

Permafrost Dynamics and Indigenous Land Use

Helsinki, 6-7 April 2014 (in connection with the Arctic Science Summit Week)



Programme and abstracts

The IASC Workshop "Permafrost Dynamics and Indigenous Land Use" will take place on the afternoon of Sunday, 6 April, and the morning of Monday, 7 April, as a fringe meeting of the Arctic Sciences Summit Week in Helsinki. The room has the name "MARE" and is located in the building of the Finnish Meteorological Institute (DYNAMICUM), Erik Palménin aukio 1, Helsinki, 00560 Helsinki, Finland. Additional info on the venue can be found on http://www.assw2014.fi/?page=venue

Should you have any questions, address them to Otto, please: https://habeck@eth.mpg.de We look very much forward to the workshop and to meeting you in Helsinki.

Programme

SUNDAY, 6 APRIL 2014

14:00 h - 15:30 h: SESSION 1

14:00 h Short Introduction (J. Otto Habeck and Hiroki Takakura)

14:15 h Fedorov Alexander Nikolaevich Melnikov Permafrost Institute, Russian Academy of Sciences, Yakutsk, Russia "Permafrost response to recent climate change in Central Yakutia"

14:40 h Crate, Susan George Mason University, Fairfax VA, United States "Addressing Adaptive Challenges: Viliui Sakha Perceptions, Understandings and Responses to Permafrost Change"

15:05 h Hiyama Tetsuya Research Institute for Humanity and Nature, Kyoto, Japan "Social adaptation to the changing water environment under recent climate warming"

15:30 h - 16:00 h: COFFEE/TEA BREAK

16:00 h - 17:30 h: SESSION 2

16:00 h Desyatkin Alexey Romanovich Institute for Biological Problems of the Cryolithozone, RAS, Yakutsk, Russia "Thermokarst ecosystem cycles depending on climate change" 16:25 h Desyatkin Roman Vasil'evich Institute for Biological Problems of the Cryolithozone, RAS, Yakutsk, Russia "Retrospective analysis and forecast of alas landscapes development in Central Yakutia"

16:50 h Ksenofontov Stas Dept of Geography, University of Zurich, Switzerland "Climate change and its impact on rural population of Central Yakutia"

17:15 h General discussion and wrap-up of the first day

MONDAY, 7 APRIL 2014 09:00 h – 10:30 h: SESSION 3

09:05 h Iijima Yoshihiro Research Institute for Global Change, JAMSTEC, Tokyo, Japan "Fine scale mapping of permafrost and forest degradation using ALOS images"

09:30 h Habeck, Joachim Otto Max Planck Inst for Social Anthropology, Halle, Germany Social-scientific approaches to studying the history and future of land use in alas regions

09:55 h Takakura Hiroki Center for Northeast Asian Studies, Tohuku University, Sendai, Japan "The interaction of permafrost dynamics with the arctic adaptation in Siberia: some thoughts on the historical possibilism and the environmental constraints"

10:20 h: GROUP PICTURE 10:30 h – 11:00 h: COFFEE/TEA BREAK

11:00 h - 12:30 h: SESSION 4

11:00 h Lantuit, Hugues / Romanovsky Vladimir / NN Presentation by representative(s) of the International Permafrost Association

11:25 hMészaros CsabaHungarian Academy of Science, Budapest, Hungary"Alaas or hayfield? Changes in the use and perception of alaases in Central-Yakutia"

11:50 h Ulrich, Mathias Dept of Geography, Leipzig University, Germany "What is the history and the future of thermokarst in Central Yakutia?"

12:15 h: WRAP-UP OF THE WORKSHOP, PROSPECTS (approx. 25 minutes)

Crate, Susan scrate1@gmu.edu George Mason University, Fairfax VA, United States "Addressing Adaptive Challenges: Viliui Sakha Perceptions, Understandings and Responses to Permafrost Change"

The majority of responses to climate change effects approach them as technical problems. However, because humans interface contemporary climate change from every aspect – from being the main cause of the issue to being the only species that can bring about resolve - technology is only part of the solution. The issue must be addressed as an adaptive challenge and therefore requires the skills and specialties of the social sciences for resolve. This presentation shows how one major effect of global climate change, the unprecedented degradation of permafrost in the world's arctic and subarctic regions, presents an adaptive challenge for rural Viliui Sakha, Turkic-speaking horse and cattle agropastoralists. In addition to clarifying the breadth and depth of this adaptive challenges, the paper also illustrates both the unique contribution of anthropology to these ends and also the need for the discipline to be more pro-active about its role(s) in this issue.

