Potential impacts of permafrost degradation on carbon storage of peat soils in the Kolyma River basin, East Siberia

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The Kolyma River basin in East Siberia is covered with numerous peat-filled, drained lake basins (known as alasses) maintained by cool, waterlogged conditions. These alasses contain large deposits of labile carbon that may be susceptible to enhanced microbial decomposition with climate change impacts and subsequent permafrost degradation. These processes may impact not only carbon storage, but also carbon availability to downstream ecosystems if dissolved organic carbon (DOC) is exported from alas soils. We examined alas peats in the vicinity of Cherskiy, East Siberia to assess the carbon content and lability of frozen vs. thawed active layers of peat soils, as well as peat pore water DOC. Contrary to expectations, our results show no significant difference between carbon content in frozen and active layers of peat soils; however, within individual alasses, there is generally greater carbon availability in the frozen layer than the active layer. There is also a strong positive correlation between soil carbon and water content in both frozen and active layers of peat, which is likely the result of faster decomposition in more aerobic layers of the soil column. Furthermore, both total DOC concentrations and lability in peatland pore waters were significantly higher than in any downstream ecosystem (i.e., streams, rivers, and the Kolyma River mainstem). This suggests that carbon inputs from alas peats may be rapidly processed by downstream systems. Thus, while carbon storage is highly variable among alasses, within individual alasses, permafrost thaw may result in a loss of peatland carbon stores as newly released carbon becomes available to microbial activity. Additionally, any factors leading to the reduction of water content may cause a further decrease in the storage of soil carbon due to increased decomposition rates. This may have profound impacts on the inputs of DOC to adjacent streams and rivers and to biological activity within these systems. This study is part of the Polaris Project, an NSF-funded undergraduate field program based out of Cherskiy, Russia (www.thepolarisproject.org).