Geophysical Research Abstracts
Vol. 17, EGU2015-6900, 2015
EGU General Assembly 2015

Altered peat hydrophysical properties following drainage and wildfire increases peatland vulnerability to ecosystem regime shift

James Waddington (1), Nick Kettridge (2), James Sherwood (1), and Gustaf Granath (1)

(1) School of Geography and Earth Sciences, McMaster University, Hamilton, Ontario, L8S 4K1, Canada. , (2) School of Geography, Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK

Northern peatlands represent a globally significant carbon reservoir, composed largely of legacy carbon which is no longer part of the active carbon cycle. However, it is unclear whether this legacy carbon is vulnerable as a result of enhanced peat smouldering and combustion under the moderate drying conditions predicted for northern peatlands as a result of climate change and/or disturbance from forestry, mining, and associated transport development. A significant loss in legacy carbon as a result of wildfire has already been observed in smaller tropical peatlands where deep peat soils have been destabilized due to severe drainage and a shift in vegetation. Capitalizing on a unique long-term experiment, we quantify the post-wildfire recovery of a northern peatland several decades post drainage. We show that the moderate drop in water table position predicted for most northern regions triggers a shift in vegetation composition, previously observed within only severely disturbed tropical peatlands, when accompanied by wildfire. The combined impact of moderate drainage followed by wildfire resulted in a shift of the peat surface down the peat profile, exposing denser peat at the surface. In undisturbed northern peatlands where depth of burn is typically low, low-density near-surface peats help regulate water-table position and near-surface moisture availability post-fire, both of which are favourable to Sphagnum recolonization. As a result of drainage and fire at the study site, the self-regulating properties of the low-density Sphagnum surface were lost. We demonstrate that changes in peat hydrophysical properties increased hydrological limitations to Sphagnum recovery leading to the conversion to a non-carbon accumulating shrub-grass ecosystem. This new ecosystem is likely to experience a low intensity, high frequency wildfire regime, which will further deplete the legacy carbon stored in the peat.