'Songs of the Kolyma Tundra' – Co-Production and Perpetuation of Knowledge Concerning Ecology and Weather in the Indigenous Communities of Nizhnikolyma, Republic of Sakha (Yakutia), Russian Federation

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Abstract
This article highlights community-based observations of climate and weather related changes in Indigenous communities of Niznikolyma or Lower Kolyma Region, Republic of Sakha (Yakutia), Russian Federation along with local efforts to preserve traditional knowledge through a nomadic school, in part as an adaptive mechanism. The observations have been collected using a method of co-production of knowledge, which allows the local Indigenous peoples to participate in a meaningful way in research that involves and affects them. In the past four years, the Snowchange Cooperative based in Finland, in cooperation with the Institute of the Indigenous Peoples of the North and Northern Forum Academy based in Yakutsk, has conducted field research in the region to document and assess observations of rapid changes to weather, ecosystems, and human societies of North-East Siberia. Thawing of the continuous permafrost, disappearance of fishing lakes, and increased flooding and erosion are some of the observed changes impacting the region and its inhabitants. The role of traditional knowledge of Indigenous and local communities and their observations of ecological changes play a central role in trying to assess and understand baselines of sustainability for the Arctic and Northern regions. Co-production of knowledge opened new research horizons that advance the study of Arctic climate change. These include for example inclusion of a more holistic reading of the landscapes under change and a deeper, multi-faceted understanding of the significance of these changes.

Introduction

Human-induced climate change has become a reality in the Arctic. The Arctic Climate Impact Assessment (ACIA 2005) and the Intergovernmental Panel on Climate Change (IPCC 2007) confirm that Arctic ecosystems and societies face immense challenges in the near future. At the same time, people living in small communities in the Arctic have long argued that there is an urgent need to study traditional economies and knowledge systems, to appreciate their character and complexity, and to preserve them (e.g., Fehr and Hurst 1996, Helander and Mustonen 2004).

The traditional knowledge developed within local communities is grounded in the close interaction between people and their local ecosystems over periods of hundreds, or even thousands, of years (e.g., Berkes 1999). Such knowledge normally reflects subtle strategies for maintaining social cohesion and for making wise use of renewable natural resources in ways. Traditional knowledge is of scientific interest for several reasons, for example as a means of knowledge acquisition and transmission (e.g., Ingold and Kurttila 2000), as a medium of social cohesion (Cruikshank 1998), as a source of information and understanding about the natural world (e.g., Johannes 1981), and as a set of human strategies for coping with social and natural environments (e.g., Macdonald 2000).

The concept of traditional knowledge, sometimes called with different terminologies, such as Indigenous Knowledge, has been widely explored in research of Arctic peoples in recent years (Berkes 1999, Bielawski 2005, Trudel 2006, Krupnik and Jolly 2002, Huntington 1998, 1999, 2000, Huntington et al. 2004, Mustonen et al. 2005, T. Mustonen 2008). Basso (1996) has emphasized the link between traditional knowledge, language, and place names. These connections are important in studying indigenous perceptions and observations of Arctic climate change.

Nowhere in the Arctic, however, is the challenge of sustaining traditional cultures and knowledge in the face of climate change impacts more urgent than in the Russian Arctic (Huntington and Fox 2005). While some aspects of indigenous ways of life in the region were protected during the twentieth century, others were not (Slezkine 1994). In the twenty-first century, nationwide societal changes and a sharp rise in the development of natural resources in remote areas have combined to reduce supporting mechanisms for traditional practices and to increase the presence of outside influences in formerly remote regions (e.g., Newell 2004).

This paper focuses on two aspects of traditional knowledge in the Kolyma River watershed in the northeastern Sakha Republic (see Figure 1: Location Map). First, we briefly summarize observations of environmental change that are especially significant to indigenous communities in the region. Second, we describe local efforts to sustain traditional knowledge as a practice through the creation of a nomadic school to serve children of reindeer herders.

