population dynamics will be projected for more than 25 Arctic sub-regions in comparison to all-nation changes of 8 Arctic countries. We will frame scenarios of population change among northern residents with the levels of their future education throughout levels of schooling to the tertiary degree completion.

Nursing education in the Sámi region enables cultural themes as a part of professional academic studies

Ervelius, Tiina

Diaconia University of Applied Sciences, Huvilakatu 31 B-rakennus 76130,
Pieksämäki

tiina.ervelius@diak.fi

Professionals of nursing and deaconesses with skills of the Sámi language and knowledge of the Sámi culture are needed in the Sámi region in Northern Finland. Diaconia University of Applied Sciences (= Diak) has taken the educational challenge by combining education to include both the nursing and deaconess professions. Sámi Homeland in Ivalo has currently a group of nursing students who began their studies in September 2015 and who will graduate in May 2019. After graduation the nurses will be qualified to work as Registered Nurses and in addition the nurses will also become deaconesses of the Evangelical Lutheran Church. Besides this the nurses are also studying the Sámi culture and are taking Sámi language courses. The nearest Diak campus is situated 500 km from Ivalo so the teaching is realized through blended learning. It means a combination of contact and distance learning in order to minimize the travelling of students and teachers. The main aim of this project is to increase the amount of professionals with a good command of Sámi culture and culturally sensitive working methods. To reach this goal the method in this project is to develop the curriculum to include studies in the Sámi culture and in Sámi language. Besides this the curriculum is developed to consider the practice in facing the Sámi people in a culturally sensitive way in different health care situations. Evaluation is made by analyzing the curriculum and interviewing nursing students Sámi people and local workers. The main results will deal with working methods in the context of the Sámi culture and also Sámi language speaking skills.

Healthy and Active Aging Policy in circumpolar territories: new course for Master's level programme

Golubeva, Elena

Northern Arctic Federal University 17 Northern Dvina Emb. Arkhangelsk 163002
Russia

e.golubeva@narfu.ru

Active and healthy longevity in arctic conditions is a rare phenomenon. Strategy of active and healthy aging implementation is complicated by the well-being level of the population in the Arctic regions which are sparsely populated suffer from constant outflow of young people to the central regions of the countries. The course for Master's program is aimed at understanding patterns and trends of aging in the Arctic territories and the development of the policy of active and healthy longevity of the population through the development of social innovations (models and services) in the system of social and medical services to improve the life quality of the elderly. The construction of course is complex and interdisciplinary based on the WHO guiding principles to promote of active and healthy ageing policy in the framework of WHO concept "Active Aging- A Policy Framework" (2002). Current technologies supporting vulnerable groups in the social and medical fields of the Arctic areas should be based on the resources of the local population that can provide employment social support and solidarity. Preliminary course structure: 1. An elderly person in the system of scientific knowledge: interdisciplinary approach. 2. The main international legal instruments forming socio-gerontological policy. 3. The concept of active aging policies (WHO) its strategy for the preservation and development of the potential longevity. The conditions and opportunities for the implementation of active and healthy longevity policy in the circumpolar regions of different countries.

The role of connection to natural environment in human well-being

Jämsä, Johanna

No current affiliations. Simpsintie 7 a 10, 90560 Oulu

jamsa.marjajohanna@gmail.com

The role of nature in human well-being is being studied in various disciplines and it is gaining more attention partly because of the rapid changing in our environment. Besides concrete material gains there are also less tangible mental health benefits that rise from connecting with nature. At the small arctic village Suvanto in Finnish Lapland people live in close connection with their surroundings. My objective was to map the integrated ways in which people gain health benefits from nature. Eight villagers were interviewed. Special attention is paid to the tacit nature of the mental aspect of human-nature -practices. Millennium Ecosystem Assessments aspects of well-being form the framework for the interviews. These aspects are material and social well-being safety health and freedom of choice. In the small arctic community nature serves as employer as well as place for hobbies. This makes the lived world flexible. Villagers know their surroundings and know how to co-operate with it in creative ways. For example due to the midnight sun one can do the timber early in the morning when it's not too hot. The material well-being gained from forestry is important. However many experience sadness due to the regulated cuttings. That affects also negatively to the feelings of safety as one's property is controlled by outside forces. Stability of environment is important for experiencing its relaxing effect. Nature is perceived as a safe place: storms cold and wild animals are seen as natural and manageable but the threats rise from global issues. Connecting with the local natural environment rises a extended sense of place and worry about the global environment. Well-being aspects are closely intertwined to each other. The possibility to express these diverse aspects is important for well-being. Greater appreciation of mental aspects would make them less tacit knowledge.

Icons of prosperity in modern life of the Nenets people

Khariuchi, Galina

Center for the study of Arctic Yamal-Nenets Autonomous Region. 629008 Salekhard
Respubliki 73 k.609

haryuchi-yamal@yandex.ru

Economic situation and economic activity of Nenets were always connected with their traditional activities – reindeer herding fishing and hunting. Reindeer herding the main sector of economy served as a foundation of peoples' well-being. To own many reindeer means to have a high social status. Pursuing to grow a livestock at the beginning of XXI century is vital need as well-being and prosperity of a reindeerherder family depend on such factors as environment predators epizootic. Today as a result of industrial development leading to the shortage of pastures it becomes problematic to have a large herd. Still to this day the most important question for aboriginal people survival remains their primordial land for their prosperous living and how structured their economic system should be. The well-being of aboriginal people leading nomadic way of life and living in villages and settlements depends on their health and their lifestyle. Quality of their life depends on their cultural level and their living standards. Using of industrial tooling significantly simplifies traditional economic activity. Growth of salary has become one of the factors for the improvement of material situation of nomadic population. Though slowly but the traditional system of values of the tundra Nenets is changing. Religion is of great importance for an emotional and mental wellbeing. Nowadays Nenets mostly keep their traditional beliefs a few have converted into baptism. Ecology and ethnic factors influence aboriginal peoples' health their social and psychological being as also environment. Therefore the most important goal is preserving of natural environment and their traditional way of life based on new technologies reduction of the pollution of their environment.

Canadian First Nations, Metis and Inuit Youth Conceptions of Health and Health Issues

Lines, L.

University of Alberta, Canada

cjardine@ualberta.ca

C.G. Jardine, S.M. Driedger, K. McTavish and C.M. Furgal

Conceptions of health are known to be complex and to vary across cultures and locations. Although Indigenous understandings of health are generally understood to holistically encompass emotional, spiritual, physical, and mental dimensions, specific notions of health and being healthy vary across Indigenous identities and geographies. In addition, there are frequently generational differences in the conception of health and relevant health issues. Indigenous youth often find themselves at the interface of traditional and more 'western' ideas of health because of their increased exposure to non-Indigenous understandings through the Internet and social media. As an initial step in an overall program of research designed to investigate the value of First Nations, Inuit and Metis youth-led risk communication messages for promoting community health and well-being, an overall assessment of youth views on health, health issues and interest in health research and messaging was conducted. This was done at organized gatherings in 2015/16: 1) Qanaq Inuit Youth Leadership Summit (~50 youth); 2) Manitoba Metis Youth Gathering (~50 youth); and 3) Dene Youth Leadership On-the-Land Workshop (~20 youth). Youth were engaged through three mechanisms: 1) a short survey on health issues and interest in health research; 2) a longer survey on personal health concerns and issues, health issues for community youth, and health information seeking and use; and 3) breakout focus groups of 8-10 youth to further discuss health issues and youth involvement in research and health messaging. Preliminary results of the information collected will be presented, and differences and similarities between the three groups of youth will be highlighted. The results of these assessments provide a sound basis for designing programs for youth participation in health messaging, and increase our overall understanding of Indigenous concepts of health and wellbeing.

Medevac operations in Russian SAR region

Logunov, Konstantin

St. Petersburg University Clinic 154 Fontanka embankment, St. Petersburg Russia
Medicon LLC 34 18/16 Zaytsev str. ST. Petersburg Russia

logounov@telemed-russia.com

To appreciate main reasons for urgent medical evacuation from ship to shore hospital and to reveal MEDEVAC common causes we reviewed SAR operations coordinated through Russian RCC (RSCs) in 5 years (2009-2013) and analyzed all cases of medical evacuation. Total 205 MEDEVAC operations took place 146 MEDEVACS happened for the reasons of acute illness 37 for traumas 3 for poisonings. Even with pre-screening of seafarers and the potential dangers of life at sea the majority of cases requiring medical evacuation from ship to shore hospital are not related to trauma.

Community-Based HIV Prevention in Northern Canada for Young Indigenous Women using the FOXY Intervention

Lys, Candice

FOXY (Fostering Open eXpression among Youth) 240 Borden Drive Yellowknife NT
X1A 3R4

candice.lys@gmail.com

Background: The sexual health of Northwest Territories (NWT) youth is a serious public health concern; thus a social arts-based intervention that uses body mapping and drama techniques named FOXY (Fostering Open eXpression among Youth) was developed for young women in the Northwest Territories (NWT) Canada. **Methods:** This doctoral research uses a community-based participatory research approach developmental evaluation methodology and the grounded theory method to develop a theory of how FOXY influences sexual behavior expectations among young women in the NWT considering determinants that contextualize sexual health outcomes. The first aim of this study explores the intrapersonal and interpersonal contexts that influence the efficacy expectations and outcome expectations of female youth in the NWT. The second aim determines if and how FOXY influences individual efficacy expectations regarding sexual behaviors among these youth. The third aim determines if and how FOXY influences individual outcome expectations regarding sexual behaviors among this population. **Results:** In Phase I pilot testing occurred with 6 female youth to improve design of the semistructured interview guide. Phase II entailed semi-structured interviews with 41 female youth aged 13-18 years selected via purposive sampling. Data collection occurred until saturation of new themes was reached at 6 study locations. A multi-stage thematic analysis using memoing and coding using the grounded theory method is ongoing. **Conclusions:** Frontline workers and community-based researchers can use the results to inform intervention programs among other Indigenous populations in rural and remote areas.

Access to health screening services among women with disabilities living in the Circumpolar North: Stories from women in Alaska

Miller, Virginia

University of Alaska Anchorage Department of Health Sciences 3211 Providence Drive Anchorage AK 99508 USA

jenny.miller@uaa.alaska.edu

Karen Ward, University of Alaska Anchorage USA

Background and significance: Health disparities in cancer morbidity and mortality have been identified as important public health problems. Lower rates of cancer screening and early detection are among factors contributing to more advanced disease at diagnosis and higher cancer death rates among the underserved. Access to primary care and health screening services may be very limited across the life course for women with disabilities especially low-income women. Cancer screening services including pelvic examinations clinical breast exams and mammograms may be particularly difficult to obtain. CDC data highlight that compared with people without disabilities women with disabilities are more likely to not have recommended screenings. Women with disabilities may encounter economic environmental attitudinal and informational barriers to receiving health services. Even among women with health insurance many may still face significant barriers to breast and cervical cancer screening such as limited health literacy less self-efficacy or self-confidence in obtaining screening lack of provider recommendation inconvenient times to access services and language barriers. **Goal/Methods:** In Alaska the influence of climate geography and limited public transportation may intensify problems with access to breast and cervical cancer screening creating enormous personal family and societal costs. Using a community-based participatory approach our mixed methods study interviewed low-income women with disabilities living in Southcentral Alaska (N=40) to learn about access to and participation in breast and cervical cancer screening. The goal was to broaden the understanding of barriers to cancer screening services in order to tailor interventions to improve access. The semi-structured interviews consisted of an investigator- initiated survey instrument and a standardized quality of life tool. **Results/Recommendations:** The narratives and recommendations from study participants to increase participation in screening based on their personal healthcare experiences will be presented in the context of health screening services and utilization in other regions of the Circumpolar North.

Scientific guiding in development of sustainable human potential in the oil and gas arctic region

Novoselov, Oleg

Tyumen State Oil and Gas University 38 Volodarskogo str. Tyumen 625000 Russia

eustyugova@tsogu.ru

Anatoly Silin, Tyumen State Oil and Gas University Tyumen Russia

The forthcoming large-scale development of oil and gas resources of the Yamal Peninsula the shelf of the North Sea other territories of the Yamalo-Nenets Autonomous Area establishing of large gas-processing infrastructure facilities and communication lines need a search of efficient paths of social and economic development of the present underpopulated territories of little use according to biomedical parameters for habitual residence of the endemic population. The conceptual approaches methods and results of the researches conducted by scientists of Tyumen State Oil and Gas University directed on search and rationale of innovative technologies of increase of human potential and stability of social and economic development of the circumpolar oil and gas region are presented in the report. The problems significant for inhabitants of the Arctic region revealed by means of sociological tools become a subject of researches and inventions of the scientists representing natural and engineering sciences. So the problem of iodine deficiency having serious impact on health of the regional population became a subject of comprehensive sociological study. Thus scientists of Tyumen State Oil and Gas University developed and approved technology of industrial manufacturing of iodine from reservoir waters of regional oil and gas fields. The diverse problems connected with already realized and still the forthcoming development of the Arctic region need a system assessment identification of all interrelations and alternative solutions. The obvious problems of life quality of different social groups of northerners preservations of fragile biogeocenoses of the North the conditions of traditional activity of native ethnoses and health of the arrived here for a permanent residence or a shift job people and others can be presented as a result of decomposition in the form of the certain amount of problems allowing to conduct effectively interdisciplinary researches of its elements.

Rautio, Arja

Faculty of Medicine Arctic Health & Thule Institute University of Oulu PO Box 7300
FI-90014 University of Oulu, Finland

arja.rautio@oulu.fi

The incidence of many diseases has increased in the Arctic and it has been assumed that pollutants may have a contributing effect especially in the heavily exposed populations. Investigations on the precise impact of environmental pollutants on human health are difficult to study because there are many factors which affect simultaneously and varying degrees. These include genetic background age sex diseases exposure history and environment. Environmental factors include mixtures of contaminants and other chemical compounds to which individuals are commonly exposed. Knowledge about the effects of mixtures is mainly missing and difficult to study at population level. During the last twenty years the Arctic Monitoring and Assessment Programme (AMAP) has followed the levels of persistent organic pollutants (POPs) and toxic metals in human populations especially pregnant women and also in environment. Exposure during the fetal period is in special attention in the epidemiological and mechanistic (in vitro) studies because fetal stage is the most vulnerable during human life. During the last decade there have been several research projects under the framework of the EU which have focused on potential toxicity at low exposure levels of environmental contaminants to child development (like ENRICO OBELIX CLEAR INUENDO ArcRisk PHIME) and in many of these projects also the Arctic population studies have been included. One goal of these research programs has been to collect all the existing evidence about the associations between environmental contaminants and measured health outcomes. The evaluation of potential health risks and their magnitude is needed.

