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Environmental studies in East Siberian tundra wetlands: The upcoming joint German-Russian POLYGON project (2009-2012)

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Permafrost regions are more strongly affected by ongoing global warming than regions elsewhere on this planet. Polygon ponds, mires and cryosols in wetland landscapes underlain by permafrost are the most common components of the Arctic Siberian lowlands. The landscapes of the polygonal tundra wetlands are sensitive to environmental and climate change, because permafrost degradation leads to changes in element and energy fluxes, affects relief and hydrology, and has a tremendous ecological impact.

A proposed joint German-Russian project aims at investigating polygonal tundra wetlands in a gradient transect comprising three representative sites across the northeast Siberian lowlands: the Lena Delta (72 °N, 126 °E), the lower Indigirka river region (70 °N, 147 °E) and the lower Kolyma river region (68 °N; 161 °E). Using an interdisciplinary approach, modern, sub-recent, and fossil environments will be characterised and compared in order to understand temporal and spatial environmental dynamics in relation to climate change.

The proposed POLYGON project aims at answering three interrelated questions:

(i) How do polygon ponds, cryosols, and permafrost in the polygonal tundra of the northeast Siberian Arctic lowlands interact and how have they reacted on climate change on seasonal, annual, decadal, centennial, and millennial time scales?

(ii) Do the biotic and abiotic states and interactions in polygonal wetlands differ along the climatic gradient from the Lena River to the Kolyma River region?

(iii) How will the components of the polygonal tundra wetlands change when permafrost degrades due to climate change?

Cryological, limnological, pedological and ecological features will be combined to link past, present and future environmental dynamics. Present day environmental conditions and their main forcing parameters will be thoroughly assessed, faunal and floral communities in ponds, mires and cryosols as major parts of the polygonal patterned ground will be described and cryogenic processes affecting these structured landscape units will be observed and evaluated. Species and assemblages that are indicative for modern ecosystem conditions will be identified and used as indicators to reconstruct Quaternary climate variations and their ecosystem reactions.

Based on interdisciplinary research that combines modern and past environmental records, the proposed project will contribute to the understanding of small-scale variations of the climate sensitive permafrost landscape units and allow a differentiation between external climate impact and internal polygon dynamics.

The obtained results will be used for explaining and forecasting future environmental dynamics in permafrost regions. The project will bring together German and Russian permafrost expertise complemented by international partners.