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Mapping of Arctic Wetlands with Threats of Future Permafrost Thaw

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The Arctic is warming twice as fast as the rest of the globe, causing changes to Arctic ecosystems. While wetlands in the Arctic provide many ecosystem services with both local and global importance, still more knowledge is needed on the location and state of Arctic wetlands to successfully focus adaptation and mitigation efforts. To understand the links between temperature changes and changes to Arctic wetlands, this study includes the use of spatial tools to map existing wetlands and model permafrost response to temperature changes, highlighting wetland areas with risks of future changes. Using available high-resolution wetland databases together with soil wetness and soil type data, a wetland map covering the Arctic was created. Based on existing relationships between climate and observed permafrost, future changes in permafrost were modeled using projected mean annual temperature from the HadGEM2-ES climate model outputs for the RCP2.6, 4.5 and 8.5 scenarios and for years 2050, 2075 and 2100. We found that the Arctic contains a large number of wetlands and a very significant number of these exist on permafrost. As substantial permafrost thaw is projected, the extent and properties of wetlands will shift, and local/regional increases or decreases in wetland extent will depend on variables such as soil type. These changes could lead to serious local consequences, such as threats to food and water security, changes in distribution and demographics of animal and plant species, and losses and disruptions of infrastructure. The findings of this study highlight vulnerable areas that need extra attention in terms of adaptation and mitigation efforts to limit the likely impacts of projected changes, given the current trends.

Keywords: Arctic wetland, spatial modeling, permafrost, climate change