Soloviev, Andrey

Northern State Medical UNiversity 51 Troitsky Ave. Arkhangelsk 163000 Russia

ASoloviev1@yandex.ru

Edgar Mordovsky, Northern State Medical University Arkhangelsk Russia; Anatoly Sannikov, Northern State Medical University Arkhangelsk Russia

Alcohol abuse is one of the leading risk factors for global population health. However to date there is no single approach to the identification of the structure of the total damage of alcohol abuse (DAA). WHO defines the harm associated alcohol-related harm as: - health consequences for those consuming alcohol - socio-economic consequences for those consuming alcohol - consequences for third parties - consequences for society as a whole. However this approach mainly focuses on the medical and demographic "harm associated with alcohol" and does not take into account the degree of statistical reliability. We propose an innovative algorithm for estimating DAA taking into account the provisions of modern epidemiology. DAA can be defined as the reduction of the potential population health social and economic well-being associated with this risk factor. In the structure of SUSA at the population level we selected health demographic social and economic components. Medical component is defined as a reduction of the potential population health; Demographic component - as a reduction of the potential population health associated with mortality from alcohol-attributable conditions; Social component - how the decline in the quality of life of the individual and social well-being of the entire population; Economic component – the sum of cash expenditures of households private and public firms and the state. For objective qualitative and quantitative assessment of DAA you must divide all components of the loss into two components – direct and indirect losses. Quantitative assessment of each component should be performed using the developed indicators taking into account cultural peculiarities and traditions of alcohol consumption.

Temp, Anna G. M.

The University of Edinburgh Office G14/15 Psychology Department 7 George Square
EH8 9JZ & ul. Księcia Janusza 64 01-452 Warszawa Polska

atemp@ed.ac.uk

Dr Billy Lee, University of Edinburgh Scotland; Dr Thomas H. Bak, University of
Edinburgh Scotland

With of up to six months of complete darkness it is unsurprising that cognition is affected in those who spend a year in the polar region: sustained attention reasoning skills processing speed and memory have all been shown to change. So far most of this research has been conducted in Antarctica. The Arctic poses additional stressors such as polar bears which make it dangerous to leave the station alone; and lacks research in this domain. The Polish Polar Station (PPS) Hornsund Svalbard experiences polar night from October to February and its crew is isolated during this time; making it an ideal Arctic analogue for Antarctic cognitive research. Results may be generalised to other non-native winterers in any Arctic nation and inform crew selection for any isolated and confined environment. The present study runs from summer 2015 to summer 2016. Ten crew members of PPS are participating. Testing points were/are July and September 2015 January April and June 2016. Tests selected include the Sustained Attention to Response Task (SART) Raven's Standard Progressive Matrices (SPM) Test of Everyday Attention (TEA) and Figure Learning & Memory Test (FLMT). Cognitive changes related to mental health not season. For each point in POMS confusion in July the accuracy in the January TEA increased by 1.24% ($R^2=0.57$ $F(1, 9)=10.79$ $p<.05$). Lower confusion predicted lower accuracy. For each point in September depression winter reaction time (WRT) sped up by 6.24ms ($R^2=0.59$ $F(1, 9)=11.7$ $p<.01$). July hostility decreased WRT by 11.89ms per point ($R^2=0.6$ $F(1, 9)=11.81$ $p<.01$) while September hostility sped it up by 9.9ms ($R^2=0.75$ $F(1, 9)=24.28$ $p<.01$). The more hostile and depressed the participants were the faster were their WRT. Depression confusion and cognition did not change seasonally but hostility did; suggesting that seasons had little direct effect on mental health and cognition. Mental health may influence cognition more strongly.

Emotional Experiences of Extreme Environments: A Case Study of Relieving Winter-Over Syndrome through Emotional Freedom Techniques (EFT)

Temp, Anna G. M.

The University of Edinburgh Psychology Department Office G14/15 7 George Square
Edinburgh EH8 9LD & The Institute of Geophysics Polish Academy of Sciences
Warsaw Poland

atemp@ed.ac.uk

Dr Billy Lee, University of Edinburgh Scotland; Dr Thomas Bak, University of
Edinburgh Scotland

Emotional Freedom Techniques (EFT) involves applying acupressure to specific meridian points relieving unpleasant thoughts or feelings. Empirical evidence shows these techniques can alleviate depression and neurochemically they can lower levels of the stress hormone cortisol. They are also relatively easy to learn self-administer and cost-effective making them an potentially suitable coping strategy with polar night. The present study form spart of a wider study to assess the mental health of stass on the 38th expedition to the Polish Polar Station Hornsund Svalbard (PPS). The measuring points were/are July and September 2015 January April and June 2016. Questionnaires and interviews were employed to assess any changes. One wintering team member reported extreme distress during their January interview. With the isolation of polar night they had become increasingly sensitive and anxious about their romantic relationship as well as about losing a family member and subsequently struggled to eat. They also described their stay as a ,waste of life' because they could spend their time better elsewhere. Initially the participant experienced in considerable emotional pain so aborting the mission to return home seemed the only option. However the isolation of the station meant that the earliest opportunity to leave would be in March. Additionally the team leader was concerned about the participant's professional future if they aborted the mission. EFT was employed with the support of the first author to alleviate rumination and anxiety and improve their experience at the PPS. After one week of supportedly exploring EFT the participant had re-gained 1.5kg begun to feel more safe in their relationship and had begun to shift their attention away from the family member's potential death.

Exploring the Explorers: Mood and Mental Health at the Polish Polar Station Hornsund What can they tell us about the effects of polar night?

Temp, Anna G. M.

University of Edinburgh Old College South Bridge Edinburgh EH8 9YL Scotland &
Institute of Geophysics ul. Pasteura 7 02-093 Warszawa

atemp@ed.ac.uk

Dr Thomas Bak, University of Edinburgh Scotland; Dr Billy Lee University of
Edinburgh Scotland

With Antarctica's harsh conditions of up to six months of complete darkness and blizzards it is unsurprising that human well-being should be affected when wintering there. Most studies have concluded that mental health and mood decline over winter. Baseline levels are reached upon return home. However these observations have not yet been repeated for Arctic wintering teams at scientific stations. The Arctic's great predators such as the polar bear pose very different threats to isolated and confined communities such as the Polish Polar Station (PPS) Hornsund Svalbard. PPS experiences polar night from late October to mid-February and its winter team is isolated from the rest of the island for much of that time. This makes the PPS an ideal Arctic analogue to the Antarctic research stations at which psychological research has been conducted. Results may be generalised to other non-native non-indigenous winterers in any Arctic nation and can inform the selection of winter crews. The present study is on-going at the time of abstract submission. Ten out of 11 winter crew members of PPS are participating three are female. The Profile of Mood States Brief Version (POMS) and Symptom Checklist 90 Revised (SCL-90-R) have been administered at PPS in July 2015/September 2015 and January 2016. They will be administered again in April and June 2016 to complete the assessment. Preliminary results suggest an increase in hostility and psychoticism from July to September while hostility ($F(df=2)=3.64$ $p<.05$) remained constant and psychoticism ($F(df=2)=3.66$ $p<.05$) decreased in January. Further more overall symptom severity increased between July and September ($df=9$ $t=2.63$ $p<.05$) and July and January ($df=8$ $t=-5.81$ $p<.05$). This implies that as people's mental health declines they become more hostile towards their co-workers which is initially accompanied by a greater need for isolation. This need declines suggesting a micro-cultural adaptation to wintering over.

Well-being in Tromso. The influence of student relationships on well-being and perceived quality of life. What is the influence of cyber relations?

Thorvaldsen, Steinar

University of Tromso ILP Mellomveien 110 9037 Tromso, Norway

steinar.thorvaldsen@uit.no

Gunstein Egeberg, University of Tromso Norway; John A. Ronning, University of Tromso, Norway

It is well known that children's experience of transactions with peers play an important part in children's development and socialization. Bullying of other children or being a victim of bullying has repeatedly been documented to exert negative influence on children's development. However research has uncovered uncertainty about the definition of bullying. With the introduction of cyber bullying Slonje & Smith argue for a debate on the criteria for something to be called bullying. Thus it seems imperative to conduct qualitative and quantitative studies on how students teachers and parents define bullying its prevalence and short and long term effects on well-being. The study is designed both as a prospective longitudinal and as a cross-sectional time trend study starting with six schools in late fall 2013. The project involves researchers students school teachers children from grade 4-10 and their parents. Seven schools are involved. Feedback to schools are given through annual dialog conferences and the research will be carried out in the school context by actively participating in shaping a better school while conducting the research. The questionnaire we apply in our study contains four different tools of measurements; KINDLR which measures quality of life (QoL) for children The Strengths and Difficulties Self-report Questionnaire (SDQ) and a traditional- and cyberbullying questionnaire. We have studied different aspects on peer-harassment (verbal physical social and cyber) in order to find out whether these different means of bullying differs between genders and age. We have also studied how QoL is affected by bullying.



This session aims to find a balance between sustainable, cost-effective and profitable professional activities of people working in the extreme High North conditions and their mental and physical health; to enhance compatibility of traditional indigenous activities and industrial exploration of natural resources; to create the base for involving of indigenous peoples' representatives in the modern production; to preserve people living and working in the Arctic from northern stress and "polar night" depression; as well as to bring to the table discussion of maritime and labor law issues in reference to the occupational health in the extreme Arctic conditions.

Convener: Natalia Simonova, Northern (Arctic) Federal University, Russia

Arefina, Marina

Northern (Arctic) Federal University

The Russian government reported about importance the Arctic Region for national economy more often. Able – bodied population, highly qualified specialists in harsh weather conditions take a big part for economic development of our country. Lately, happens negative changes in field of labor. Competent experts do not go to the North, because legal guarantees and reimbursement cannot make up for shortfall material and psychological resources, which related to working and living in extreme conditions of the Arctic. Legal regulation in the Arctic region mean of special documents, which include: the act of the International Labour Organization, the Russian Constitution, Labor Code of the Russian Federation, Russian Federation laws, acts of the President and the Government of the Russian Federation, the normative legal acts of federal executive authorities of the Russian Federation, acts of the Russian Federation, acts of local self-government. The basic law, which measure Legal issues of labor in the Arctic zone of the Russian Federation is law “On state guarantees and compensations for those working and living in the Far North and equated localities” February 19, 1993 № 4520-1. Now, there is no well-defined technology for realization and adjust legal issues of labor in the Arctic zone rules and boundaries are blurred. The labor relations in the Arctic Region do are not studied all- around and integrated. This is problems needs improvement Legal issues of labor in the North, which will keep and develop employment potential in perspective and rich region. The purpose of our investigation is to study legal problems related to labor regulation in the Arctic zone, in view of its practical application.

Organisational networks as a gate to cross cultural knowledge sharing and cooperation

Bundgaard, Stine Bylin

Department of Learning and Philosophy Aalborg University Kroghstræde 3 9220
Aalborg Ø

sbb@learning.aau.dk

Many Arctic societies are characterised by low population with a great and unique local knowledge. A great challenge can be to gather capacity and volume when huge projects are to be realized. As the world changes it can be difficult for small local companies to keep up with big businesses from other nations who are interested in developing industry within the Arctic. There is a great need of combining local and global knowledge and for businesses to work together but studies states that it can be difficult for small Arctic companies to navigate on the global marked finding the right sources the start projects with. In this gap organizational network can be seen as an intercultural community in which mutual cultural understanding can be the base for developing new cooperative opportunities between companies that are interested in the marked. The organizational network can be a forum for sharing knowledge between companies to build mutual capacity and projects based on divers cultural thinking. This research is based on qualitative studies within Greenland and Denmark and aims to focus on cultural diversity as a step to mutual understanding supporting intercultural knowledge sharing and building. The study can contribute to more knowledge about how working together in networks can assist a greater reference for small companies in the Arctic as well making an opportunity of benefitting from multiple knowledge to support growth and sustainability.

Degteva, Galina

Northern State Medical University Russia Arkhangelsk av. Troitskiy 51

polarmed@nsmu.ru

Yana Korneeva, Northern State Medical University Russia

Professional work in shifts in the Far North contributes to stress the functional reserves and adaptive systems of the body the formation of unfavorable functional states the development of destructive personality traits and the occurrence of various diseases of workers which lead to a decrease in the level of mental and physical health productivity and efficiency. Improvement of methods and techniques of health workers shift forms of labor in the Far North and the Arctic is becoming increasingly important. Currently there are formed the direction that studies physiological psychological socio-psychological aspects of shifts: identified vocational important qualities needed for the personnel conducted analysis for groups of occupations studied the stages of adaptation to extreme conditions the types of adaptation strategies styles self-regulation shift personnel etc. However to improve the efficiency of labor and health of shift workers should be implemented prognosis. In order to predict the efficiency of the personnel of the professional is necessary to determine the likelihood of negative psychological states properties and qualities as well as occupational diseases that would prevent its implementation i.e. professional and psychological risks of shift personnel. This goal can be achieved with the use of a risk-based approach which is widely used in medicine and economics. Risk - is the parameter to change the level of which may have a control action before the development of risk management measures necessary to identify analyze and evaluate them. Medical and psychological support to shift personnel in the Arctic should be built under the concept of risk management.