While indigenous observations of change have received attention throughout much of the Arctic (e.g., Huntington and Fox 2005), little such research has been carried out in the northern Sakha Republic. Furthermore, despite growing recognition of the importance of traditional knowledge, and awareness of the danger of such knowledge

vanishing in a rapidly changing world, very little has actually been done in the way of revitalization of traditional knowledge on community level.

The Region

Nizhnikolyma lies in the Russia Arctic in the far north-east of the Sakha Republic. Splintered by the great Kolyma River and its tributaries, it covers 87,100 square kilometers, with a population of only some 5600 people (Pavel Sustalov, pers. comm., 2005). Most roads in the area are made of ice and thus exist only in winter. Most supplies are transported to remote communities by river and air. Outside the main settlements, the region is tundra and woodland, and home to an abundance of wildlife. It is also home to many different indigenous peoples, including the Dolgan, Evenki, Even, Yukagir, Chukchi, and Nenets. Nomadic reindeer herding is a traditional way of life in Nizhnikolyma and, along with hunting and fishing, the main traditional occupations of the area. Weather plays a crucial role in daily life, as do landscape features and conditions. The impacts of climate change, therefore, are crucial.

The cultures of Nizhnikolyma are based on cold and still practice a way of life rooted in the shamanistic traditions. The landscape is imbued with myriad meanings, information, knowledge, stories, and events that are fully accessible only through local languages together with deep cultural understanding. The settlements in which we worked are along the lower Kolyma River (Kolymskaya and Cherskii) and inland (Andreyuschkino) as well as Even, Yukagir, and Chukchi indigenous communities. The Nutendli and Turvaurgin *obschinas* (self-organized indigenous communities recognized under Russian federal law [Fondahl et al. 2001, Vladimirova 2006]) were the primary partners for our work.

The Nutendli *obshchina* was established in the early 1990s at the northeastern corner of the Lower Kolyma Delta. Nutendli has a nomadic school and currently one brigade for nomadic reindeer herding. The community consists mainly of the relatives of Grandmother Akulina Kemlil and Grandfather Yegor Nutendli, who are the Chukchi elders of Nutendli. The maps for this article and research have been co-produced in the nomadic camps with the wishes and guidance of the community reindeer herders to ensure that only that is mapped which is acceptable to the local community (see as well Huntington 2000).

The Turvaurgin obschina is organized primarily as an economic unit of indigenous nomadic reindeer herders. It was founded in the early 1990s to replace the Soviet-era *kolhoz* state farm of the same name. Its base is the village of Kolymskaya. Most of the herders in the community are Chukchi and Yukagir. The lands used today by Turvaurgin start along the Kolyma River close to the village of Kolymskaya and continue to Arctic Ocean some 350 kilometres to the north, where the brigades spend their spring and summer with the reindeer. Burch (1988: 228) indicates that the lands used by Turvaurgin today would have been used by Chukchi tribes of *Dry Anyuy* and *Saalet* before colonization in the 1800s. Turvaurgin has seven brigades for the 2007-2008 season. Most of the fieldwork 2005-2007 with Turvaurgin was carried out with the elders in Kolymskaya and extended field visits to brigade number four of Turvargin.

Methods

The research presented in this article rests on a theoretical framework of Human Geography put forwards by Massey (2005). She associates the qualities of time and space with power and the history of power. In order to understand better the changes taking place in the Russian Arctic in the context of Indigenous peoples and climate change, we need to explore locally produced histories, discourses, and assessments of change and time-spaces. Such an approach offers the possibility for colonized peoples to participate in a meaningful manner in research (Smith 2005). As Huntington et al. (1999) and Mymrin et al. (1999) emphasize for Chukotka and Alaska, local peoples as well may retain greater interest in initiatives where community agency is recognized. For the community, a real research partnership may provide much needed resources for cultural revitalization and re-traditionalization (Pika 1998-99).

