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The long-term fate of permafrost peatlands under rapid climate warming

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High-latitude permafrost peatlands contain globally important amounts of soil organic carbon, owing to cold conditions which suppress anaerobic decomposition. However, there is much concern that climate warming and subsequent permafrost thaw threaten the stability of this carbon store. The ultimate fate of permafrost peatlands and their carbon stores is unclear because of complex feedbacks between peat accumulation, hydrology and vegetation. Unfortunately, field monitoring campaigns only span the last few decades and therefore provide an incomplete picture of permafrost peatland response to rapid warming in the twentieth century. Here we use a high-resolution palaeoecological approach to understand the longer-term response of peatlands in Subarctic Sweden in contrasting states of permafrost degradation to recent rapid warming. At all sites we identify a drying trend until the late-twentieth century; however, two sites subsequently experienced a rapid shift to wetter conditions as permafrost thawed in response to climatic warming, culminating in collapse of the peat domes. Commonalities between study sites lead us to propose a five-phase model for permafrost peatland response to climatic warming. This model suggests a shared ecohydrological trajectory towards a common end point: inundated Arctic fen. Although carbon accumulation is rapid in such sites, and thus peatland ecosystem services are resumed, saturated soil conditions are likely to cause elevated methane emissions that have implications for climate-feedback mechanisms. We outline our plans to test the model published in Swindles et al. (2015) using the same methodological approach in other high-latitude locations, including zones of continuous and discontinuous permafrost.

Reference:
Swindles, G.T., Morris, P.J., Mullan, D., Watson, E.J., Turner, T.E., Roland, T., Amesbury, M.J., Kokfelt, U., Schoning, K., Pratte, S., Gallego-Sala, A., Charman, D.J., Sanderson, N., Garneau, M., Carrivick, J.L., Woulds, C., Holden, J., Parry, L. and Galloway, J.M. 2015. The long-term fate of permafrost peatlands under rapid climate warming. Scientific Reports 5, 17951.