Yukon mining community participation in mining: a mobility companion guide for early career workers

Gartler, Susanna

Universität Wien Universitätsstrasse 7/C0412 1010 Vienna, Austria

susanna.gartler@univie.ac.at

Gertrude Saxinger, University of Vienna Austria

A key strategy of Canadian government policy of the last decade was to support socio-economic and regional development in northern communities through boosting extractive industry operations. Furthermore, aboriginal participation in the mining labour market as employees or entrepreneurs is a goal. However, boom and bust cycles in this sector and the currently experienced downturn of mining in the Yukon raise the question if mining is indeed a sustainable strategy for development of communities and people's wellbeing. Considering a next mining boom coming along the way and the numerous projects that are in planning and permit phase, an increase of labour demand can be expected in mid-term future. Today this industry operates with the fly-in/fly-out (FIFO) or drive-in/drive-out (DIDO) methods for labour force provision. This requires rotational absence from home for a substantial period of time and living under specific conditions in camps. This paper presents findings of research aiming at a Mobility Companion Guide that shall support early career miners on the basis of stories and recommendations from experienced workers in the mining sectors on how to cope with the specific life-style as mobile rotational shift-worker. This paper draws on examples of mining operations in the Yukon Territory comprising experience from the Mayo region and the Ross River region.

Giltman, Marina

Tyumen State University 625003 Semakova St. 10 Tyumen Russia

giltman@rambler.ru

The article examines the impact wages on employment in the High North regions of Russia. The unique features of the labour markets of these territories include compensative differentials and specific labour protection legislation. Compensative differentials do present themselves in the structure of wages of the individuals employed in unfavorable living conditions. Additional employment protection legislation in the High North regions of Russia is based on the Labour Code of the Russian Federation Chapter 50. It increases the costs to the employer in official hiring wages and lay-offs and weakens the enforcement. All this makes the labour supply in the High North of Russia more flexible and labour demand more constrained compared with the rest of the country. Using the panel data for the High North regions of Russia from 2005 to 2013 we have estimated fixed effects models for such dependent variables as number of employees number of unemployed and net-migration. Our estimations demonstrate that wage is a significant factor and positively affects interregional migration to the northern regions. Employment and unemployment react to changes of wages with different lags and in both cases - negatively. This may indicate that even in the case of the need for additional employees in the High North regions it will be covered by immigrants only partly and partly by the unemployed already living in those regions. The results of our research demonstrate the surplus of labour supply with respect to labour demand in the High North regions of Russia. The reaction to the growth of wages by immigrants from other regions of the country is too strong and eventually leads to lower wages and higher unemployment in the northern territories. The main findings of the paper can be used for providing the social policy in the High North regions of Russia.

Kekkonen, Alexandra

Petrozavodsk State University Budget monitoring center Lenin av. 33 Petrozavodsk
Russia 185910

alexandra.kekkonen@gmail.com

Development of Russia Arctic zone human capital is a strategic priority for increasing economy's competitiveness in terms of globalization as well as considering raising interest and attention to this topic. The role of regions' human capital development also increases considering their territorial characteristics and peculiarities of economic natural geographical social-demographic and other factors based on regional strategies devoted for self-development. The condition of human capital in Arctic zone is an important part of territory strategic development. Herewith modern society irrespectively to territorial position is facing number of threats like globalization population ageing decreasing of labor productivity level. Problems in the society caused by that threats lead to deterioration of population social-economic status marginalization of youth imbalance of occupational and qualification structure. Described problems should be overcome and it is important to evaluate them and monitor the dynamics. Above mentioned problems strongly affect Arctic zone human capital because life in Northern territories has great impact on health (one of important components of human capital) while for other territories this factor is crucial. The dynamics of human capital in the Arctic zone is analyzed in the report. The following results are reflected: - Algorithm of calculating Arctic zone human capital indicators taking into account the unique factors of living conditions in the north; - Analysis of the aspects of the human capital reproduction in the regions of the Arctic zone taking into account factors related to life in the north; - Assessment of human capital devaluation during the life in the North; - Revealed structure of the human capital and the main components with the differentiation of regions of the European North of Russia and the Arctic Zone; - Proposed solutions in the management of Russian Federation Arctic zone human capital development.

The research was prepared with the implementation and support of the project within the state task of Russian Ministry of Education and Science No.30.207.2016/HM, Russian Humanitarian Science Foundation project № 15-02-00231 and The Russian Foundation for Basic Research project № 16-46-100923\16.

The working capacity dynamics of oil and gas workers and their self-regulation possibility in the Arctic

Korneeva, Yana

Northern (Arctic) federal university named after M.V. Lomonosov Russia amb.
Northern Dvina 17

amazonkca@mail.ru

The study was sponsored by the Russian President's grant for state support of young Russian scientists - PhD (MK-7500.2016.6). The aim is to study the working capacity dynamics of oil and gas workers of different professional groups during shift-in period and their self-regulation possibility in the Arctic and the development of measures to optimize them. The study involved 70 oil and gas workers in the Nenets Autonomous Okrug of Russia (the shift-in duration was 30 days) between the ages of 24 to 60 years (mean age 38.7 ± 9.7) from March to April 2015. Research methods are questioning a complex visual-motor reaction "variation cardiointervalometry"; descriptive statistics and multivariate analysis of variance MANOVA. Increases the efficiency of the staff assignments to the complex visual-motor reaction by the end of the shift period increases inaccuracy reduced the number of feedforwards wrong answers; the reaction speed remains at the same level the number of passes increases slightly from the middle to the end of the shift period. The operator's work capacity improved slightly in the middle of shift period and then goes into decline by the end of the shift (with them work capacity during the entire shift have average level). Shift beginning can be characterized by the average operator working capacity with an increased number of errors in the middle shift operator's efficiency is increased the number of errors is reduced by the shift end decrease the operator's of working capacity to the average level while the number of errors is at the same level relative to the middle of the shift period. Employees of all the studied occupational groups have an average level of self-regulation of behavior which is expressed in the independence flexibility and adequate response to changing conditions; extension and achieving goals are largely conscious.

"Where we live everything is by nature - both in life and work": specificities of Chukotka natives\ labour behaviour in the present-day environment'

Kulik, Nikolay

Chukotka branch of North-Eastern Federal University. Russia Anadyr
Studencheskaya st. 3

kulikomolon@mail.ru

Anastasia Yarzutkina, Chukotka branch of North-Eastern Federal University, Russia

Due to industrial production development mineral resource mining activation and traditional types of economic activity renaissance the ethno-cultural division of labour in the Far North is nowadays becoming more obvious. The basis of such division comes from specificities of labour behaviour among representatives of different cultures\ communities. There is also some discrimination on the grounds of national origin during recruitment. Often the employer is orientated not towards education knowledge and skills but to his/her own view of possible labour behaviour of people of different nationalities. Such a stereotypical model as "Native" or "Chukcha" is defined in Chukotka. This employee image includes not only those belonging to native small-numbered peoples - Chukchis Inuits Evens Yukaghirs but also certain labour behaviour characteristics. They are revealed within the process of comparison of labour understanding by employees from different cultural environments and also of what is suitable and desirable work labour motives and actions which connect the employee with the labour process orientation towards the time level of productivity etc. For instance work and long-term staying in Tundra during winter is heroism for Russians and for Chukchis it is normal but plants\' cultivation can be impossible for natives. My own observations and many of interviews with employers employees newcomers and Chukotka natives revealed features of indigenous nationality\'s labour behaviour which are based on their cultural and world-view traditions. Relying on field ethnographic material the cultural basis of such distinctive behavioural characteristics as a rejection of regulation within labour processes preferences or a lack of acceptance of certain activity types and attitude towards salary will be shown and described.

Development of functional food for people working in the Arctic

Kuzmina, Natalia

Northern State Medical University 163000 Arkhangelsk Trotsky avenue 51

natik_kuzmina@mail.ru

Ksenia Bolotova, Northern (Arctic) Federal University named after M.V. Lomonosov
Russia; Galina Degteva, Northern State Medical University Russia

The harsh conditions of the Far North have specific requirements for the physical state of the person. Energy costs for people working in the Far North increased by 15% and by 15% in proportion to the increased needs in proteins fats and carbohydrates. There is research was conducted in the expedition in Yamalo-Nenets Autonomous District in 2014. The study of the diet of shift workers found that their diets are deficient in vitamin A (5.6 times below the norm) beta-carotene (2 times below the norm) vitamin B2 (1.5 times lower than the norm) vitamin C (1.76 times less than the norm) and calcium (2 times lower than the norm). Also by a number of elements found exceeding the normative values of physiological needs: for sodium - in 5 times phosphorus - in 2 times iron - in 2 times and vitamin B1 - in 2 times. On the basis of the calculated data marked by the need for correction of the diet of shift workers in the Arctic. Developmented of juice drinks on the basis of the resources of the northern territories: wild berries pine buds and taiga honey. These drinks are characterized by good organoleptic properties and have a high biological value. The obtained juice drinks contain vitamins B1 – 0.5 ... 80.5 g/l B2 – 19.2 ... 133.8 g/l B6 – 7.8 ... 67.1 g/l A – 53.1 ... 69.1 g/l and E – 5.3 ... 8.1 g/l. Most vitaminized drinks are drinks from cranberry raspberry cranberry and cloudberry. Achieves results of the development of functional foods will be the implementation of measures for adaptation and preservation of human health in extreme living conditions.

Preservation of human health and ensuring of work safety in the system "Man - Arctic environment - protective clothing"

Lebedeva, Elena

CJSC "Meridian", Moscow, Russia

leleol@mail.ru

The Arctic region characterized by extreme climatic conditions complicates considerably the industry growth in this area undermining work efficiency and human health. Prolonged exposure to cold leads to development of chronic diseases, lowers body temperature and blood pressure, violates the carbohydrate and protein metabolism, causing weakness, drowsiness, fatigue and impaired motor coordination. Poor well-being in the workplace increases the risk of errors that can cause injury or accident. One of the most common problems in many industry branches are ambient temperature drops, as well as its changes during physical activity. In this case, the average skin temperature during physical work may reach 37 ° C and at rest - 23 ° C. Thus, in usual clothing a person can overheat due to heat excess during physical activity, and then frozen. Such situations often provoke colds and impair human health. To protect people and reduce the risk to their health and life in the cold conditions we develop protective clothing, which will reduce the temperature imbalances. The effectiveness of long-term use of these products was proved during experimental studies, which were conducted in 2015 in the Far North areas.

Lobanov A. A.

"Scientific Center of Arctic Research" Nadym, Russia & Federal Research Center –
"Food and Biotechnology", Moscow, Russia

Andronov S.V., Kostritsyn V.V., Kobelkova I.V., Keshabyants E.E., Lobanova L.P.,
Popov A.I., Kochkin R.A.

The Nenets of Western Siberia have preserved the nomadic reindeer herding and traditional fishing. Meat, liver and reindeer blood, meat of fish of the whitefish family are diet basis of more than 22 thousand people. Unfortunately, the global economic, climatic and social changes greatly affect the consumption of traditional food by the inhabitants of the Arctic, which may increase the incidence of civilization diseases: heart and blood vessels diseases, overweight and diabetes mellitus. Materials and methods: this study involved inhabitants of Nenets villages and tundra, located in the north of Western Siberia, Gydan, Yamal, Tazovsky peninsulas. 401 people, men 23.2%, women 76.8% participated in the study. The average age was 47.6 ± 14.9 years. The frequency method of nutrition study was used. Measurement of blood pressure was taken three times by the method of Korotkov, the presence of hypertension was determined in accordance with the RSSC (Russian Scientific Society of Cardiologists) recommendations on arterial hypertension. The index of functional oxygen consumption in the tissue was determined using capillary blood flow laser analyzer – apparatus "LAKK-M" ("LAZMA", Russia). Bioimpedance analysis was performed on the KM-AR-01 complex unit in the configuration of the "Diamond-AIST". High density lipoprotein cholesterol ("Piccolo Express" ("Abaxis", USA)) was determined in the blood serum. Dynamics of deer meat and local fish consumption were examined in the period 2012-2014. To build hypertension development risk models was used non-linear logit regression with step-by-step inclusion of variables by the method of maximum likelihood. Results and discussion: it was revealed that from 2012 to 2014 the local fish consumption by the population in indigenous villages decreased by 36.9%, and venison consumption by 48.2%. This dramatic decline in consumption of traditional foods cannot be explained by the industrial development of the territory only. An important factor in this process is the increasing role of commodity-money relations replacing subsistence economy. Climate change, frequent abnormal thaw and other weather phenomena, causing reindeers deaths of and the timing change of fishing should be taken into account as well. Fish and reindeer meat consumption reduction significantly increases the risk of hypertension and prevalence of overweight. To the greatest extent the risk of hypertension development can be decreased by the consumption of pike. Consumption of the whitefish family deters hypertension slightly less than the pike: broad whitefish - 2.0; vendace - 1.9; whitefish - 1.4. Along with local fish, hypertension development risk can be decreased by the consumption of onions - 1.9, cloudberries - 1.1; buckwheat - 1.1; brown bread - 1.1. The most favorable combination of food types are: venison + berries (OR 1, 39) and broad whitefish + pike (OR 1, 67). Hypertension development risk is reduced most probably due to ability of traditional food (freshwater fish and venison) to normalize endothelial function of the vascular wall, to influence on blood lipids composition in favor of non- atherogenic fraction, to improve efficiency of tissue respiration. Thus, the analysis of body composition revealed that individuals consuming venison not less than 3 times a week differ significantly (-20.0%) in body mass index (U-2577.0; $p=0.04$), have significantly more (+20.0%) lean body mass (U-2279.0; $p<0.01$), significantly less total fluid (-10.0%) (U-2352.0; $p<0.01$) and intracellular fluid (to 15.0%) (U-2252.0; $p=0.03$). Positive correlation between daily venison intake and concentration of high-density lipoproteins in the blood ($r_s=0.5$; $p=0.003$), as well as between pike consumption and functional index of oxygen consumption in tissue ($r_s=0.6$; $p<0.001$) were revealed.