Our work stems from the general efforts of the Snowchange Cooperative and on our specific research activities in Nizhnikolyma. Our general approach employs a community-based production of research and knowledge that rests on the experiences and models used since 1970s in the Canadian Arctic (Berkes 1977, Krupnik and Jolly 2002) as well as the Snowchange work among the Saami and other Arctic traditional communities in the European North (Helander et al. 2004).

The Snowchange Cooperative

Snowchange was started in 2000 to work with local and Indigenous communities of the northern regions, documenting their knowledge and observations to empower their response to climate change and to help their efforts to sustain their cultures. This work contributed case studies from northern Fennoscandia and the Kola Peninsula of Russia to the Arctic Climate Impact Assessment's chapter on indigenous perspectives (Helander and Mustonen 2004, Huntington and Fox 2005). Overall, Snowchange partners have given a clear message about the changes taking place in the Arctic: in the past two decades or so, weather and other natural cycles have moved into a distinctly new pattern with no precedent in local experience.

In addition to its research emphasis, Snowchange has a strong educational element designed to introduce students of the mainstream societies of Russia, Finland, Iceland, Canada, and Alaska to the values, ethics, lifestyles, and knowledge of the Indigenous societies of the North. Students affiliated with Snowchange worked with reindeer herders, fishermen and hunters in the circumpolar regions to collect the Indigenous observations of change.

Documenting traditional knowledge in the Russian Arctic

In 2003, the President of the Northern Forum Academy, Vladimir Vasiliev, invited the Snowchange Cooperative to extend its community-based monitoring of climate, ecological, and biodiversity changes to include communities in the Republic of Sakha-Yakutia in the Russian North.

In July 2004 the first visit from Snowchange was made to Sakha, and plans were drawn on priority regions and topics, together with project partners from or working in the region. The most important of the international projects for Snowchange was ECORA: An Integrated Ecosystem Management Approach to Conserve Biodiversity and Minimise Habitat Fragmentation in Three Selected Model Areas in the Russian Arctic (www.grida.no/ecora). Locally, Dr. Vasiliy Robbek of the Institute of Indigenous Peoples of the North of the Russian Federation guided our traditional

knowledge work in Sakha. He is both an Even and a scientist and was invaluable in bridging two worldviews and also introducing us to the traditional and scientific practices of the region. Two regions of Sakha Republic were chosen: Nizhnikolyma due to the tundra ecosystem and its location around 69 degrees North, and as a comparative area the Neriungri region in the southern Yakutia, a taiga-based ecosystem inhabited by the Evenki.

It was decided that in addition to the community-based observations of changes, the Snowchange Yakutia project would focus on collection of oral histories, traditional knowledge, and legends. Methodologically, the work would involve members of the respective Indigenous communities, in order to allow for the development of an internal perspective to local cultures (e.g., Smith 2005). Much emphasis was put local, practical application of the project's efforts, such as the re-generation and perpetuation of traditional knowledge and support for communities struggling in the face of rapid changes. Each local participant is a co-owner of the documented material. They and/or their representatives have rights to decide what parts and in what ways their knowledge will be presented to various audiences and in the Snowchange archive.

Most of the project fieldwork relied on ground-up approaches. We employed participatory observation in remote nomadic reindeer camps, one-on-one interviews, Indigenous group interviews, and participation in communal and private events, such as ceremonies and rituals as well as events of the reindeer year, including the round-up of Nutendli reindeer in March 2007. Actual field interviews were conducted using semi-structured interviews. Informant participation was important and semi-structured interviews allowed the participants to prioritise the issues, observations, narratives and processes that they felt were important for them (Huntington 1998). Topics of research included narratives, observations, stories, and understandings that put emphasis on relationship between local people and surrounding ecosystems.

Special emphasis was put on gender-based knowledge (K. Mustonen 2008). In the recent years much has been written about women and their knowledges but it is still uncommon to look at knowledge of women through local economies. By investigating with the women their experiences of place, landscape and time-space (Massey 2005) a new understanding of nature may emerge. It can be argued that formal research methods and gender-excluding frameworks fail to capture the holistic experience of marginalized communities. Such discovery further argues for aware, gender-specific studies of Indigenous communities.