Desyatkin Alexey Romanovich

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Institute for Biological Problems of the Cryolithozone, RAS, Yakutsk, Russia "Thermokarst ecosystem cycles depending on climate change"

Central Yakutia is the most populated region of Yakutia. This territory is characterized by typical taiga-alas landscapes. Bosikov estimated the presence of approximately 16,000 thermokarst depressions, known as *alas*, located in Central Yakutia lowland within the boreal forest region with a total area of 440,000 ha, and it covers up to 17 % of the total land area of Central Yakutia. Grasslands are widely distributed on these formations, replacing boreal forests during the *alas* development period. These grasslands are the basis for the indigenous community farming. Thermokarst ecosystems are extremely sensitive to changes in climatic conditions, primarily hydrological ones because alases are closed systems. Resizing of lakes and grasslands occurs, which directly affects the soil's hydrothermal properties within *alases*. Due to these changes the annual fluctuation of alas grassland productivity occurs. This in turn affects the emission of greenhouse gases and the whole carbon cycle within the thermokarst depressions. An important factor in the carbon cycle of *alases* is the anthropogenic influence, e.g. hay making. Thus, anthropogenic impact, in additional to the natural one, also puts pressure on these sensitive permafrost ecosystems.

Desyatkin Roman Vasil'evich

rvdes@ibpc.ysn.ru Institute for Biological Problems of the Cryolithopozone, RAS, Yakutsk, Russia "Retrospective analysis and forecast of alas landscapes development in Central Yakutia"

Features of landscape formation in Central Yakutia are closely related to the evolution of the Northern Hemisphere cryolithozone. Till the end of early Pleistocene (360 thousand years ago), this area was covered by broadleaf forest. The average annual air temperature (t°C year) was about 4°C. During the upper Pleistocene there was sharp cooling of climate, followed by mountain glaciation. In the middle Pleistocene (250-300 thousand years ago) permafrost began to form. Subsequently, there was an increase of area and depth of the cryolithozone.

Events which created the features of this region occurred in the late Pleistocene. Thus, about 60 thousand years ago began the Zyriansky glacial period. At this time, on the level of the Abalaakh plain, the accumulation of the ice complex under the domination of tundra-steppe landscapes took place (t°C year = -14-16°C). About 37 thousand years ago, this glaciation period was followed by the Karginsky interglacial period. However, significant degradation of the ice complex did not occur (t°C year went up to -12-14°C). 26 thousand years ago the Sartan glacial period began, it lasted until the Alleroed (11 500 years ago). At this time on the Tyungyulyu plain of Central Yakutia featured accumulated ice complex.

Climate warming between Pleistocene and Holocene led to the melting of ground ice, and development of the lacustrine thermokarst and formation of alases. From this time the thermokarst – slower in dry periods, and faster in wet ones – created the contemporary landscapes of Central Yakutia, where alases occupies 20-30% of the total area. In recent decades, in this area the warming of the climate has been marked, which led to the activation of thermokarst. Under continuation of this trend one may expect degradation of the ice complex and formation of new alas thermokarst depressions.

Fedorov Alexander Nikolaevich

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Melnikov Permafrost Institute, Russian Academy of Sciences, Yakutsk, Russia "Permafrost response to recent climate change in Central Yakutia"

The proposal of our studies is assessment of the modern climate change impacts on cryogenic landscapes as habitat. Recently, Central Yakutia is one of the most populated regions of the permafrost area and it is highly affected by climate warming. The simultaneous impact of anthropogenic and climatic factors is expressed most strongly. Under recent climate changes the cryogenic landscapes have changed dramatically. The main reason of transformation was the formation of dramatic shift of permafrost temperature in early 1980s. The reason of these changes is related to climatic conditions, a complex combination of air temperature, precipitations and snow cover changes. This temperature shift served as a basis for thermokarst activation, primarily on open grassland landscapes and fields. It has caused some imbalance in the land fund, as large areas of used land came out of order. In 2005-2008 due to the anomalous warm climate conditions in Central Yakutia, a second shift occurred, which exacerbated the already critical situation of cryogenic landscapes. This presentation will provide data about rate and extent of cryogenic landscapes degradation and suggest ways to optimize for the conservation of the socio-economic potential of the region.