Health and social well-being of the Nenets in Western Siberia in comparison with other indigenous peoples of the world

Andronov, Sergey

State Public Institution “Scientific Center of Arctic Research”

Lobanov, Andrei; Popov, Andrei

Global research (Indigenous and tribal peoples' health: a population study) which involved 23 countries and 28 indigenous peoples of the world, showed that the greatest differences in the health and social well-being between migrant population and aboriginal people was observed on the magnitude of infant mortality rate and access to education. This global study included examination of health and social well-being of the Nenets people in Western Siberia. Information was obtained from government data and our own research. The Nenets have largely retained their traditional way of life: nomadic herding and traditional fishing. However, nomadic way of life, remoteness of villages, absence of roads create significant challenges for ensuring medical care and education quality. In addition, education in boarding schools, prenatal hospitalization of pregnant women do not always positively perceived by tundra nomadic peoples. There is a certain correlation between these two factors. If elder children start to study in a boarding school, their mother keeps her nomadic lifestyle in tundra, usually with several younger children who need care. When a woman is hospitalized in maternity house, family members have to choose between two options: younger children are left without proper care (which can be dangerous by nomadic way of life) or elder children are forced to leave boarding school and replace their mother. Otherwise, long stays in one place lead to reindeer loss, caused by lack of food. Other relatives can handle the situation but they are not always able to care for several children. As a result, women are often urgently hospitalized with the help of aviation. Given a large number of days with bad weather conditions, the complications risk in childbirth is quite high. So, the infant mortality rate in the region according to 2012 data among Nenets population is 47.8 per 1000, among non-indigenous population is 6.6 per 1000, that is 7.2 times less ($p < 0.001$). The maternal mortality rate in the region according to 2013 data among Nenets population were 146.4 per 100000, among non-indigenous population 24.5 per 100000, that is 6.0 times less ($p < 0.001$). For comparison: in Canada the infant mortality rate according to 1997-2007 data among indigenous population was 10.7 per 1000, non-indigenous population 5.7 per 1000, that differs 1.9 times ($p > 0.05$). The infant mortality rate in Sweden according to 2009-2013 data among indigenous population was 2.8 per 1000, non-indigenous population is 2.2 per 1000, that is 1.3 times less ($p > 0.05$). The education level (corresponding to upper secondary) in the region according to 2012 data among the Nenets amounted to 90.2% of the adult population, the non-indigenous population 99.6% of the adult population ($p > 0.05$). The education level in Sweden according to 2013 data among indigenous population amounted to 71.0% in comparison to non-indigenous population 72.0% ($p > 0.05$). The high level of infant mortality among the Nenets unlike indigenous peoples in other Arctic countries is connected with difficult logistics and remoteness of the tundra population from medical institutions, where expert medical care is provided.

The development of professionally important qualities of an engineer

Nikitina, Nadezhda

Northern (Arctic) Federal University named after M.V. Lomonosov

ya.nnikitina@yandex.ru

Professor N.N. Simonova, Northern (Arctic) Federal University named after M.V. Lomonosov

Nowadays paid great attention to the oil and gas industry as it is the main type of energy. The majority of oil and gas fields are located in the Far North it is the area of extreme climatic conditions work in which is very difficult and risky. Engineers need to possess a wide range of skills to succeed in this industry. Specificity of engineering activity requires the presence of certain professionally important qualities of the person. Professionally important qualities include individually-psychological and personal qualities of a specialist which are necessary for the implementation of a productive activity. JA Korneyeva wrote in her researchs about the necessary professional qualities of engineer among which are listed: moderate introversion rationalistic high level of self-control behavior especially in interpersonal relationships and in health-disease; high emotionality in the field of intellectual emotional stability. Identification of professionally important qualities enables you to build a professional model professional reveal features of engineering activities that are important for understanding the specifics of preparing for it. We designed the training program for beginners to experts - students of Oil and Gas Institute. The purpose of this program is the identification and development of professionally important qualities that are necessary for the successful implementation of the future work of the future engineers. The exercises were aimed at the development of abstract thinking attention training actions in a situation of conflict as well as self-regulation skills training the development of communicative qualities organizational qualities work with the ability to plan the work provide precise control stress resistance. This event has given to the participants a confidence in their success as students understood what qualities need to develop as to be more competitive and more successful in the future. For us the criterion for the success of this event will be a successful execution of work duties and professionalism of the participants of our program. This work has been very effective and then in the future we are planing to continue to hold such events.

Physical strain of mast and pole work

Oksa, Juha

Finnish Institute of Occupational Health Oulu Finland Aapistie 1 FIN-90220 Oulu
Finland

juha.oksa@ttl.fi

Sanna Hosio, Finnish Institute of Occupational Health Oulu Finland; Hannu
Rintamäki, Finnish Institute of Occupational Health Oulu Finland; Sirkka Rissanen,
Finnish Institute of Occupational Health Oulu Finland

Since physical strain during mast and pole work is not known this study evaluated the level of muscular cardiorespiratory and thermal strain of mast and pole workers with special emphasis on winter. Fourteen voluntary mast and pole workers participated. We measured their muscular strain using electromyography expressed as percentage in relation to maximal EMG activity (%MEMG). We estimated VO₂ from HR measured during work (using individual VO₂-HR relationship) and expressed it as %VO₂max. To quantify thermal strain skin and deep body temperatures were measured using temperature sensors and telemetric pill and receiver. We found the highest average muscular strain in the wrist flexor ($24 \pm 2\%$ MEMG) and extensor ($21 \pm 1\%$ MEMG) muscles exceeding the recommendation of 14%MEMG. Average cardiorespiratory strain was $48 \pm 3\%$ VO₂max. Nearly half (40 %) of the subjects exceeded the recommended 50% VO₂max. Winter condition increased both muscular and cardiovascular strain on average by 4 and 2 % respectively. Deep body temperature varied between 36.8 and 38.0°C and mean skin temperature between 28.6 and 33.4°C. Cooling was most pronounced in extremities during winter. Lowest single temperatures in middle finger hand and big toe varied between 6.4 and 18.5 9.4 and 24.9 and 15.4 and 24.6°C respectively. This field study showed that workers may be at risk for local and/or systemic muscular and cardiorespiratory overloading (the winter enhancing this effect slightly) and thus for excessive fatigue reduced work efficiency and increased risk for musculoskeletal symptoms. Generally thermal strain remained at a tolerable level.

Personal determinants of the expeditionary activities effectiveness of the participants of expedition "Arctic Floating University"

Porokhina, Irina

Northern (Arctic) Federal University named after M.V. Lomonosov The Russian Federation 163002 Arkhangelsk Northern Dvina Embankment 17

i.porokhina@ya.ru

Natalia Simonova, Northern (Arctic) Federal University named after M.V. Lomonosov

The purpose of the study is to identify personal characteristics that influence the effectiveness of the expedition activities of the Arctic floating university' members. Materials and methods. This study was conducted as part of a scientific expedition Arctic Floating University in the period from 01 to 20 August 2014. The participants were students graduate students young and experienced researchers in the Arctic which were on the research ship "Professor Molchanov". The study involved 30 participants. Women accounted for 56% of the total number of subjects men - 44%. The average age of respondents was 24.13 ± 1.026 years. For the diagnosis of the level of efficiency of forwarding activities used: Expert assessment of the work effectiveness on the following evaluation criteria: ability to work in a team emotional stability endurance maintaining of operability motivation to work independence initiative; professional skills (knowledge skills); self-assessment of the work effectiveness on the same criteria; questionnaire "Integral job satisfaction." In accordance with the terms of the study three experts participated in the evaluation - the head of the expedition and leaders of research units. For the diagnosis of personal characteristics of the following methods were used: Questionnaire of terminal values (I.G. Senin) Questionnaire "The level of subjective control" (J. Rotter) the technique of studying of character accentuations K. Leonhard (modification of H. Smishek) Questionnaire of formal-dynamic properties of individuality (V.M. Rusalov) Express method for assessing the socio-psychological climate in the team (A. Mikhalyuk L.Y. Shalyto). Results. Efficiency forwarding activities in terms of the head of research unit is determined by the desire and ability of the participants to compliance of formal requirements and communication - the ability to establish social contacts. From the perspective of expedition participant determinants are desire to establish social relationships self-expression interest creativity and optimism.

The attitude to the special clothes of shift workers in the Far North

Pulina, Elena

Northern (Arctic) Federal University named after M.V. Lomonosov Arkhangelsk
Russia

Helen.31-12@mail.ru

Natalia Simonova, Northern (Arctic) Federal University named after M.V. Lomonosov
Arkhangelsk Russia

The work in the Far North is a very specific type of the professional activity. Specificity is determined by conditions and factors which act on the specialist in the implementation of his professional duties. There is a contradiction between the objective need for use the special clothes in the extreme conditions of activities\ performance and specialists' attitudes to it when they are working in the Far North. The special clothes are necessary condition of health keeping and personnel\ efficiency which work in the Far North. However functional qualities of the special clothes not always correspond to the peculiarities and requirements of professional activity (protective properties convenience durability etc.). Therefore clarification of the attitude to the special clothes and its using is very actual problem. Its solution will allow increasing satisfaction with the quality properties and characteristics of the special clothes and as a result to optimize of the functional state to keep health and efficiency of workers. In the course of the empirical research is planned to find out various aspects of the attitude of workers in the Far North to the special clothes. The qualitative methods will be used for this purpose. A pilot research will be carried out in March 2016. It is the first stage. The 60 shift specialists from the Verkhovina diamond field will take part in it. The Verkhovina diamond field is in Mezensky district of the Arkhangelsk region. The research is based on methods of questionnaires (a specially designed questionnaire and a standardized interview) which will help to find out what characteristics are most oriented specialists who work in the Far North. These empirical findings will be the basis for the development of tools which will be offered to specialists who work in the Far North at the second stage of the investigation.

Rintamäki, Hannu

Finnish Institute of Occupational Health Aapistie 1 FI-90220 Oulu, Finland

hannu.rintamaki@ttl.fi

Sirkka Rissanen, Finnish Institute of Occupational Health Oulu Finland; Satu Mänttari, Finnish Institute of Occupational Health Oulu Finland; Juha Oksa, Finnish Institute of Occupational Health Oulu Finland; Kirsi Jussila, Finnish Institute of Occupational Health

The initial response of humans exposed to cold is the prevention of heat loss by decreasing circulation in skin arms and legs. Hands and feet are especially vulnerable to cooling as their heat balance depends almost totally on the heat transported by circulation. The thermal insulation of handwear is usually smaller than that in footwear as manual performance is decreased by well insulated handwear. As a result cold hands are a common problem in outdoor work. Cooling of hands decreases manual performance as well as tactile sensitivity and increases the risk of accidents. This study aimed to quantify the problem of cold hands in Arctic open pit mines. The questionnaire study was carried out in four open pit mines in Russia Finland Sweden and Norway. Moreover skin temperatures as well as thermal sensations were recorded in Kevitsa (Finland) and Aitik (Sweden) open pit mines among 14 male and 2 female mine workers with duties consisting mainly of outdoor work. The questionnaire study (n = 1323) revealed that experienced cold problems were negligible at ambient temperatures above -10°C. However at -10 - -20°C 25 % of workers estimated that their prevailing thermal sensation was "cold". Skin temperature measurements showed that finger skin temperatures were below 15°C (a threshold for sharp performance decrement) for 21% of the working time. The questionnaire study and skin temperature measurements suggest unequivocally that hands/fingers are so cold that manual performance is markedly decreased in more than 20% of workers/working time. Such a decrease in manual performance increases the risk of accidents. It should be noted that during the skin temperature measurements ambient temperature was never below -16°C. Improved cold protection should be directed to cold sensitive workers and tasks especially at ambient temperatures below -10°C. This study was funded by Kolarctic ENPI CBC.

Temperature effects while using a fan-assisted respirator in the cold

Rissanen, Sirkka

Finnish Institute of Occupational Health Aapistie 1 FI-90220 Oulu, Finland

sirkka.rissanen@ttl.fi

Merethe Larsen, University Hospital of Northern Norway Tromsø Norway; Eva Kramvik, University Hospital of Northern Norway Tromsø Norway; Morten Skandfer, University Hospital of Northern Norway Tromsø Norway; Satu Mänttari, Finnish Institute of Occupational Health Oulu Finland; Hannu Rintamäki, Finnish Institute of Occupational Health Oulu Finland

Respirators protecting against airborne particles and gases are also needed in cold environments. However low temperature causes special problems such as freezing of exhaled moisture in the respirator increases respiratory resistance and hampers communication. Fan-assisted respirators aim to solve the problem of respiratory resistance. However there are a lot of complaints that the high and continuous air flow inside the face shield cools the face and eyes. This study aims to quantify the cooling problem and seeks solutions. Fan-assisted respirator with the face shield together with the battery-powered fan and filters was used. Air flow rates used were 170 and 240 l/min. Exposure temperatures were 10 -20 and 30°C. Under the face shield the face skin was either unprotected or protected by a facemask (balaclava with a ventilator). Five male volunteers participated in the study. Face skin temperatures were measured at forehead cheek nose and lower lip. In the exposure temperature the subjects were standing stepping and lifting for altogether 30 min. Face skin temperatures varied between 5 and 17°C and thermal sensation was “cold” without the facemask. While the facemask was used skin temperatures varied between 17 and 30°C and thermal sensation was “slightly cool”. Fogging of the visor started from the sides in 10 to 15 min (exercise started) and humidity started to freeze soon after regardless of the use of the facemask. In conclusion the flow of air inside the fan-assisted respirator decreased skin temperatures to uncomfortable level within 5 - 10 min without the facemask. The use of facemask kept the skin temperatures in comfort/acceptable level. Freezing of exhaled moisture in the face shield was a marked problem without and with the facemask. It seriously restricted the eyesight causing a critical safety issue. Further development is needed for the respiratory protection in the cold.

Human resources to overcome the negative climate impacts in the context of sustainable development of the Arctic

Simonova, Natalia

Northern (Arctic) federal university named after M.V. Lomonosov Russia
Arkhangelsk amb. Northern Dvina 17

n23117@mail.ru

In the beginning of the XXI century the Arctic has attracted the attention of many countries. The reason for this is largely due to the presence in the Arctic significant hydrocarbon reserves. However the territory of the Arctic are in extreme climatic conditions and far removed from the developed infrastructure centers. In this regard the question arises: who can work in these conditions? And what are acceptable forms of work for such conditions? One of the work organization methods in such areas is shift method. This is a special form of implementation of the labor process is the place of workers residence when it cannot be provided daily return them to the place of permanent residence. Shift work in Arctic conditions is carried out in different modes of work and rest for example 30 work days then 30 rest days; 45/45 etc. In this labor form in addition to extreme climatic factors are a number of social factors associated with group isolation in which there are employees. This leads to a special organization of professional psychological selection for work in these extreme conditions which are addressed in this study. The study involved 297 people aged 21 to 63 years (mean age 38.9 ± 0.61). Methods are: questionnaires surveys and psychological testing. Statistical analysis was performed using the software package SPSS 22.00. The study identified professional important qualities of specialists to shift work in the Arctic.