Most of the interviews, provided permission was given by the Indigenous knowledge holders, were recorded with digital video and audio. Technically, documentation of the fieldwork involved the use of field notes, digital cameras, and minidisk recorders as well as conventional documentation equipment. Most of the field documentation was filmed using MiniDV Digital Cameras.

Our research also included mapping, specifically of land use and site maps for Turvaurgin and Nutendli. The maps were drawn by reindeer herders on top of a regional map of the area, with the degree of accuracy with which they wished to share their communal land use and seasonal activity. Figures 2 and 3, referred to below, are summaries of the maps created by the herders.

The first work in the communities was conducted in March and April 2005. We visited the study communities, *obschinas*, tundra camps, regional center, museums, and schools. We met with local officials; conducted interviews with reindeer herders, their families, and elders; and gave presentations at schools, museums, and public meetings. After this initial research trip, we translated and transcribed the interviews, analyzed the information, and prepared draft reports and video and audio tapes to review with project participants in the region.

During this initial visit, we worked with the Nutendli nomadic school. School leaders and the community emphasized the innovative nature of the school, pointing out that it was a mechanism by which they can preserve their culture, knowledge, and way of life. We realized that the school also functions as an adaptive mechanism to climate change, insofar as it allows for herders to transmit traditional as well as new knowledge to their children. We began therefore to document details about the way the school works and how its efforts relate to adaptation to climate change.

From January to March 2006 another community round was made. We reviewed the material gathered the year before and conducted additional interviews in both the *obschinas* and settlements of lower Kolyma delta. We also expanded our work to the fishing settlement of Podkhovsk in the Kolyma delta. Meetings were held in the Cherskii Scientific Station with station chief Prof. Sergei Zimov to compare scientific results and Indigenous observations in the region. As in 2005, presentations and other events were held in local schools, museums, and other venues. Surveys on *obschina* land use, weather changes, impacts to the water ecosystems, gender-specific activities, sacred locations such as shaman graves, and other topics were conducted successfully.

At the end of the field work in 2006, the first results were presented to the local administration and to the Northern Forum Conference on Arctic Floods in Yakutsk in March 2006. From April 2006 to January 2007 the community voices were presented to various scientific and public events in Finland, Russia, Alaska, and Sweden, including the 4th Open Meeting of the Northern Research Forum. In March 2007 the last project field period took place. The results were taken back to the region and communities. In April 2007 the findings highlighted below were presented to scientific community, administration, and community stake holders at the Snowchange 2007 Conference held in Sakha Republic.

In 2008 community follow-up monitoring was conducted, and further research results presented in one monograph (T. Mustonen 2009) as well as one master's thesis (K. Mustonen 2008). Snowchange worked with three kinds of indigenous communities in the Nizhnikolymsky Region: towns, settlements and reindeer camps. We hope that the work begun in 2005 is the start of a long-term collaboration on community-based monitoring with the local people. So far approximately 100 hours of materials has been recorded, translated, analyzed and stored in the Snowchange Kolyma archives. Copies of the materials are in the possession of the local communities and/or their representatives in Yakutsk, depending on their wishes.

Results

Key messages from changing Kolyma

The documentation of observed changes and land use in Nutendli is presented in the Map 2. The documentation of observed changes and land use by Turvaurgin Brigade #4 is presented in the Map 3.

