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Limits of pastoral adaptation to permafrost regions caused by climate change among the Sakha people in the middle basin of Lena River

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ABSTRACT

This article focuses on the pastoral practices of the Sakha people in eastern Siberia to explore the impact of climate change on human livelihood in permafrost regions. Sakha use grassland resources in river terraces and the alaas thermokarst landscape for cattle-horse husbandry. Although they practice a different form of subsistence than other indigenous arctic peoples, such as hunter – gatherers or reindeer herders, the adaptation of Sakha has been relatively resilient in the past 600–800 years. Recent climate change, however, could change this situation. According to hydrologists, increased precipitation is now observed in eastern Siberia, which has resulted in the increase of permafrost thawing, causing forests to die. Moreover, local meteorologists report an increase of flooding in local rivers. How do these changes affect the local pastoral adaptation? While describing recent uses of grassland resource by local people, and their perception of climate change through anthropological field research, I investigated the subtle characteristics of human-environment interactions in pastoral adaptation, in order to identify the limits of adaptation in the face of climate change.

1. Introduction

The purpose of this paper is to explore the impact of climate change on human livelihood in the permafrost region. Arctic anthropologists heretofore have used their accumulated knowledge in discussing culture and climate change by focusing on indigenous peoples as the main stakeholder, and indeed, rights-holders, of arctic societies and on the socio-cultural settings of these peoples. Their primary interests have been the sea-mammal hunters and their social conditions related to the decrease of sea ice (e.g., Krupnik and Jolly, 2002; Laidler and Ikummaq, 2008; Wenzel, 2009) and reindeer herders and their social conditions related to the change of the tundra environment (e.g., Forbes et al., 2010; Forbes and Stammler, 2009; Nakada, 2015; Stammler-Gossmann, 2010). The condition of sea-ice has been a notable focus of Arctic climate observers, both natural scientists and policy makers. While research trends have reflected anthropological knowledge and theories regarding arctic adaptation of marine hunters and reindeer herders in tundra, taiga and (sea) coastal ecologies (Krupnik, 1993), cultural adaptations to the permafrost ecology has not been the mainstream of arctic anthropological research: indeed such research has only appeared quite recently (Crate and Fedorov, 2013). Permafrost and climate change is rather mostly examined in terms of the oil and gas development due to the thaw affecting the pipelines and other infrastructure (e,g, Zum Brunnen, 2009).

For the natural sciences, permafrost is a paleothermometer that can be used to identify fluctuations of air temperature in order to estimate the extent of climate change. Geographically permafrost contributes to the formation of unique topography and flora, because it contains water.[1] This is critical to the cultural issue, since water is a key substance in interactions of humans with the environment. What is the relationship between human cultures and societies and permafrost?

The word permafrost might symbolize cold and barren landscapes, with negative connotation to human existence. However, anthropologically, permafrost contributes to cultural diversity and expands human adaptability. One Eurasian arctic people, the Sakha, historically developed a unique cultural adaptation of cattle-horse production in the permafrost region of eastern Siberia. The pastoralist Sakha originally migrated from Baikal region with a subsistence culture similar to that of Mongolian and Central Asian

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[1] See the website of International Permafrost Association. http://ipa.arcticportal.org/resources/what-is-permafrost (2015/10/15).

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nomads. There another indigenous adaptation, that hunting-fishing and reindeer herding, predominated. The exceptional character of traditional subsistence provides the unique ethnic identity of the people and the source of historical development of the political economy. Today Sakha are geographically distributed across most parts of eastern Siberia. They number 470,000, which is 10–15 times larger than other indigenous[2] peoples of Siberia. Their ethnic autonomy within the political system of the Russian Federation is guaranteed at least nominally through the Sakha Republic (Yakutia). As I will explain, the background to their success lies their specific adaptation to the hydrological effects of permafrost. The permafrost contributes to constitution of the local culture and identity (Crate, 2006; Takakura, 2015). Climate change is now challenging this historical development. Through the process of describing this change, I also discuss the possibilities and vulnerabilities of cultures that have developed in permafrost regions.

First, I briefly introduce the natural history of the local environment and culture, and describe the recent effect of climate change in this region, which is causing an increase of precipitation. Then, I explore the human-environmental interactions from the perspective of local knowledge, in order to identify the limits of pastoral adaptation by the local population.

2. Permafrost and pastoral culture: alaas and Lena River terraces

The region on which this paper focuses is in the middle basin of Lena River, a sub-arctic region covered by taiga. Globally, the boreal forest ecology covers regions of the same latitude. However, the precipitation of this region is very low compared to that of western Siberia and the American sub-arctic. To take an example, in Yakutsk, the capital city of the Sakha Republic (Yakutia), the precipitation is 236.9 mm per year, which is nearly identical to that of Ulaanbaatar, and typical of the dry-steppe biome. Generally, the formation of forest requires precipitation of more than 300 mm per year, rates experienced in western Siberia and Northern America. Theoretically, given the low precipitation rate, the middle basin of Lena River should be covered by grassland. Why does the boreal forest grow under such conditions? The key is that permafrost stores water, which makes it possible for a forest to grown on the land (Fukuda, 1996, 1999; Sakai and Saito, 1974).

