

## Social–nature interactions in changing climate: Russian Arctic, Murmansk Region examples

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The growing worldwide interest to the Arctic natural resources, climate change and anthropogenic pressures create new challenges for this region. To overcome these challenges we need to have the management decisions based on the most relevant and reliable evidence of natural and socio-economic processes in the Arctic. The report presents results of natural and social processes study in the zone of intensive nature management in the context of ongoing climatic changes in Murmansk Region.

We conducted 19 semi-structured interviews with residents of various ages, gender, educational level in mainly urban areas of Murmansk Region; each included more than 50 questions. A necessary condition for interviews was the respondent's residence in the region for at least 30 years. Interview analysis implied combined information of the same type for each aspect of the study, to reveal patterns of repeated responses. The obtained results were compared with the data of long-term meteorological observations. Diversity of plants and fungi were analyzed in areas of Murmansk Region affected by man.

Residents observe: the climate as a whole has become warmer, the air temperature has increased especially strongly in the winter months; the weather became more changeable (both during the season and within one day), there were more dangerous phenomena (strong winds, storms, ice); the duration of the off-season has increased, spring and autumn have become longer. All respondents were stressed that new species fungi and plants were emerging in their places of residence; new types of pests; forest areas are decreasing.

In recent decades, there has been a tendency to increase the overall biodiversity due to the adventive species invasion. Particularly by means of fungi, which grow on introduced species with more southern distribution as well as on anthropogenic materials (e.g. *Coprinopsis nivea*, *Ganoderma applanatum*, *Hericium cirrhatum*, *Sistotrema confluens*, *Xanthoporus syringae* [Khimich et al. 2016; Bolshakov et al. 2018]). Flora of the Murmansk Region gets richer due to alien species. This is especially noticeable in and around towns and villages. Now, in the Murmansk Region occur about 500 species of vascular plants associated with human [Nature and indigenous people..., 2020]. Seven invasive species are considered as dangerous for the regional biota: *Aconogonon weyrichii*, *Elodea canadensis*, *Heracleum sosnowskyi*, *H. mantegazzianum*, *Impatiens glandulifera*, *Lupinus polyphyllus*, *Rosa rugosa* [Nature and indigenous people..., 2020]. Terrestrial ecosystems of the region answer to climate change mainly by moving of the natural zones boundaries. The southern limit of tundra zone is shifting to the north along its entire length, subarctic birch forests and northern taiga spread to the north as well. At the same time, as a result of airborne industrial pollution and logging the plant cover destroyed, especially in the central and western parts of Murmansk Region, where clear

cuttings are carried out and fragmentation of intact forests occur. The forest area is decreasing due to an increase in the number and area of fires as a result of rising summer temperatures and an increase in the frequency and duration of abnormally hot summer periods.

Observed changes in biota of the Murmansk Region occur as a result of the combined action of natural and anthropogenic factors. Both plants and animals as well as residents are forced to adapt to the ongoing.

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