Many people reported that continuous permafrost is thawing in a number of sites across Nizhnikolyma. Alyora, a local site of fishing activity, has had several lakes disappear, as the permafrost has thawed, opening channels through which the water has drained out. This phenomenon has begun in the past ten years according to community members:

- "Several lakes in Alyora are gone. Water went away. This has had impacts on fishing sites and times." (26.3.2005, Alexei Gavrilovich Tretiakov, Andreyuschkino, Kolyma)
- "River Chukotskaya as many new bushes growing rapidly. Weather is warmer and permafrost has thawed. The River Kolyma is eroding fast, the banks of the river are collapsing, and the river is wider than before." (4.3.2006 Piotr Kaurgin, Vice Head of the Nomadic Indigenous Community 'Turvaurgin')
- "Changes have taken place on the permafrost. Many lakes have disappeared in the past ten years both in the taiga and tundra zones. We can see this happening in front of our eyes. It is warmer than before. This has impacts to fishing, reindeer herding. One lake disappeared so that the fish in the lake died completely. New holes on the ground have appeared – collapsed zones. We do not move any more so much on the marsh lands." (2.3.2006, Aleksei Nikolayevich Kemlil, Chukchi reindeer herder, Reindeer Brigade Number 4, Nomadic Indigenous Community 'Turvaurgin')

Snowfall and the times of freeze up and melting have shifted according to study participants:

- "This year (2005) there is more snow fall than I have ever seen in my life." (23.3.2005, Zoya Nikolayevna Tokareva, Yukagir Woman, Krasnuska, Nomadic Indigenous Community 'Nutendli')
- "We watch the weather and notice changes. Lakes are flooding the banks. Small rivers become larger. On grazing grounds, I come across unknown plants. There are many dwarf willows growing on the tundra. We use them for bonfires. When I was a kid we had to search hard for the willows. Today, I don't need to look hard at all. New fish species can be observed in the Kolyma River. Marine species are showing up. We used to migrate north slowly to reach the sea. Now we reach it very fast because of the mosquitoes that bother the reindeer. We observe new streams and very little ice on the sea. We are observing lots of single polar bears wandering along the shore. Four cyclones in the fall and lots of snow. Very difficult to ensure enough food for the reindeer." (26.2.2006, Vyatcheslav Kemlil, Chukchi reindeer herder, Leader of Nutendli)

Alexei Gavrilovich Tretiakov, an Even reindeer herder, believes the climate is getting warmer. Ground is "sinking," he says, because it is wetter than before. There is more floods in the region and lakes have disappeared as the ground becomes waterlogged, he says. The local landscape is changing. He has also seen the arrival of sable in the area. Sable is traditionally a species of taiga habitats, but has now spread northwards to the tundra regions. It has replaced squirrel in the border areas between taiga and tundra.

Permafrost changes in the Lower Kolyma area are identified by the communities as the most significant of the climate- and weather-related changes in the region. Both Turvaurgin and Nutendli herders have witnessed a rapid process of collapsing riverbanks, disappearance of fishing lakes and increased erosion along the Kolyma river. Thawing of continuous permafrost had started in mid-1990s according to the Nutendli herders, but it has accelerated in the 2000s. Riverbanks, such as along the Philipovka River which is along the Nutendli seasonal round, are collapsing. Herders report that the thawing is changing the annual water cycles and affects floods and accessibility to fishing lakes and water sources for the reindeers. The disastrous 2007 flood of Andreyuskino, worst in the recorded history of the community, is attributed to this phenomenon by local residents.

These changes have had a variety of impacts. The shorter freezing season leads to more widespread dangerous ice conditions for travellers and reindeer herders. Traditional fishing has already had significant negative impacts from the thawing of permafrost as whole lakes have disappeared, but so far the herders indicate that alternative routing of reindeers has provided an adaptation mechanism for the 2005-2007 period. Even for ice roads, the shorter season creates a longer period of isolation, which is especially problematic for medical emergencies and similar events.