4.6 Gaining a better understanding and awareness of the Arctic through education and outreach



The interest in the Arctic region is high at the moment and therefore, the role and importance of the Arctic has to be communicated at different levels to different audiences. The recent International Polar Year 2007-2008 had placed a strong emphasis on education and outreach, and building on its momentum, many early career and experienced polar researchers have gotten involved since then in communicating more broadly their work as well as the importance of the Polar Regions. This session will discuss different methods, approaches and visions of education and outreach tools for Arctic research communication; their role in increasing the understanding and awareness of the Arctic and in building the human capacity of the region.

Principal Convener:

Yulia Zaika, Faculty of Geography, Lomonosov Moscow State University, Russia/APECS

Co-conveners:

Gerlis Fugmann, APECS/UiT The Arctic University of Norway

Andrian Vlachov, European University at Saint Petersburg, Russia

Julie Bull, University of Toronto, Canada

The Model Arctic Council: Educating Postsecondary Students on the Arctic Council through Simulation and Experiential Learning

Boylan, Brandon

Department of Political Science University of Alaska Fairbanks P.O. Box 756420
Fairbanks Alaska 99775-6420 United States

bmboylan@alaska.edu

Mary Ehrlander, Arctic and Northern Studies University of Alaska Fairbanks PO Box
756460 Fairbanks AK 99775-6460 United States

The Arctic Council has been at the forefront of coordinating the agendas and policies of states and indigenous communities of the region as they respond to the challenges of living in the far north. Yet two decades after its founding the Arctic Council's mandates processes and functions remain little understood. Thus the Model Arctic Council (MAC) is a new initiative designed to educate students at postsecondary institutions about urgent issues facing the Arctic and the work of the Arctic Council with a long term goal of developing leadership capacities within the region. The University of Alaska Fairbanks hosted the first fully international MAC program in March 2016 organized as a thematic network within the UArctic. This presentation explains the inception planning execution and outcomes of the MAC 2016 program highlighting the value and challenges of offering the program and institutionalizing it.

Engaging Indigenous and Indigenist methods in student outreach: Building human capacity in Arctic research

Leonard, Beth

Center for Cross-Cultural Studies, University of Alaska Fairbanks

brleonard@alaska.edu

Ocean Mercier, Victoria University of Wellington, New Zealand

Engaging students in interdisciplinary communication around Indigenous knowledge[s] science local and global issues impacting Indigenous communities is a vital part of Indigenous and Arctic studies higher education programming. Many of us as Indigenous scholars are situated within institutions located on Indigenous lands therefore in our minds Indigenous cultures occupy rightful places and spaces within these contexts. A key challenge is the creation and expansion of safe Indigenous spaces within Western institutions; spaces that can both support student learning and communication while facilitating transformative student contributions on issues affecting Indigenous peoples of the Arctic and beyond. In this session we examine an Arctic-Pacific virtual exchange between the University of Alaska Fairbanks and Victoria University of Wellington (VUW) joint videoconference course "Science and Indigenous Knowledge in Global Contexts." We describe our design of the collaborative digital spaces pointing out aspects that facilitated and challenged engagement between and among students. We then discuss the learning outcomes of the engagement using selected commentary from student evaluations and online forum posts. Building long-term human capacity in the Arctic and beyond should require the engagement of Indigenous peoples in formulating policies and programs (see for example the United Nations Declaration on the Rights of Indigenous Peoples). In this regard three aspects of the exchange motivate us to continue this Arctic-Pacific initiative. In our analysis of student communication to date we find these virtual exchanges provide: a critical sense of place[s] in local and global senses; reorient students' understandings of Indigenous identities; and cause students to reflect on their current and future roles in shaping spaces that promote Indigenous safety self-determination and sovereignty. These all contribute to 'glocality' that is critical processes promoting human capacity and citizenship that are locally embedded yet globally connected.

Safety of Industrial Development and Transportation Routes in the Arctic – collaboration project for research and education of future High North experts

Marchenko, Nataliya

The University Centre in Svalbard

natalym@unis.no

The University Centre in Svalbard is the northernmost (78° N) high education institution providing research-field-based education of next generation of Arctic experts. Arctic Technology department increases understanding of engineering problems in harsh environmental condition knowledge in the field Ice Mechanics Applied Oceanography and Marine Technology and gives students unique experience of full-scale tests with sea ice. During several years AT department implements the international collaboration projects involving students and professors from different countries in joint investigations for sustainable industrial development. Current project is SITRA (Safety of Industrial Development and Transportation Routes in the Arctic 2015-2016) sponsored by Norwegian Centre for International cooperation in Education (SIU). This project is a part of a High North Program. It continues the more than 20 years long Norwegian-Russian collaboration in the field of Ice engineering and expands it overseas by means of students and staff/professors exchange and joint field works. SITRA project raises cooperation in higher education and dissemination of knowledge amongst two Norwegian universities (Norwegian University of Science and Technology and UNIS) a Canadian university (Memorial University of Newfoundland) two US universities (Dartmouth College and University of Alaska Fairbanks) and a Russian university (Moscow Institute of Physics and Technology) and the whole scientific society. Industrial development of offshore and coastal regions extension of navigational activity in the Arctic enhances the risk of accidents under severe conditions. Deep knowledge of the physical environment and understanding of methods of risk reduction are necessary for technical experts and for young specialists planning to work in companies providing industrial development in the Arctic. SITRA project is focused on the organizing of a multi-international educational network of experts having experience in high north research and on the teaching of Arctic engineering courses for students. The project multiplies understanding and awareness of the Arctic through education and outreach.

Osgood, Kathleen

Antioch University New England

kathleen.osgood@gmail.com

Based on long-term study and collaboration with The Center for Circumpolar Studies North Eastern Federal University and the University of the Arctic the Borealis curriculum is designed to give voice to human expressions in the north. From storytelling to film from shamanism to cultural identity Borealis courses are targeted at upper undergraduate and graduate students with abiding interests in the circumpolar world. They are designed using a robust online learning platform but delivered in seminar format with an experienced instructor guiding students in their studies research and writing. A virtual platform means that northerners from Siberia to Svalbard can participate on an equal footing. While the Borealis curriculum has been highly successful among the participants we are considering the next steps to reach a larger audience while keeping the small-scale seminar format.

Evaluating Contaminants Learning: the experience of the Nunavut Arctic College Environmental Technology Program's wildlife contaminants and health workshop

Provencher, Jennifer

Carleton University C/O National Wildlife Research Center 1125 Colonel By Drive
Raven Road Ottawa ON Canada K1A 0H3

jennifpro@gmail.com

Jamal Shirley, Nunavut Research Institute; Jason Carpenter, Nunavut Arctic College;
Mary Gamberg, Gamberg Consulting; Chris Furgal, Trent University; Shirin Nuesslein,
Trent University

Northern college training programs like Nunavut Arctic College's (NAC) Environmental Technology Program (ETP) are producing the Arctic's next generation of front line environmental workers and decision makers. These individuals are being trained to help identify understand and address the many challenges confronting the North and position communities and organizations to take advantage of opportunities in an ever-changing Arctic environment. Further they are often tasked with being critical knowledge translators working between communities of scientists resource users industry and government. To date many online courses workshops in-class presentations and on the land science camps have been conducted in Arctic communities to support the enhancement of local capacity to understand and take action on critical environmental issues such as the presence of environmental contaminants in the Arctic food chain. However few are typically documented and shared and even fewer are evaluated as to their impact on participant or student learning outcomes. This one week workshop combines lectures interactive lab activities and group discussions to bring together science and Inuit Qaujimajatuqangit that draw upon scientists to introduce students to the lab environment and local experts to teach students traditional methods for butchering and skin preparation of marine birds and seals. We document and evaluate the workshop's contribution to student learning in 6 learning domains fields (depth and breadth of knowledge knowledge of methodologies application of knowledge communication skills limits of knowledge and understanding and professional capacity and aptitude). It is hoped that the documentation and sharing of this experience (e.g. the workshop approach modular structure and integrated curriculum design) along with the evaluative feedback on the course impact in the areas of learning and development will help other programs and communities wanting to enhance the capacity of students or residents to be better engaged and prepared to address challenges they may face related to environmental contaminants.

Rykova, Valentina

The State Public Scientific-Technological Library of the Siberian Branch of the Russian Academy of Sciences the department of Scientific Bibliography 15 Voskhod St. Novosibirsk 630200 Russia

onbryk@spal.nsc.ru

The Arctic as a region of the special geostrategic and economic interests playing an important role in maintaining the ecological balance of the planet has attracted researchers attention all over the world. The interest in the region grows nowadays for several reasons: the possibility of hydrocarbon development at the Arctic shelf the Arctic sea ice loss associated with global environmental changes the need to preserve indigenous people as bearers of adaptive mechanisms for sustainable development of Arctic territories. Comprehensive study of the region is impossible without the proper information support. The department of the scientific bibliography of the State Public Scientific-Technological Library of the Siberian Branch of the Russian Academy of Sciences (SPSTL SB RAS) provides information for students post-graduates scientists and specialists in various fields of research. The library has created a bibliographic-information complex to assist researchers which includes bibliographic indices targeted databases bibliometric analysis of information massives on different topics. DB 'Problems of the North' reflects the history of the Arctic nature and natural resources development features of their topography climate water surface and underground ice soil flora and fauna ecosystems including materials on human impact on the environment in Arctic and sub-Arctic regions biomedical and sanitary problems of the North. Database covers a wide range of the socio-economic problems of the Far North: natural resources the development of productive forces the settlement system labour resources etc. Materials on the various aspects of northern aboriginals take a special place in DB. Issues related to the geoecology geoengineering under permafrost conditions as well as a set of topics of transportation development at the Arctic regions are reflected in DB.

Norwich School Model Arctic Council: A case study in promoting Arctic awareness and understanding amongst youth

Specá, Anthony

Polar Aspect Consulting 25 The Maltings Pirnhow Street Ditchingham Bungay NR35 2SA UK -and- Norwich School 71A The Close Norwich NR1 4DD UK

anthony.speca@polaraspect.com

Norwich School one of the UK's leading co-educational independent day-schools held a Model Arctic Council (MAC) on 2nd July 2016 under the direction of a member of staff with experience living and working as a government official in the Canadian Arctic. MAC is a simulation of the institutions and processes of the real Arctic Council with pupils playing the roles of official representatives of the eight Arctic States six indigenous Permanent Participants and various observers. Unlike Model United Nations MACs are a relatively new educational development. Whilst a number of MACs have now been held at university level research suggests that the Norwich School MAC may have been the first MAC in Europe and only the second in the world at secondary-school level. As the Norwich School MAC had yet to be held at the time of writing outcomes will be reported the 2016 UArctic Congress along with commentary on pupil learning organisational issues and plans to hold a second larger MAC in 2017. However initial preparations suggest pupils are already being exposed to many issues of Arctic governance indigenous rights community and economic development environmental policy and geopolitics to which they had little or no previous exposure. Indeed where the standard UK secondary-school curriculum focuses on the polar regions at all it tends to emphasise the physical geography of the Antarctic or of glaciated regions generally. It seems likely that it is the very rare UK secondary-school pupil who enters university inspired to study the Arctic further whether as a natural or social scientist. For these reasons the Norwich School MAC has the potential to become a primary channel for promoting Arctic awareness and understanding amongst UK youth and if grown over time to national or international scale perhaps also more widely in Europe and beyond.

APECS education and outreach activities for shaping the future of polar research

Vingerhagen, Ruth

University of St. Andrews Scotland Association of Polar Early Career Scientists

ruth.hindshaw@gmail.com

Gerlis Fugmann, APECS / UiT The Arctic University of Norway; Yulia Zaika, Faculty of Geography Lomonosov Moscow State University

The Association of Polar Early Career Scientists (APECS) is an organization for undergraduate and graduate students postdoctoral researchers early career faculty members educators and anyone with interests in Polar and Alpine regions. APECS developed during the 4th International Polar Year (IPY 2007-2008) with the primary objectives of stimulating interdisciplinary and international research collaborations and developing effective future leaders in polar research education and outreach. An important part of our job as scientists is communicating our research and its impact on others and therefore IPY placed a strong emphasis on education and outreach in its planning. Many early career polar researchers are actively engaged in sharing their work and the importance of the Polar Regions with broader audiences. APECS has considerable experience in education and outreach activities through its involvement in the Polar Resource Book project during the IPY as well as the IPY Education Outreach and Communication (EOC) Assessment Project. In collaboration with the APECS National Committees we organise highly successful annual outreach events such as Antarctica Day and the International Polar Weeks which reach hundreds of school children all over the world. Other outreach activities include Frostbytes and social media activities (e.g. Reddit blogs twitter). APECS is an example of how a community-based and community-driven group can achieve broad international recognition and can serve as a model for future organizations aiming to engage early career scientists in a meaningful and lasting way.