Permafrost enables the growth not only of forest, but also of grasslands around lakes known as *alaas*, in thermokarst depressions.[3] The countless patchy grasslands with lakes and flood plains in the forest are a special feature of the middle basin of the Lena River in central Yakutia (Saito, 1985; Jordan and Jordan-Bychkov, 2001). Alaas are the product of long-term climate change, the origin of which could go back to early Holocene. The larch and the pine tree, the key trees of these ecosystems, has been dominant since the late glacial period. The alaas formation process was triggered by global climate amelioration after the late glacial period. Conditions of high humidity combined with poor drainage facilitated the development of the bodies of water that cause thermokarst subsidence (Katamura et al., 2006, 2009; Nelson et al., 2002; Sakai and Kinoshita, 1974).

The forests, grasslands, lakes and rivers form the cultural landscape of Sakha people. In particular, the grasslands are critical for the formation of horse-cattle pastoralism. Two types of grasslands are recognized in Central Sakha society. One is the alaas grassland. Such grasslands are found in seven to eight terrace elevations varying from 10 to 30 m in height and ranging from 30 to 40 km in surface width (Saito, 1985:71). Another type of grassland is formed on the extensive riverbank terraces of the Lena River. Alaas are also found on riverbanks in relatively higher-moist elevations in the east (right) side of Lena River, which expands into the inner forest areas. However, there are few alaas on the drier, lower elevation riverbank on the west (left) side of the Lena (Saito, 1985:73).

The local people perceive the alaas and terraced riverbanks as different cultural landscapes. The terraced grassland is associated with the ethnic origin of Sakha people. The legendary hero-founder of the people, Ellei, migrated from the south and started his livelihood in the river terrace grassland called Tyimaada. The type of grassland provides the local people with their identity: people today refer to being of terrace origin (*khocho oggoto*) or alaas origin (*alaas oggoto*). *Oggo* (*to*) means child in the Sakha language, and therefore *khocho oggoto* literally means “child of the terrace”.

The forest and grassland sustained by permafrost are key elements in the evolution of Sakha cattle-horse pastoralism in this region. Historical sources suggest that before moving northward their pastoral ways were the ways of inner Asian nomads, with five species of livestock — sheep, goat, cattle, horse and camel (Tokarev and Gurvich, 1964). After migrating, due to the harsh climate only horses and cattle could be sustained. Hunting in forests and fishing in rivers and lakes are also important sources of subsidiary food procurement for the Sakha people. It is noteworthy that a vast volume of hay made from grass is used as fodder for livestock during winter (Takakura, 2015). Sakha people have developed a semi-sedentary form of pastoralism as their traditional way of life, living in fixed wooden houses at summer and winter pastures and moving between the two sites.

It is hypothesized that the northern migration of the Sakha people occurred either in the 10th–13th centuries (Okladnikov, 1970), or in 13th–15th centuries along the Lena River (Pakendorf et al., 2006). They must have first used the grassland in river terraces and then moved to the alaas region. Since then, during the past 600–800 years, the Sakha people have been relatively resilient in their adaptations to changes in the middle basin of Lena River. It is certain that colonization by imperial Russia had increased the pressure for fur-bearer hunting in the forests. The economic significance of livestock changed from horses to cattle, and agriculture was introduced into the region during 18th–19th centuries. The socialist modernization in the 20th century stopped the semi-nomadic ways of life through forced sedentarization. Nevertheless, horse and cattle breeding, which is sustained by the local environmental conditions, has always occupied most Sakha people as their main subsistence activity. The recent climate change could change this situation.

3. Recent floods in the Sakha Republic (Yakutia)

What impact has climate change had on the middle basin of Lena River? The Lena River's middle basin lies within the Sakha Republic (Yakutia) of the Russian Federation. Recently damage due to flooding has increased in the republic. If catastrophic flood events have occurred seven times during 1900–1997 serious floods, which brought about the economic loss of more than 1% of republican expenditures, occurred four times since 1998 (Filippova, 2010; Takakura, 2015b). Several anthropologists have reported an increase of flood related disasters on the Tatta Viliui and Anabar Rivers (Stammler-Gossmann, 2012; Fujiwara, 2013) and on the alaas lands in Viliui region (Crate, 2012). Causes for flooding appear to be either due to the earlier thawing of ice and snow in the spring,

[2] The Sakha are not considered an indigenous people in the Russian legal conceptualization. The term implies rather “aboriginal,” or “local,” in a historical sense in this paper. By using the term “indigenous,” I highlight traditional features of adaptation by Sakha, comparable to those of other indigenous peoples.

[3] The term “alas” is often used in most scientific literature , but here I adopt the term “alaas” designating thermokarst depression with cultural implication which is originated from a local word of Sakha language.

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