Weather is the most important factor determining where reindeer go for winter and summer pastures and where the brigade sets camp during their seasonal round. Traditional observation and prediction methods are still in use in the Kolyma area for daily, seasonal, and long-term weather. Elders in Kolymskaya confirmed in 2006 that it can be said that the weather prediction, especially for the seasonal and long-term, has become next to impossible, as the markers and indicators are out of place. Traditional knowledge regarding the weather is under change as the markers do not hold true anymore. Weather prediction measures include starlore, moon, dreams, snow knowledge, observation of animal behaviour, winds and so forth. The special role of spiritual people, including their shamanistic knowledge (Siikala 1996), plays a role in the relationship to weather that these communities in Lower Kolyma River possess, though that topic is beyond the scope of this paper.

Reindeer may not follow the expected migratory routes, making it difficult for herders to predict where to set up their camps. In the winter of 2007-2008, a 90-kilometer strip of the Halartsa tundra, a key pasture area of the Turvaurgin community, froze after rain fell during an unusual warm period in December-January. The rain water froze as temperatures returned to below freezing, causing the lichen to freeze. This ice layer prevented the reindeer from accessing the lichen through this layer and required the herders to provide fodder or move the reindeer to avoid losing a large number of animals. Community responses to the variety of climate change impacts have included efforts to generate and share knowledge about the new patterns and cycles. The next section describes one such effort, the nomadic school which serves children of reindeer herders without removing them from the daily lives of their families.

The Nutendli Nomadic School

The nomadic way of life survives in Yakutia. Nutendli has a nomadic school where local elders teach the younger generation, with help from a teacher provided by the local or regional administration. Other costs of the school are provided by the *obschina* rather than from the Sakha or Russian governments. The approach to

learning in Nutendli is unique. Every child has his or her own reindeer, and their parents help the children take care of them. During the summer, children take part in reindeer herding and other traditional activities such as fishing. In winter, the students remain with their families, rather than being sent to residential schools in towns. In this way, the herding groups remain socially intact throughout the year, and the children participate in all the activities of the group. This practical approach enables them to learn about their own culture and language in action.

Vyatcheslav Kemlil, the leader of Nutendli, says he wants to teach children all aspects of reindeer herding, and the Chukchi language. He says that it is "easy" to become a herder, but that one must also learn about nature, and from other elders with more experience. He wants his children's generation to be well educated and capable of living the traditional way of life. He and others interviewed believe that preservation of knowledge, culture, and way of life are essential for the community to survive in the face of the societal, economic, and climate changes they face.

Discussion & Conclusions

This article is the first from our Kolyma research. In the voices, maps, photos and other materials presented here, a landscape under change emerges. Turvaurgin and Nutendli members identify the thawing of permafrost as the most significant and rapidly proceeding change that their homeland is undergoing, notwithstanding the many other pressures and changes experienced by these communities in the post-Soviet era. In other areas and times in northern Russia, climate change has not been the major issue for communities. For example, the in the ACIA study of Kola Saami reindeer herders, climate was important but not as much so as other social and economic changes (Huntington and Fox 2005). Whether the results from Nizhnikolyma reflect a new location or a new time (or both) is not clear.

Our research findings were compared with the findings of natural science research in the region. We discussed our results extensively with Professor Sergey Zimov who has been carrying out long-term research in the Lower Kolyma region (reported, for example, in Walter et al. 2006). The previous macro-trends and views from the *Arctic Climate Impact Assessment* (ACIA 2005) were also examined. In Yakutsk we worked with the Sakha Ministry of Nature Protection as well as various institutes of the Russian Academy of Sciences and the renowned Permafrost Institute. While the Russian scientific views sometimes differ from the international Arctic climate change research, recent scientific articles point to similarities between the observations of the Indigenous peoples of the region and natural sciences (Walter et al. 2006: 71–75).

A more detailed comparison is yet to come, but in general there is a consensus that the Lower Kolyma permafrost is thawing fast. Scientific analysis of this trend indicates that it has significant implications beyond the region, especially in the context of increased greenhouse gas release to the atmosphere (Walter et al. 2006), creating a positive feedback to global climate change. Specific impacts to the traditional livelihoods of the Indigenous peoples of Nizhnikolyma, such as ice layers that prevent reindeer from reaching lichen and the loss of fishing lakes, are consistent with findings from other Arctic localities (Helander and Mustonen 2004, Huntington and Fox 2005).