Habeck, Joachim Otto

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Max Planck Inst for Social Anthropology, Halle, Germany Social-scientific approaches to studying the history and future of land use in alas regions

Against the backcloth of the workshop's rationale – to bring together different disciplines' research agendas in the study of permafrost dynamics – I seek to identify social-sciences methods and research questions that offer new perspectives on environmental, economic and cultural change in alas (thermokarst) landscapes. Located in the circumpolar North, these regions are said to experience rapid environmental change. Any assumption about the speed and scope of environmental change (including global warming) and its likely consequences for human livelihoods needs to be considered in the context of past levels of change, and of local inhabitants' past and present strategies to deal with change. Hence the need to explore the environmental history of this region in an integrated manner. More particularly, my aim is to design a research agenda to explore the extent to which humans have appropriated and shaped thermokarst landscapes in the central Yakutian lowlands. While it is evident that the alas landscape has been subject to anthropogenic influence, the reasons and effects of that influence have not yet been really systematized. Research on the agricultural

history of the region may thus provide key insights into landscape development. Such research will also contribute to the assessment of future land use and resource management in this and other rural regions of the Far North.

Hiyama Tetsuya

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Research Institute for Humanity and Nature, Kyoto, Japan "Social adaptation to the changing water environment under recent climate warming"

Meteorological data revealed high rates of summer precipitation in the upper and middle parts of the Lena River Basin from 2005 to 2008 and in 2012. Cyclones have appeared frequently in summer in the region, bringing much precipitation to Siberia in particular. Accordingly, summer floods around Yakutsk have become a problem, severely damaging local agriculture and pastoralism. On the contrary, the spring thaw along the Lena River typically causes river ice flooding, which can be severe when low winter temperatures are followed by gradually increasing spring temperatures. Such spring floods have caused severe damages to local residents living along the river in almost every year since 1998. Village relocations were pursued as one of the adaptation strategies to prevent damages from spring floods. Because local people prefer to live along the river on which their subsistence depends, they agreed, with governmental support, to migrate seasonally. There have been no similar adaptations to *summer* flooding, however. Thus we intend to promote sustainable subsistence activities in the region by proposing strategies to facilitate information transmission and improvement of feed-hay distribution networks that can aid in adaptation to spring and summer river flooding.

lijima Yoshihiro

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Research Institute for Global Change, JAMSTEC, Tokyo, Japan "Fine scale mapping of permafrost and forest degradation using ALOS images"

In the last decade, unusual increases in soil temperature and active layer thickness have been taking place in the central Yakutia. The peculiar feature of the warming is that soil moisture correspondingly increases within the active layer. This hydrothermal change is due to wetter climate conditions with abnormally large amounts of winter snow and pre-winter rainfall. Increases in the thickness of the active layer caused rapid thermokarst subsidence, which has negatively impacted the growth of larch forest. The perennially waterlogged conditions furthermore exacerbated the boreal forest habitat; namely, withered and dead trees are widespread in this region. We have attempted to extract the degraded permafrost and forest based on fine scale (10 m resolution) satellite image analyses during the wet climate period. We utilized ALOS-PALSAR and AVNIR-2 images taken during 2006 through 2009. Classification of water surface area was performed using PALSAR images with supervised classification. Then, we compared the distribution of the waterlogged area between multi-years. Additional supervised classification of boreal forest change was conducted using AVNIR-2 images. Both classifications produced the multi-years change in degraded boreal forest due to water-logged conditions. The analyses exhibited that the water surface area expanded in concaved terrain (alas lakes) and along the valleys year by year in conjunction with change from forest to grassland well corresponding with the field observation results. This fine scale mapping possibly enables us to understand the relationship between permafrost dynamics and indigenous land use.

Ksenofontov Stas

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Dept of Geography, University of Zurich, Switzerland "Climate change and its impact on rural population of Central Yakutia"

The majority of rural population in the Republic of Sakha (Yakutia), North-Eastern Siberia, Russia practices subsistence harvesting, including cattle breeding, gardening, gathering, hunting and fishing. However, these important livelihood activities are threatened due to recent climatic changes. Increasing average air temperatures, rising levels of precipitation, altering snow cover, and other fluctuations are significantly affecting subsistence practices of local people and thus make their livelihood vulnerable and unsustainable.

