

Permafrost-affected soils of Peat Circles (the NorthEast European Russia)

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Subarctic terrestrial ecosystems are to be the key components of global carbon cycle, holding huge amounts of organic in peatland soils and permafrost (Hugelius et al., 2011). Soil cover of permafrost peatlands is rather complicated with bare peat circles, having specific organogenic soils, with turbic features. Peat circles are surfaces on permafrost peatlands, which are devoid of shrub-moss vegetation. They are widespread in the permafrost peatlands formed along the southern permafrost in the NorthEast European Russia. The peat circles have been studied in two permafrost-affected peatlands. One of them is located in the northern taiga subzone (Kosju river Basin), second one is in the forest-tundra (Seida river Basin). Recently, it was found that peat circles in permafrost peatlands are sources of increased N₂O emission into the atmosphere (Repo et al., 2009; Marushchak et al., 2009). However, despite widespread occurrence, the specificity of peat circles formation and its soil properties are underexplored. In peatlands the relative area covered with peat circles increases southward.

According to our data, the formation and existence of peat circles are affected by local activations of cryogenic processes (frost heave and cracking) and wind surface erosion impacted on the top of active layer. A common feature for studied soils is the presence of a specific surface horizon without histic layer. Hydrothermal conditions in permafrost-affected soils of bare peat circles and surrounding vegetated sites are rather differentiated during summer, which affects permafrost table lowering under the circles. Taking into an account recent climate change scenarios, the occurrence of bare peat circles might accelerate permafrost melting in peatlands. Temperature increase in peat soils will accelerate microbiological activity, increase a decomposition rate of organic matter and greenhouse gases release into the atmosphere (Davidson & Janssens, 2006).

Soils of peat circles are differentiated from upland peat soils formed under shrub vegetation according to basic physical-chemical properties. Studied surface-cryogenic soils are characterized by a high degree of organic matter decomposition and, therefore, high carbon stocks in active layer. Absence of vegetation cover on peat circles is correlated with low content in easy mineralizable organic compounds providing plants with nitrogen and nutrients. The study has been conducted under Clima-East & CryoN projects.