Another area for further research and analysis based on the Nizhnikolyma materials is the deeper layers of knowledge that have been called "shamanism" in anthropological literature (e.g., Siikala 1996). In Nutendli and Turvaurgin, these layers represent a crucial pool of knowledge regarding change, weather, landscape, and traditional practices that these communities use to make observations, reflect on them, and then decide and act. In Spring 2008 using these deeper layers of their knowledges the community elders had observed that the changes taking place in the region mean that "Nature has stopped believing in us." In this vein, Vyatcheslav Kemlil has made new songs in the traditional style about the seasonal round, Chukchi life, and reindeer nomadism. The best known of these, also recorded during our research, is titled *Tundra Awakens in the Spring*. It contains vital information about the relationships and knowledge Nutendli residents possess regarding their landscape and home area. A second avenue of research from our collected materials will link observations with the surviving Chukchi calendar. A third avenue will study the role of Yukagir and Chukchi language and snow knowledge as an indicator of changes. The focus will be on the existence and characteristics of different snow types and qualities in the Lower Kolyma nomadic communities.

Our research stemmed in no small part from the rising international interest in climate change research in the Arctic and the connections being made between regions and research programs. The Institute of the Indigenous Peoples of the North in Yakutsk was aware of the work Snowchange had done among the Saami, through the *Arctic Climate Impact Assessment*, and found such work to be relevant and desirable for the nomadic Indigenous communities of Sakha. Nonetheless, it is important to be aware of the potential for imposing research agendas on those communities and changing their perceptions of climate, environment, and even culture. Massey (2005) points out, like Smith (2005), that the act of *research* of the mainstream societies can in itself be part of the colonial processes of possessing, controlling, and subjecting. The increased global focus on climate change and the impact it has through media is well known in the communities. One result can be that climate change becomes an explanation for all perceived changes. We designed our approach, using successful examples of community-based research in North America (e.g., Krupnik and Jolly 2002) and Fennoscandia (e.g., Helander and Mustonen 2004), to the co-production of knowledge with the intention of developing relationships with and commitments to the communities in Nizhnikolyma to help address and avoid the potential pitfalls of research that is imposed on a community.

We believe that the application of the community-based approach to research in Nizhnikolyma was successful. Local residents were at first sceptical that foreign organizations would keep their commitments to indigenous communities. As the project developed, local leaders and community members became more involved in the project. During the 2006 field season in the nomadic camps, the leaders of both Turvaurgin (Pyotr Kaurgin) and Nutendli (Vyatcheslav Kemlil) took the initiative themselves to provide further observations of change, specifically about thawing of permafrost. Members of the Turvaurgin *obschina* had even documented on their own, with a camera, areas of collapsed riverbanks (see Photo 5). Our mapping efforts, too, developed into a collaborative process fully supported by the communities, although mapping of indigenous land use remains a complex and contested issue in indigenous scholarship (e.g., Smith 2005, Helander et al. 2004).

The peoples of the Kolyma are aware of the changes that are happening around them on the land that has provided for these cultures for millennia. They are negotiating and re-negotiating their relationships to their homeland in the middle of this period of rapid change. The creation of the Nutendli nomadic school and its efforts to perpetuate and sustain traditional knowledge concerning life on the tundra is a rare example of a community taking the initiative to address the potential impacts of climate change. The fact that Nutendli residents have identified the maintenance of traditional knowledge with the capacity to adapt sheds light on the way they view their future. Future research on the school in years to come will show the extent to which it has succeeded. We close with the words of Yegor Nutendli, an Elder from Nutendli:

"We worship the sun. And the return of sun after the long polar night, after the long winter darkness. We feed the sun. When our families conduct their rituals, we always give offerings to sun; it is the source of light in our lives. We feed the fire and the sun. We have the waters, sky, sun and the land."

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