Antarctic education: recent advances and future challenges in stimulating polar education

Xavier, Jose

Marine and Environmental Research Centre (MARE) Department of Life Sciences
University of Coimbra 3001-401 Coimbra Portugal and British Antarctic Survey
Natural Environment Research Council High Cross Madingley Road CB3 0ET
Cambridge United Kingdom

jccx@cantab.net

Gerlis Fugmann, Association of Polar Early Career Scientists (APECS) UiT The Arctic University of Norway Norway; Inga Beck, Heidelberg University Institute of Geography Berliner Straße 48 69120 Heidelberg Germany; Gary Wesche, Polar Educators International (PEI) ARCUS 3535 College Rd. Suite 101 Fairbanks AK 99709-3710 USA; Jenny Baeseman, Scientific Committee on Antarctic Research c/o Scott Polar Research Institute Lensfield Road Cambridge CB2 1ER United Kingdom; Louise Huffman, Ice Drilling Program Office Dartmouth University Hanover New Hampshire USA

Like the Arctic the Antarctic is famously associated with extreme temperatures ice snow legendary explorers penguins and other impressive fauna and flora. The past decades have witnessed a revolution in the amount of data collected in the Antarctic with considerable advances in the knowledge of numerous areas. Educationally the Antarctic can be the perfect vehicle to transfer educational concepts but unfortunately the evaluation of the impact of educational activities related to polar is scarce. This presentation aims to address how to best evaluate educational activities while providing a general review of the importance of the Antarctic educationally give examples of major advances and discuss how different organizations and programs have been acknowledging the role of Antarctic education and Outreach in Antarctic affairs. The Polar Educators International (PEI) the Association of Polar Early Career Scientists (APECS) and the Scientific Committee on Antarctic Research (SCAR; SCAR Capacity Building Education and Training advisory group along with their science research programs (e.g.: SCAR AnT-ERA SCAR EGBAMM)) have been active particularly in organizing and supporting workshops and formal/informal educational initiatives (e.g. PEI master Class APECS Webinars) along with scholarships for early career scientists. From an Antarctic Treaty System (ATS) perspective Parties have recognized the relevance of education and outreach by the establishment of an Intersessional Contact Group on Education and Outreach. Under such level this presentation will also aim to report the most recent developments at ATS and identify links with the various stakeholders interested in Polar education and Outreach.

Theme 5: New Markets for the Arctic, including Trade, Tourism and Transportation



Silversea Silver Explorer at Monacobreen Glacier, Svalbard, 2015. (Gary Bembridge, Wikimedia Commons)

5.1 Arctic Tourism Futures



This session will look at where Arctic Tourism is now, and where is it headed in the future. In this session various aspects of Arctic Tourism, such as economy, culture, environment, governance and experience, will be presented and afterwards discussed in the form of a panel discussion. The session is organised by the UArctic Thematic Network on Northern Tourism.

The session is closely linked with the session 5.2. Arctic Tourism: the interplay between supply and demand, culture and environment.

Convener: Patrick Maher, Cape Breton University, Canada

Development of nature-based tourism in the Russian Arctic in the context of limited environmental potential

Gavrilov Yuriy

State Research Center "Arctic and Antarctic Research Institute", St.Petersburg,
Russia

yuriy.gawrilov@yandex.ru

Russian Arctic is a region of great importance for our country, as it was stated in the national Arctic zone development strategy for the period until 2020. The strategy points to the need of comprehensive measures for social and economical development of Arctic. Tourism is considered to be one of the instruments to support the region's economy. An example of such a development is Western Arctic, where tourism is an important social and economical factor. These regions are visited by more than 1 million persons/per year. No accurate statistics on the visitors number to the Russian Arctic is available today. We can compare the two neighboring Arctic Archipelagos: the Norwegian Svalbard is visited annually by more than 80000 tourists, the Russian Franz Josef Land - by approx. 1000 people. Such a great difference in the number of visitors is not due to low attractiveness of the Russian Arctic territories. Tourist companies are showing great interest to operations there. Many natural and historical objects existing there can be considered as tourist destinations. The reason consists in lack of transport network, destroyed infrastructure, sufficient amount of border points, bureaucratic bars hampering advance planning. Among the factors limiting the economic activity, special attention in all the Arctic regions is paid to ecological capacity of landscapes. Arctic desert and Arctic tundra ecosystems are referred to Arctic landscapes. They are characterized by low environmental potential and, as a result, by low recovery capability. Polar biota is adapted to the extreme conditions characteristic for this region, with large temperature and lighting amplitudes, and to snow and ice action. The fragility of these ecosystems is caused by the absence of natural reducing agents - flowing waters. The heat to moisture ratio is one of the most important characteristics defining the hydrothermal stability of an ecosystem. Extreme values in such a relationship determinate the small range of polar biota tolerance. Poor biodiversity sometimes alternate with its almost complete absence. Among the most important issues related to anthropogenic impacts on the region is the problem of waste accumulation and disposal and soil disturbance. Even modern waste disposal programs often breaking the already damaged ecosystems. This example demonstrates the importance of regulation and careful planning of any economic activity in the Arctic zone. Tourism is no exception. Return of the state to the Arctic is opening prospects for rehabilitation, empowerment of its infrastructure and development of social and nature-based projects.

Guk, Elena

Department of Regional Policy and Political Geography Institute of Earth Sciences
Saint Petersburg State University; 10-ya liniya V.O. 33-35 room 80 199034 Saint
Petersburg Russian Federation

elena.guk@gmail.com

Dr. Tatiana Isachenkom & Prof. Dr. Dmitrii Sevastianov; Department of Regional
Studies and International Tourism Institute of Earth Sciences Saint Petersburg State
University

In 20th century many new industrial areas had been developed in the Arctic. One of the largest Soviet mining plants was supported by planning of Norilsk and now it's the second most populated city in the Arctic estimated as one of the most polluted settlements in the world. Remoteness of the area in combination with hazardous climate and industry caused emergence and development of specific tourism and recreational practice around Norilsk. Field research has identified different forms of outdoor recreational activities and facilities in Norilsk Region. It has been found that tourism and recreation market in the region can be divided into two segments. The first is «mass-market»: recreational camps holiday homes and activities in more or less polluted area near Norilsk – designed for and used by locals. The second is «elite» aimed mainly at non-local tourists – visiting Putorana Plateau. The UNESCO world heritage site Putorana is attractive tourist destination in Norilsk Region which however majority of Norilsk residents cannot afford to visit due to travel costs and limited accessibility. Transport connection of Norilsk with other regions of Russia remains strong travel limiting factor due to insufficient capacity and expensiveness. Consequently incoming tourism is rare and local tourism and recreation is on demand in Norilsk Region although the quality of environment both natural and built degrades with proximity of the certain recreational area to Norilsk Nickel plants. Outdoor recreational practice remains an essential part of everyday life and determinant of well-being of Norilsk inhabitants not only due to its importance for healthcare but also because of underdevelopment of urban environment. The further discussion is aimed at possible ways of sustainable development of Norilsk: how to balance quality of healthcare and free time of locals regional economic development (including tourism) and quality of natural and built environment in the region.

Arctic touring and a problem of presentation of North Siberia outcrops of mammoth fauna

Kiselev, Gennady

Institute of Earth Science SPbSU 16 Liniya 29 Saint-Petersburg 196178 Russia

g.kiselev@spbu

Uncommon paleontological specimens and collections of fauna and flora were announced as cultural values (UNESCO 1970 1972; Decision of Government of Russian Federation 1993 2001). The first commercial fossils of Russia were skeletal remnants of *Mammuthus primigenius* from “frozen earth” of North Siberia which were very value at China Middle Asia and Europe. Remnants of mammoths bisons and coelodonta are known from frozen earth of different localities of Russian Arctic. These representatives of animal of Ice-Age to be of interest for paleontologists and for tourists too. Very important for researches are mummies of baby of ancient pleistocene animals slab with fragments of tissue and skin hair cover with remnants of microbiota and fragments of flora in stomach. These findings can get an opportunity use preservations of cells structures for reconstructions and for an attempts for cloning of ancient animals. Outcrops of animals of Ice-Age are a paleontological natural heritages. These outcrops are very interesting for tourists and for business men (‘hunters for fossils’) are using fossils as a souvenirs in trade them to a private collections or use mammoth tusk and tooth as a substitute ivory. Paleontological collections of mammoth fauna are collected from outcrops by a private persons (“hunter for fossils”) without an official licence and they have infringed a scientific methods of collecting of fossils. In this occasion taphonomical and paleoecological scientific information are destroyed and outcrops of mammoths are disappeared. These unique outcrops were announced as national heritages of Republic Sakha (Yakutia) for a keeping of scientific information about Ice-Age biota and was created The Mammoth Museum at city Yakutsk which was visited by more than five hundred tourist groups since 2014 year. Summary The report deal with a discussion concerning of mammoth subjects as a scientific objects or an element of “paleoart” souvenirs and material for a trade and business.

Barguzinsky Nature Reserve: educational tourism development from the perspective of centennial management

Luzhkova, Natalia

Federal State Establishment "Zapovednoe Podlemoye" Lenina st. 71 Ust-Barguzin
Republic of Buryatia Russia

gbt.international@gmail.com

Sergey Sedykh, V.B. Sochava Institute of Geography SB RAS Russia

Barguzinsky Nature Biosphere Reserve is the first protected area in Russia most of human activities are strictly forbidden here. Established on the northeastern shore of Lake Baikal in 1916 it has gone through functional and territorial changes. During the past decade educational tourism has become a priority. After historical and geographical analysis of conservation efforts this function can be justified in certain areas. The research goal is to demonstrate tourism possibilities from perspectives of long-term management. Objectives are analysis of territorial changes mapping of infrastructure and routes assessment of visitor preference justification of new recreational sites. We used the map and results of 1914-15 Doppelmayer Expedition as the basis because they contained original assessments of cultural and biological resources full area description materials on reserve foundation and infrastructure distribution. We analyzed five stages of boarder changes in 1916 1937 1951 1957 and 1987 reserve visitation during the Soviet period and recent years. Next we created an integrated map of infrastructure by overlapping modern maps with the Doppelmayer's map. Thus coastal educational tourism sites received full description including primary vegetation forest vegetation of Barguzinsky ridge original toponymical names and cultural constructions. Davsha Bay could become the main educational tourism center despite of boarder changes it had always been a part of the reserve. Tourists had visited the area since 1970s recently their annual number reached approximately 500. Two proposed trails here were a part of a historical route; their creation would have both environmental and historical meanings. Assessment of anthropogenic load over past decades allowed constructions additional trails and demonstration sites and reconstructions of traditional housing. Deep analysis of historical and geographical features supported educational tourism development by determination of priority sites and provision of supplementary information. Centennial management of Barguzinsky Nature Reserve showed possibilities for educational tourism in certain areas.

Tourism strategies in protected areas in Northern Baikal: Frolikhinsky Wildlife Sanctuary case studies

Luzhkova, Natalia

Federal State Establishment "Zapovednoe Podlemoye" Lenina st. 71 Ust-Barguzin
Republic of Buryatia Russia

gbt.international@gmail.com

Evgenia Bukharova, Federal State Establishment "Zapovednoe Podlemoye" Russia;
Andrey Razuvaev, Federal State Establishment "Zapovednoe Podlemoye" Russia;
Anastasia Myadzelets, V.B. Sochava Institute of Geography SB RAS Russia

Lake Baikal and wilderness of its northern shore attract thousands of international visitors every year. Here Frolikhinsky Wildlife Sanctuary is one of the most popular destinations with warm Ayaya bay glacial Lake Frolikha and coastal passes to Khakussy hot spring resort. Access limitations double management remoteness from administrations and lack of qualified staff on-site caused difficulties in complex ecotourism development. The goal of research was geo-ecological assessment of tourism opportunities. Objectives included analysis of management plans and existing infrastructure; soil vegetation and geosystem mapping establishment of monitoring sites and proposal of development scenario. In 2012 Federal State Establishment "Zapovednoe Podlemoye" (United Administration of Barguzinsky State Nature Biosphere Reserve Zabaikalsky National Park and Frolikhinsky Wildlife Sanctuary) started protection of the sanctuary and provided a long-term management plan. Active tourism with hiking biking trails and water routes around Lake Frolikha was the priority. Several methods (geosystem mapping botanical description soil sampling hiking trail assessment) were applied on seven recreational sites. We recommended constructing three sites improving four out of five hiking trails and building additional biking facilities on the trail linking Lake Baikal and Lake Frolikha. Two trails received priorities; we made detailed maps for their vicinities and established monitoring sites near paths. The development scenario fit in possible functional zoning and an integrated map showed priorities. As the land belonged to the regional forest service division its administration had to approve constructions as well. In the future "Zapovednoe Podlemoye" considers Frolikhinsky Wildlife Sanctuary as a cluster site of Zabaikalsky National Park. In this case the establishment receives full rights for area management and research results form foundation for ecotourism development. Frolikhinsky Wildlife Sanctuary has potential to become a popular destination with environmentally friendly tourism infrastructure in Northern Baikal.

Analyzing and Forecasting Tourism Indicators of Greenland with the Box-Jenkins Approach

Pflaumer, Peter

Department of Statistics Technical University of Dortmund 44221 Dortmund
Germany

peter.pflaumer@tu-dortmund.de

The Box-Jenkins forecasting approach has gained great popularity in the last decades. Applications can be found in many scientific fields such as geography economics and demography. This paper presents the results of an investigation to assess the utility of the univariate Box-Jenkins technique for analyzing and forecasting touristic time series of Greenland between 1994 and 2015. The variables include the number of international air and cruise passengers the number of hotel stays and guests and the number of rented rooms. The monthly numbers show strong seasonality within each year. There is no apparent trend in the data over the chosen period. Because of the seasonality we use seasonal ARMA (autoregressive-moving average) time series models for the analysis. In a seasonal ARMA model seasonal AR and MA terms predict forecasts at time t using data values and errors at times with lags that are multiples of 12. After the inspection of the plot we use the sample autocorrelation function (ACF) and the sample partial autocorrelation function (PACF) to specify the order of the ARMA model. It turns out that an ARMA(2 1) specification is appropriate for most seasonally adjusted variables. In the next step the parameters of the model are estimated by nonlinear least squares. With the chosen models it is possible to make short term monthly forecasts. The residuals from the fitted model are examined to see if the selected model is appropriate. The further into the future we forecast the more uncertain our forecasts become as indicated by the widening of the confidence interval at the longer lead times. Finally Box-Jenkins forecasts are compared with the accuracy of forecasts made with other traditional time series models. The accuracy of the Box-Jenkins model is better than the accuracy of the traditional time series models.