This research aims at assessing changes of livelihoods of rural population in central regions of Yakutia due to climatic variability. In-depth interviews have been conducted with 10 households in 3 villages to get insights about their subsistence activities, perceptions of local people of their environment and changes referred to global warming in the region. Moreover, coping strategies of villagers regarding the consequences of climate change have been discussed with interviewees.

The results confirmed a close relation of rural people with the nature. They use their environment's resources to sustain their livelihood, namely [grass] and wood for heating, cooking and house construction, water for drinking, animals, berries and birds for food and so on. The most considerable environmental change was, according to rural people's observations, a drastic change in air temperature. "Winters became milder, summers colder though. If in the past winter temperature went down -60°C, now it does not go beyond -50° to -55° C". In some people's opinion hydrological conditions became worse. "Heavy rainfalls during the mowing time in summer are bad for villagers' cattle breeding. Inundations because of river, soil water level increase and spring floods are also negative for hay harvesting". During the last decades people have observed ecosystem changes. "Many wild animals have disappeared and many insects have arrived, a lot of trees have died because of fires, tree cutting, insects and other [reasons]".

Mészaros Csaba

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Hungarian Academy of Science, Budapest, Hungary "Alaas or hayfield? Changes in the use and perception of alaases in Central-Yakutia"

Thermokarst depressions (*alaase*) in Yakutia provide fertile hayfields for Sakha cattle economy. Besides salary jobs and state assistance, in the village of *Tobuluk* (Central-Yakutia) the only source of income is horse- and cattle breeding. After the collapse of the state-run farming system, households can sustain cattle and horse breeding by joining one of the two local cooperatives heavily dependent on state subsidies. Due to subsequent changes in local economy and lifestyle, interaction of villagers with *alaas* has transformed radically, causing profound differences in the way generations relate to, interact with, and perceive *alaas*.

Based on field work conducted between 2002 and 2013, this paper focuses on the changing perception and use of alaases in the local community. For those villagers who were born before the centralisation of settlements, *alaas* is far more than a type of landscape with agricultural importance; rather, it is an entity similar to human beings in terms of spiritual features. Members of the younger generation, however, have rather limited knowledge on *alaases*, and perceive them plainly as hayfields. In accordance with a simplification in the perception of *alaases*, some of the traditional methods of managing them withered as well, making the present agricultural system exposed to environmental changes and vulnerable to reforms in Yakutia's agricultural policy.

Takakura Hirokihrk@m.tohoku.ac.jpCenter for Northeast Asian Studies, Tohuku University, Sendai, Japan"The interaction of permafrost dynamics with the arctic adaptation in Siberia:some thoughts on the historical possibilism and the environmental constraints"

Recently, climate change researches inform the social scientists about how the natural environment is vulnerable and sensitively responsive. The human dwelling is located in a *nature on the move*. It alters the social scientists' conventional view that culture-society is on the move, with different but stable natural settings as a background. Anthropologists should recognize how easily the historically familiar natural environment changes and then reconsider the human-environmental relations.

One among the primary goals of Siberian anthropology is to explore the cultural history of ecological adaptations of local people in harsh environments. Thus far, theories have focussed on the hunter-gathers and reindeer herders, which are parallel adaptations in Euro-American northern regions. Exceptional is the horse-cattle pastoralism of Sakha people in eastern Siberia who had migrated from 'southern' steppe regions. I argue that the role of the permafrost and alaas environment is key to their adaptation. The boreal forest and permafrost complex is exceptionally widespread in eastern Siberia, which originated [from] natural-history events rather than climate-physical mechanism. I discuss the human-environment interaction from the subsistence of Sakha, which is the case of historical possibilism with *nature on the move*. It would also explain why the cultural diversity of ecological adaptations has emerged in human history.

Ulrich, Mathias

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Dept of Geography, Leipzig University, Germany "What is the history and the future of thermokarst in Central Yakutia?"

Ice-rich permafrost degradation is a major environmental change in Central Yakutia and results in the expression of characteristic periglacial depressions (thermokarst basins, alases). Permafrost thawing due to increased air temperatures during the late Pleistocene to Holocene global warming (about ten thousand years ago) resulted in surface subsidence and the subsequent formation of large thermokarst lakes and basins. The past thermokarst evolution was a dominantly climate-driven process. Today, the landscape of Central Yakutia is subject to strong short-term modifications by intensified land use, extreme weather events, and the ongoing global warming.

