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Impacts of thermokarst on permafrost carbon losses and ecosystem services

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Permafrost thaw is altering northern ecosystems and the services they provide at scales ranging from local subsidence to global climate feedbacks. In organic-rich peatlands, thermokarst initiation and spread rates are increasing with rising mean annual air temperatures, changes in wildfire, and human land use. This presentation will outline empirical and modeling approaches to better understand the consequences of thermokarst in peatlands as well as other types of northern terrains on carbon cycling, wildlife, and other aspects of ecosystem services. We are using fine scale datasets and remote sensing to map thermokarst coverage and expansion in both the Northwest Territories, Canada and interior Alaska. Using chronosequences and regional gradients, we are studying thermokarst impacts along gradients of time-since-thaw. Through a Permafrost Carbon Network synthesis, we developed conceptual and numerical models to understand how thermokarst development (formation, stabilization, re-accumulation of permafrost in some conditions) affects carbon storage and release. We are using a combination of empirical and modelled data to test hypotheses about climatic, ecological, and Quaternary controls on thermokarst rates and subsequent impacts on ecosystem services. We demonstrate that thermokarst in peat-rich landscapes are hotspots for permafrost carbon release primarily through methane emissions, have the potential to impact hunter movement and safety, and affect caribou habitat quality.