Safe Snow and Ice Constructions to Arctic Conditions

Ryynänen, Kai

Lapland University of Applied Sciences Jokiväylä 11 FI-96300 Rovaniemi, Finland

kai.ryynanen@lapinamk.fi

Snow and ice material are pure natural resources of the Arctic area. Snow and ice are also the key elements in winter tourism especially in the Nordic countries. In Finnish Lapland has a multitude of attractions that provide visitors unique arctic experiences in snow and ice constructed environments. In Finland snow and ice operator and builders usually are SME. There is lack of knowledge of using snow and ice as construction material. In Finland snow and ice structures are constructed and used according to uniform guidelines. Design and construction of snow and ice structures in Finland are described in guidelines such as the Design and Construction Guidelines for Snow Construction and the Snow and Ice Construction Guide. The basic principle in designing snow and ice structures is to ensure the safety of the people using the structures. Snow ice and slush can used a construction material within certain boundary conditions in compressive structures. In Finnish guidelines there is given type structures of snow and ice. Present type structures are walls breastworks towers arches vault and domes. Next step is to build a network of local and regional research institutions and adopt policies that allow for long-term and stable co-operation in snow and ice research. Aims are to strengthen the research knowledge in the field of snow and ice physics and to apply the outcome in the technological development and innovation of snow and ice construction. Aim is to draw out instructions and building regulations in other countries. Also aiming to find new types of snow and ice structures. New learning environments are developed through innovation activities and co-operation between educational institutions e.g. courses in snow and ice construction and snow physics. Next steps are to develop new innovations in snow and ice construction and to strengthen the opportunities for SMEs especially snow construction and tourism-based businesses.

Tourism as one of the most promising ways of the regional development of the Arctic Zone of Russia

Shimshek, Sergey

Moscow Academy of Entrepreneurship under the Government of Moscow 36
Planetnaya str. Moscow Russian Federation 125319

sf.shimshek@gmail.com

Elena Vorontsova, St. Petersburg University Russian Federation

During the last decade public interest in the Arctic was growing. Typically the attention of Russian and foreign scientists and media is focused on the problems of natural resources in particular oil. There is widespread recognition that the Arctic zone is a 'storehouse' of resources that must be extracted in the quickest way to improve the economic situations of the countries of the Arctic region. However the consensus view is that excessive exploitation of the Arctic resources may cause a number of complex ecological problems. So there is considerable debate about how to use natural resources in the Arctic with the greatest benefit and to avoid environmental problems at the same time. While there are clear advantages of oil extraction in the Arctic it is not the only way to use this unique region and the Arctic tourism is one of the activities that can be developed most effectively here and it is much more environmentally-friendly. Tourism in the Arctic zone of Russia plays a big role in positioning Russia in the international community. At the same time the Arctic tourism is an effective tool for sustainable economic development of the region. Therefore the development of the Arctic tourism requires clear state and municipal regulation support and control that can steer and accelerate its growth. Some years ago the Russian authorities decided to select the Arctic in a particular area where special attention to its management and development could be paid including the creation of a single legislative framework. A number of federal and regional programs of the development of the Arctic has been accepted since then. This investigation is devoted to the issues of the development of the Arctic tourism in the course of the regional strategies and that in reality.

The new Northern Lights tourism

Thorvaldsen, Steinar

University of Tromsø The Arctic University of Norway ILP Mellomveien 110 9037
Tromsø Norway

steinar.thorvaldsen@uit.no

This new kind of winter tourism started quite suddenly when nice pictures and videos started to appear over Internet. It was further initiated by some impressive TV-programs revealing “Nature’s own light show”. The tourist industry had to catch up and develop step by step to meet the growing demand. Today the volume is estimated to be around 500 000 tourists each year and about 20% use Tromsø and the North of Norway as their location. In the season 2014/15 the trade was close to 40 million euro for the Tromsø region. Much of the arctic regions are ideally located in the middle of the Northern Lights zone. Winter tourists can choose between Northern Lights cruise packages Northern Lights tours and Short Northern Lights breaks with stay at an “unforgettable” hotel and adventurous activities such as dog sledding snow mobile safari whale safari reindeer sledge & king crab fishing. The snowy wilds of Canada and Alaska are fine viewing spots but for many tourists it may be more affordable and convenient to fly to northern Scandinavia Iceland or northern Russia. It is possible to see the lights from late September to early April with October to November and February to March considered optimum periods. The Northern Lights (Aurora Borealis) is caused by solar winds that meet the atmosphere in a belt around the magnetic North Pole forming arches waves and curls of light moving across the sky with sudden rays of light shooting down from space. The activity is correlated with the sunspots with its well-known 11-years cycle and this fact will challenge the sustainability of this special kind of tourism. The industry will need more installations and centers to back up the arctic tourism. In Tromsø we are discussing to build a big “Northern Lights Globe” to support the tourist activity.

Arctic industrial tourism for sustainable development of the Northern cities (case study: Khibiny Mountains Murmansk region Russia)

Zaika, Yulia

Khibiny educational and scientific station Faculty of Geography Lomonosov Moscow State University Address: Zheleznodorozhnaya str. 10 184250 Kirovsk Murmansk region Russia

yzaika@inbox.ru

Today's Arctic gets more and more attention based on its profile shared through media: remote and cold place with extreme environments the "hotspot" of climate change. All these connotations within the identity of this place create the image which is actively consumed by the community. Along with its doubtless resource role Arctic is the polar region with a permanent human population which refers us to the sustainable development of local settlements and communities. The most part of Arctic settlements and cities depends on exploitation and extraction of resources. Murmansk region as one of the heavily industrialized Arctic regions is not an exception. The well-known model of Northern extractive industries and communities is a single-industry city with a low diversification of economy. Along with active resource extraction (like mining fishing etc.) regional tourism is considered as a driving force for local economy. The fragile Arctic environment is drastically damaged by extractive industries and is additionally disturbing by "wild" and "unorganized" tourism. Tourism management planning organization and proper branding are the key elements. According to the interviews with the local communities and tourists industrial infrastructures and damaged ecosystems can be seen as the very specific promotional factor of attraction complementing the "harsh" connotation of the Arctic. Thus along with the nature-based and heritage tourism industrial tourism can be seen as one of the local economic drivers. Natural attributes as Arctic-Alpine environments changing landscapes along the Murmansk region from taiga to Arctic tundra Polar days and nights together with indigenous history and communities; and industrial complexes and enterprises can be taken as economically viable region's brand.

5.2 Arctic Tourism: The interplay between supply and demand, culture and environment



This session will cover topics related to Arctic Tourism: how is such tourism developed, managed, and governed in relation to both cultural and environmental spheres? What are tourists looking for in the Arctic (demand) and how does the industry deliver that (supply)? The session will critically question the sustainability of tourism in the Arctic region in relation to a variety of cultural and environmental resources, and the sustainability of the Arctic tourism experiences in relation to both consumption and production. The session is organised by the UArctic Thematic Network on Northern Tourism.

The session is closely linked with the session 5.1 Arctic Tourism Futures.

Convener: Patrick Maher, Cape Breton University, Canada

Gostyaeva, Maria

Ural State University of Architecture and Art 23 K.Liebknecht str. Ekaterinburg
620075 Russia 240/10 Lunacharskogo str. Ekaterinburg 620026 Russia

maria_gostyaeva@mail.ru

The paper presents the idea of ‘protecting by consuming’ by the means of tourism industry coupled with design expertise. Based upon research in indigenous communities of Western Siberia and Northern Urals the team of researchers from the School of Arctic Design suggests using the growing sector of Arctic tourism as a test bed for developing a comprehensive – environmentally and culturally appropriate – lifestyle for short-term visitors of the region. This task serves as a professional challenge: designers do have means and methods to approach the North ethically i.e. to change the perception of the North from that of a severe and cruel area a “land of prison camps” as well as a “global storehouse of raw materials” to a mysterious and attractive “cold but hot country” “Earth with skin and hair” with supernatural treasures “under seven layers of permafrost” (Golovnev 1995). In fact design professionals are uniquely placed to reveal and explore the potential of the material world to shape the forms of human existence: from conquering to respect. The research opens a new transdisciplinary track in the Arctic studies by the comprehensive consideration of successful adaptation of Arctic indigenous people i.e. their ways of dealing with severe natural conditions through life support systems embodied in man-made things. The potential of this kind of comprehensive approach coupled with design has not been explored before in addressing diverse environmental social and cultural challenges related to the sustainable development of the Arctic Region. By applying indigenous vision of mobility to the tourism sector it is aimed to come up with future-looking innovations e.g. new tour itinerary infrastructure mobile shelters and energy-efficient vehicles. Also it will contribute to the development of the sector of Arctic tourism enabling experience- and value creation. The primary fieldwork method is participant observation which relies not on words and conversations but mainly on actions.

Legutko, Agnieszka

Cracow University of Economics Address to contact with author: Wroclawska 66/13
30-017 Cracow Poland

legutko.a@gmail.com

Arctic has attracted people for centuries. Polar tourism has its roots in 19th century when first trappers started to organize expeditions. It developed to mass tourism thanks to steamships and later due to a better technologies turn into longer season and higher latitudes. Nowadays Arctic is more and more promoted open and reachable too. Growth of interest with this area is a combination of numerous factors such as environment politics cultures and economics as well. At the beginning of 21st century demand in the polar tourism has peaked. Variety of available options from luxury cruise ships up to small ecotourism expeditions are possible. Development of this industry is often a blessing – a simply good business opportunity for communities that struggles with an unemployment and remoteness. On the other hand many negative impacts are recognized in the discussion. The aim of the following paper is to discuss changes in Svalbard economy due to growing tourism market for a specific economic structure of the archipelago. Author starts with short presentation of historical changes – from hunters and whalers throughout boast in coal industry up to current situation when tourism and research take lead. The changes that occurs due to the growing number of tourists such as rebuilding cities developing infrastructure and new initiatives in small business are discussed. Paper differentiates tourist groups and its activities. It presents economic data considering growth of the region population and income changes and its influence on inhabitants and environment. Thanks to combining both quantitate analysis and empirical data gathered during author's research in Spitsbergen in summer 2015 paper answers research question what are the benefits and cost of growing tourism in Svalbard and how does it affect archipelago economy.

Tourism in Arctic area

Nikitina, Elena

Nenets agrarian economic technical school Narayn-Mar Russia

alena.elenanao@yandex.ru

Abakarova Kistoman, Nenets agrarian-economic technical school narya-Mar Russia

We live behind the Polar Circle and It is very interesting to visit our region to see reindeer races snowbikes races visit chum and shaman to take part in Ski hiking for 200-300 km without any houses or to visit nenets festivals and see traditional dances. Welcome!

Cruise tourism activities in the Barents Sea: local communities' perspectives and governance

Olsen, Julia

Nord University Postboks 1490 8049 Bodø Norway

julia.olsen@nord.no

Karin Wigger, Nord University Marta Bystrowska University of Silesia

The melting Arctic opens potential for cruise tourism development. The Russian Barents region due to its favorable climatic conditions offers multiple travel opportunities along the coastal areas. The literature review on 'shipping activities in the Barents region' indicates that the impact of such cruise activities on local coastal communities has not received much attention yet. A few studies discuss that cruise activities can create opportunities to the region and may for example result in the development of Arctic town-ports and the improvement of search and rescue facilities. Despite those opportunities leading to socio-economic improvements an increase in cruise activities may affect the well-being of coastal communities. Cruise ships bring a great amount of visitors to small coastal communities and may put traditional resource management at risk. For example more access to imported goods and possible trade with local natural resources (e.g. berries fish and reindeer) may add new challenges to indigenous communities that are already adapting to climatic environmental and economic changes. This paper discusses opportunities and risks associated with cruise tourism activities for local communities in the Barents region from governance perspectives. The discussion is based on the outcomes of the interviews with local and regional stakeholders (representatives from local communities and tourism sector) from the Barents region. We will analyze the translation of local values and knowledge in the development of national and international cruise tourism guidelines and shipping regulations in order to maximize the benefits and minimize the negative impact from cruise activities. A special focus is given to local communities' engagement and participation in the decision-making processes.

Risk reduction as a result of implementation of the functional based IMO Polar Code in the Arctic cruise industry

Solberg, Knut Espen

GMC Maritime AS/University of Stavanger Clipperveien 4 Buøy Stavanger Norway

knut.espen.solberg@gmc.no

Ove Tobias, Gudmestad University of Stavanger Norway

Purpose: Investigate possible reduction of risk in the part of the cruise ship industry that has Arctic destinations as a result of implementation of the IMO Polar Code. Background: IMO has developed the functional based Polar Code which will enter into force 01.01.2017. The code requires marine operators to provide lifesaving equipment that ensures a minimum of 5 days survival time. This requirement puts additional strain on the existing life-saving appliances. AECO conducted a table top exercise in Iceland in April 2016. The exercise explored the availability and response time for responders in case of an Arctic cruise ship incident. The exercise was conducted as a joint venture between major expedition cruise ship operators (AECO members) and responders including relevant coastguards and emergency coordination centers. The fullscale SARex exercise is to be conducted in the marginal ice zone North of Svalbard. The exercise is to explore the gap between conventional SOLAS approved safety equipment and the functionality of safety equipment required by the IMO Polar Code with a special focus on the minimum 5 days survival time requirement. The exercise is a joint venture between the University of Stavanger and the Norwegian Coast Guard. Methodology: Based on the AECO table top exercise and the SARex exercise this paper is to assess the effect of the IMO Polar Code on the risk picture associated with cruise activity in the Arctic region. This includes assessment of challenges associated with: Cold climate evacuation, Evaluation/survivability when utilizing different types of personal survival equipment, Evaluation/survivability when utilizing life raft versus life boat, Evacuation from survival craft to rescue vessel. The findings are to be assessed in the light of the search and rescue resources available in the Arctic region in addition to the IMO Polar Code functional requirement of minimum 5 days survival time.



This session, consisting of two sub-sessions, aims to problematize the strategic interplay among regional and local governments, small and medium enterprises (SME) and local indigenous and non-indigenous communities. There will be presentations from different disciplines including but not limited to political science, economics, and business studies as well as employing different methodological approaches. The session aims to combine a macro- and a micro-perspective on the relationship between context, strategies and plans.

5.3.A The role of local and regional strategies, plans and budgets

The main interest of this session is to investigate how local politicians and administrative officers develop strategic planning and budgeting practices. Issues of changes in attitudes of local politicians and administrative officers towards transparency regarding access and use of resources will be also addressed. Contributions addressing the impact of planning and budgeting practices on the quality of and needs for local welfare production are welcome too. Presentations in this session are related to Local governments budgeting reform in Russia's local governments – implications and tensions (2012-2016) BUDRUS project, funded by the Norwegian Research Council.

