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Ecohydrology of the wetland-forestland interface: hydrophobicity in leaf litter and its potential effect on surface evaporation

Samantha Probert (1), Nicholas Kettridge (1), Kevin Devito (2), and Alexander Hurley (1)

(1) School of Geography, Earth and Environmental Science, University of Birmingham, Birmingham, United Kingdom (sxp298@student.bham.ac.uk), (2) Department of Biological Sciences, University of Alberta, Edmonton, Canada (kdevito@ualberta.ca)

Riparian wetlands represent an important ecotone at the interface of peatlands and forests within the Western Boreal Plain of Canada. Water storage and negative feedbacks to evaporation in these systems is crucial for the conservation and redistribution of water during dry periods and providing ecosystem resilience to disturbance. Litter cover can alter the relative importance of the physical processes that drive soil evaporation. Negative feedbacks to drying are created as the hydrophysical properties of the litter and soil override atmospheric controls on evaporation in dry conditions, subsequently dampening the effects of external forcings on the wetland moisture balance. In this study, water repellency in leaf litter has been shown to significantly correlate with surface-atmosphere interactions, whereby severely hydrophobic leaf litter is linked to the highest surface resistances to evaporation, and therefore lowest instantaneous evaporation. Decreasing moisture is associated with increasing hydrophobicity, which may reduce the evaporative flux further as the dry hydrophobic litter creates a hydrological disconnect between soil moisture and the atmosphere. In contrast, hydrophilic litter layers exhibited higher litter moistures, which is associated with reduced resistances to evaporation and enhanced evaporative fluxes. Water repellency of the litter layer has a greater control on evaporation than the presence or absence of litter itself. Litter removal had no significant effect on instantaneous evaporation or surface resistance to evaporation except under the highest evaporation conditions, where litter layers produced higher resistance values than bare peat soils. However, litter removal modified the dominant physical controls on evaporation: moisture loss in plots with leaf litter was driven by leaf and soil hydrophysical properties. Contrastingly, bare peat soils following litter removal exhibited cooler, wetter surfaces and were more strongly correlated to atmospheric controls. The interaction between evaporation, hydrophobicity and moisture of the soil surface, or litter, presents a potentially significant negative feedback to drying across wetland-forestland interfaces.