It is not sufficiently clear, how and when thermokarst basins in Central Yakutia were formed or how they have evolved long-term trough the Holocene. It is neither clarified for the Holocene nor the short-term modern thermokarst and lake dynamics which climatic, morphological, hydrological, and especially anthropogenic parameters are influencing. The anthropogenic aspect is of special interest for modern dynamics as human existence in this populated permafrost region is strongly connected to the use of thermokarst basins and lakes by agriculture and fishering.

First insights gained from extensive coring at thermokarst key sites, for instance, reveal no clear cryolithological conditions that could be linked to stable lacustrine conditions during alas development, as it would be expected from a classical view on alas evolution. Rather, it appears that lateral expansion by thermo-erosional processes on alas slopes have been the primary processes during alas development in Central Yakutia. The anthropogenic forcing is probably underestimated in such processes.

Workshop Description

Summary: The idea for this workshop on "Permafrost Dynamics and Indigenous Land Use" is owed to a conspicuous gap between different disciplines' research agendas: there is substantial expertise on permafrost (and related hydrological and soil processes) on the one hand, and on indigenous forms of land use that utilise thermokarst, on the other hand; but the two have rarely been integrated. This workshop will show in an exemplary manner how these different domains can be proficiently connected. The workshop will draw on local knowledge about mid-term and short-term changes in terrestrial and cryospheric conditions; ask to which extent these have been induced by humans; and provide a basis for assessing the prospects for renewable resource use under conditions of more rapid change in future years.

Format: this workshop is planned as one of several events on the topic of permafrost dynamics and indigenous land use under rapidly changing climatic and economic conditions in the Far North. This particular workshop will have a specific focus on the Central Yakutian Lowlands, cyclical processes of thermokarst and permafrost build-up, and historical and contemporary forms of land use in alaas landscapes ("alaas", or "alas" as it sometimes spelled: see below). Follow-up events are planned to assess permafrost dynamics and indigenous land use in regions in additional circumpolar regions and possibly also in high-altitude permafrost regions of "Third-Pole" Inner Asia.

Aims of this workshop: (i) bring together expertise on how local communities have made use and are making use of permafrost dynamics for subsistence activities; (ii) assess how climate change is likely to change permafrost dynamics and indigenous land use in this part of the Sub-Arctic; (iii) explore to what extent humans have appropriated and actively shaped the thermokarst landscapes of North-east Siberia both in the short range of the current period and in the mid-term, i.e., over several centuries.

Research data management: workshop proceedings and resulting publications will be reported to IASC. Abstracts of papers should make explicit mentioning of the nature and scope of data used for the research.

Background: geomorphologists and cryologists have a long-standing interest in how periglacial processes shape the land surface, hydrological conditions and vegetation cover in lowland areas with quaternary sediments (Kachurin 1961; Czudek & Demek 1970; Feldman 1984; Bosikov 1991 for the region in question). Thermokarst depressions are a widespread and characteristic landscape phenomenon in this region. Thermokarst and subsequent re-freezing of the ground can be understood as a cyclical process, creating a particular dynamic of landscape development of the Central Yakutian Lowlands (Bosikov 1998; Shpolyanskaya 2001). However, thus far there is insufficient knowledge about several factors in this process, viz. forest fires and short-term climate changes (Skachkov 2000; Katamura et al. 2009; Kravtsova & Tarasenko 2011; lijima et al. 2013) and logging and other changes in land use (Brouchkov et al. 2004). Moreover, the body of geomorphological, cryological and climatological studies needs to be connected with anthropological and historical research on land use in this region. It is well-known that the local population, notably Sakha, have used thermokarst depressions for horse-breeding and related forms of subsistence livelihoods (Mészaros 2012; Takakura 2010). In Sakha language, these thermokarst depressions are called alaas. They are not only of economic but also symbolic and spiritual importance (ibid.). However, little is known about the extent to which the local population has sought to induce thermokarst processes and to create thermokarst depressions for their economic purposes. In the light of ongoing discussions of climate change and the likely effect of widespread permafrost degradation on the local economy (Crate 2008; Fedorov & Konstantinov 2009), it is important to assess to which degree the current landscape of Sakha is the result of human-induced change of cryological conditions.