5.3.B The role of place in Northern SME-business strategies

This session will focus on the different ways that Northern SMEs engage with local communities in their business strategies in order to manage place-related challenges associated with operating in rural, northern contexts. More specifically the focus is in how SMEs relationships to places or place-strategies influence the resilience of SMEs and communities over time as well as the performance and viability of SMEs over time. Some of the topics in this session look at SMEs place strategies and their effects on the development of human capital, flexibility and dynamic capabilities as demonstrated in managing major crisis and upheavals.

Conveners:

Anatoli Bourmistrov, Nord University Business School, Norway

Svein Tvedt Johansen, UiT The Arctic University of Norway

Aleksandrov, Evgenii

Business School, Nord University, Norway

This explorative study seeks to contribute to a growing literature on the global travel of participatory budgeting (PB) on the example of one Russian municipality. The selected municipality is the pioneering city within the country to begin experimentation towards PB. The travel of PB idea is presented as a four-stage process, comprising the formation, design, implementation, as well as the achievement of results and further development. The empirical evidence is gathered through sixteen semi-structured interviews, document search, and observations. The paper fits in impeccably well with the prior research, showing a great deal of heterogeneity of PB experiences worldwide. Having emerged in the studied municipality in a rather normative manner from the research unit, PB attracted attention of decision-makers at the federal level, becoming a promising and legitimate practice that has been taken up by other municipalities across the country. Providing the paucity of rigorous research on PB in the Russian context, the paper brings its travel on the example of one pioneering municipality into the international arena for the purposes of cross-national comparisons and raises concerns about further development of PB in Russia.

Gestsson, Helgi

University of Akureyri Faculty of Business Administration Nordurslod 2 600 Akureyri
Iceland

helgig@unak.is

Ogmundur Knutsson, University of Akureyri Iceland; Markku Vieru, University of
Lapland Finland; Lenita Hietainen, University of Lapland Finland; Svein Tvedt
Johansen, UiT The Arctic University of Norway

Northern SMEs often work out of and in small communities in sparsely populated regions. Such firms often become the first victims of prolonged economic crises due to limited Financial Resources. In many cases such firms share a fate-dependency with the community in which they operate. The community depends on the company for work whereas the company depends on the community for the social infrastructure that enable firms to operate and attract employees to the region in the first place. SMEs differ with respect to how they view the relationship between the firm and local communities. Some firms see the firm and communities as tightly interwoven whereas others see the firm and community as clearly separated. Drawing on a series of interviews with Icelandic Norwegian and Finnish firms we look at how firms' construal of and relationships to local communities shape the firms responses to the crisis. The interviews feature examples from Iceland Norway and Finland with an emphasis on the Icelandic banking crises. In the paper we argue that SMEs relationship to their local communities influence reactions to crises in three ways: (i) First SMEs relationship to their local community influence the goals and values that inform the responses. (ii) Second SMEs relationship to their local community form a more or less explicit compact between the firm and the community that help coordinate transactions between the SME and community representatives. (iii) Third relationships also imply goodwill and trust that enable SMEs to activate a more diverse set of resources thus allowing SMEs more leeway and a greater flexibility in responding to the crisis. In the paper we relate such SME-community relationships to the literature on dynamic capabilities and threat rigidity and show how social capital in the form of local relationships form an important component of dynamic capabilities for rural Northern SMEs.

SME in Sakha Republic: The Challenges of the North

Grigoryeva, Anna

North-Eastern Federal University Institute of Finances and Economics Department of Economics and Industrial Management 677000 Yakutsk Pr. Lenina 1 Room 513

lectures.mgmt@yandex.ru

Companies operating in the North encounter numerous problems that are place-defined. Among the most important challenges faced by the businesses in one of the northern regions of Russia - the Republic of Sakha (Yakutia) - are relatively small market size low population density uneven economic development of the region lack of infrastructure seasonal logistics high transportation and energy costs extreme temperatures liquidity problems etc. While larger companies may have a wider range of instruments to solve these problems small and medium-sized enterprises are often limited in the choice of solutions and business strategies. At the same time they are much more flexible which supplies them with a greater resilience and closer ties with the local communities. This study is to provide an overview of the challenges faced by people managing small and medium-sized businesses in the Republic of Sakha (Yakutia) and define the approaches that Yakutian SME use to cope with the place-specific constraints. The aspects explored are the general role of SME and its place in the social and economic structure of the regional business system; opportunities challenges and issues facing Yakutian entrepreneurs; skills necessary to successfully develop operate and manage a small business venture in Republic of Sakha (Yakutia).

Staying local and flexible; compatible tasks or a contradiction in terms?

Johansen, Svein Tvedt

School of Business and Economics Campus Harstad UiT - The Arctic University of Norway

svein.t.johansen@uit.no

Markku Vieru, University of Lapland Rovaniemi Finland; Lenita Hietainen, University of Lapland Rovaniemi Finland; Ogmundur Knutsson, University of Akureyri Akureyri Iceland; Helgi Gestsson, University of Akureyri Akureyri Iceland

A major challenge for many northern SMEs is how to achieve flexibility to adapt to changing market conditions. Industries such as fisheries or tourism tend oscillate between strong demand and high prices and the opposite and SMEs must align capacity and product-lines in order to make a profit or even survive. Organizational slack is often seen as a mean to achieve flexibility yet Northern SMEs typically have very little slack in the form of excess resources. Northern SMEs moreover often operate out of small local communities with few alternative means of employment. Embeddedness and long-term commitments to local communities are often seen as impediments to flexibility yet in our paper we describe based on a study of Northern Norwegian Finnish and Icelandic SMEs how embeddedness and local commitments in some cases lead to more not less flexibility. We first describe how Northern SMEs differ in their views of as well as ways of interacting with local communities and argue that such differences affect how SMEs handle market variation and instability. More specifically we suggest that SMEs commitments to local communities or what we refer to as a “build” strategy can create greater flexibility by leading companies to adopt a longer and strategic perspective that guides investment in human capital and production facilities. Investments in human capital create a highly skilled and knowledgeable workforce capable of alternating between different production lines. Such investments also build social capital and trust which further enhances communication and coordination between employees and employees and managers/owners. While such investments often take the form of local improvisations or bricolage such decisions are informed by a clear sense of identity and purpose that help ensure consistency over time and between decisions. The paper finally looks at implications for further research and practitioners.

Comparison of public sector reforms in Murmansk and Leningrad regions: the implications of contexts and actors

Khodachek, Igor

Business School, Nord University, Norway

Anatoli Bourmistrov, Business School, Nord University, Norway

Authors present a comparative study of two Russia's regions - Murmanskaya oblast' and Leningradskaya oblast'. The focus is made on regional governance and public sector reforms within the period since 2004 until 2016. Recent research on public sector reforms shows the impose of power and the seek for legitimacy as well as the resilience of traditional accounting instruments and their contradiction with New Public Management ideas as the main sources of changes. In this study authors search for other drivers that seem to shape and force changes on the regional level. These can be the actions of transnational corporations and federal players such as military and financial authorities as well as initiatives of regional politicians and executives.

Kuznetcova, Viktoria

Deputy Chairman of the Committee for Economic Development and Investment
Activity of Leningrad Oblast

Russian strategizing before 2014 demonstrated the diversity of approaches and schools of thought. The other side of the coin was little focus on the implementation that led to the 'devaluation' of public strategies. The federal law #172 "On strategic planning in the Russian Federation", adopted in 2014 sets the normative framework for public strategies: 6 and 12 years planning cycles, rigid system of links between planning documents as well as state budgetary programs as a mean of implementation. Due to the federal construction of state governance, Russia's regions receive a sufficient level of autonomy in strategic planning. In 2015, the Leningrad region has developed its 2030 strategy - within the guidelines of the federal legislation, but bringing in significant innovations. The new strategy demonstrates a shift from classic competitive regional strategy in the Porter's terms to the kind of corporate type of strategy. It defines realistic priorities and makes a strong focus on the implementation, employing project management methodology to track key regional development projects. Besides, the document addresses regional governance reform as an essential mechanism of enhancing the effectiveness and efficiency of regional government as well bridging the strategic and the operational levels of planning.

Mineev, Andrei

Nord University Business School High North Center for Business and Governance
8049 Bodø Norway

andrey.mineev@nord.no

The circumpolar areas belong to different national regimes, and information on social- economic issues and business development has been dispersed and not easily available. Business Index North will contribute to filling the knowledge gaps by developing a comprehensive, comparable and regular information and analytical tool on socio-economic issues and business developments in the circumpolar areas. The annual overview and analysis will highlight new opportunities, and - more importantly – identify challenges associated with, as well as barriers to further developments in the Arctic regions. Business Index North will establish a recurring, knowledge-based, systematic information tool for stakeholders on Arctic business development. The project will facilitate coordination between stakeholders in the different circumpolar nations whilst aiming for identifying and developing mutual benefits in order to strengthen cooperation in the High North, both between nations and stakeholder groups.

Experiences from a regional cluster project in Northern Norway and possible implications for Russia

Mineev, Andrei

Nord University Business School, High North Center for Business and Governance
8049 Bodø Norway

andrey.mineev@nord.no

Stimulating regional cooperation through various network and cluster initiatives became a recognized practice in Northern Norway in the light of the state Policy for the High North. The underlying idea is integration of local SMEs in new or existent supply chains. Often subsidized by the state the initiatives are implemented in coordination with larger companies and regional authorities. Such “policy-induced” networks are widely applied in OECD regions as a tool to build regional business capacity. A prevailing opinion is that local companies who are often small and inexperienced in relation to new markets should join forces if they want to survive in business becoming inevitably global. My paper highlights experiences from a cluster project implemented in Northern Norway in 2012-2015. The ambition of the project was to build capacity of local companies with regard to high requirements of the petroleum industry. Together with opportunities for local businesses such projects are inevitably associated with challenges. Managers of participating SMEs normally experience time pressure from their day-to day business lack time for development work as well as have various expectations to the projects. At the same time to build strategic relationships the cluster project had to be planted in a nest of links with important other organizations and grew in member mass. Increased relational complexity diversity of expectations and time deficit together make management of such projects a difficult affair. Given this background I identified several success factors for development of similar projects. First the cluster has to be built where political interests are counter-balanced by strong entrepreneurial motives and supported by an idealistic broker. Second the development process should be of organic nature based on the participants’ free will and willingness to accept uncertainty. Third the project should maintain multiple identity in relation to expectations of the heterogeneous actors around the setting. Implications for using the North-Norwegian cluster experience in Russia are also outlined in the paper.

Summary and reflections for future research

Mouritsen, Jan

Copenhagen Business School, Denmark

A dilemma associated with budgetary reform programs is that the aspiration to unlock local initiative and innovation by delegation of responsibilities for broad strategic results is that specification of such results has stopped innovation and initiative. While the program of NPM has the ambition to make local manager and institutions more of a set of actors who can influence the properties of the local by integrating wider and narrower issues and concerns, it seems that the NPM program it has turned these actors into puppets on a string. This has happened because the targets have become detailed and many. Therefore actors cannot make trade-offs.
What would it take to make NPM more interested in developing the socio-economic status of a space? It does not mean to refuse targets but it may mean that targets should be make more a dialogue with the socio-economic concerns they are understood to help bring about. In this sense targets are understood to make strategy more vibrant. This may happen by learning from the so-called promissory economy. This is a economy where it is accepted that any target requires new investments and efforts by many parties and that the target cannot pre-empt all the things that have to be made to fulfill promise. This invites the proposition that targets, since they are incomplete, may be accorded a more tentative role in order to be more interesting for a wider development of socio-economic relations. The tension in this approach is that part of the process is to find out whether the target is a good one or whether, by learning about things while they happen, other targets may also be relevant.

Sustainable development of ecosystems and local communities in the industrial development of the Arctic regions (at least of activity of OJSC "Almazy Anabara" in Oleneksky Evenki national district in the Sakha Republic (Yakutia))

Potravny, Ivan

Plekhanov Russian University of Economics, Chair "Management of Projekts and programms"

ecoaudit@bk.ru

In "the Fundamentals of state policy of the Russian Federation in the Arctic for the period till 2020 and further perspective" (2008) the territory of the far North is regarded as a strategic resource base development. In recent years, there is a process of active industrial development of the territories, including the lands of compact residence of indigenous peoples of the North. Therefore, the development of mechanisms of interaction of business with indigenous peoples of the North in industrial development of territories. Thus one of the tools to reconcile the interests of the target groups in the field of traditional nature use is an ethnological examination of projects. Currently on the territory of the Republic of Sakha (Yakutia) in the stage of substantiation, development and implementation of a number of projects for the industrial development of territories in the Arctic zone, one way or another affect the interests of the indigenous peoples of the North in the exercise of their traditional economic activities. Such projects include the following extraction of rare earth metals at the Tomtor Deposit; development and production of alluvial diamond field on the moon; prospecting, exploration of oil and gas, oil and gas manifestations in the Arctic zone on the territory of Oleneksky Evenki national district; exploration and mining of alluvial diamonds at the field Talagtag, of Bolshaya Kuonamka river; prospecting and production of alluvial diamonds in the concession area at the Malaya Kuonamka river, etc. In 2015 the JSC "Almazy Anabara" acted on its own initiative with a proposal to conduct research on the impact of changes on original habitat and socio-cultural development of indigenous minorities of the North in the area of operations in the Malaya Kuonamka river on the territory of municipal district "Oleneksky Evenki national district". It should be noted that OJSC "Almazy Anabara", a subsidiary enterprise of OJSC ALROSA, the largest company in the world, the world's leading diamond mining at alluvial deposits. In the presentation and the report will show the methodology, procedure of research on the subject in order to ensure sustainable development of ecosystems and local communities in the region, reviewed the results of the assessment of possible losses to the users of land and other natural resources in places of traditional residence and traditional economic activities of indigenous minorities of the North. Will be presented the results of sociological and ethnographic research on the problem. Main purpose of the presentation and report is to develop the development of a mechanism to coordinate the interests and needs of different target groups in the industrial development of the territory, including the mechanisms of compensation of losses and sustainable development of the territory under consideration, will be proposed scheme of interaction between target groups when assessing the impact of planned industrial development of territories of traditional nature use of indigenous numerically small peoples of the North.

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