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Impact of mesh tracks and low-ground-pressure vehicle use on blanket peat hydrology

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Peatlands are subject to multiple uses including drainage, farming and recreation. Low-ground-pressure vehicle access is desirable by land owners and tracks facilitate access. However, there is concern that such activity may impact peat hydrology and so granting permission for track installation has been problematic, particularly without evidence for decision-making. We present the first comprehensive study of mesh track and low-ground-pressure vehicle impacts on peatland hydrology. In the sub-arctic oceanic climate of the Moor House World Biosphere Reserve in the North Pennines, UK, a 1.5 km long experimental track was installed to investigate hydrological impacts. Surface vegetation was cut and the plastic mesh track pinned into the peat surface. The experimental track was split into 7 treatments, designed to reflect typical track usage (0 – 5 vehicle passes per week) and varying vehicle weight. The greatest hydrological impacts were expected for sections of track subject to more frequent vehicle use and in close proximity to the track. In total 554 dipwells (including 15 automated recording at 15-min intervals) were monitored for water-table depth, positioned to capture potential spatial variability in response. Before track installation, samples for vertical and lateral hydraulic conductivity (Ks) analysis (using the modified cube method) were taken at 0-10 cm depth from a frequently driven treatment (n = 15), an infrequently driven treatment (0.5 passes per week) (n = 15) and a control site with no track/driving (n = 15). The test was repeated after 16 months of track use.

We present a spatially and temporally rich water-table dataset from the study site showing how the impacts of the track on water table are spatially highly variable. Water-table depths across the site were shallow, typically within the upper 10 cm of the peat profile for > 75% of the time. We show that mesh track and low-ground-pressure vehicle impacts on water-table depth were small except for directly under and close to the track. Where the track runs parallel to the contours, water-tables were found to be deeper downslope of the track and shallower upslope. However in the no track/driving treatment; water table was significantly shallower downslope than upslope. Strong anisotropy was found in both 'before-track' and 'after-track' Ks, with horizontal Ks significantly greater than vertical Ks. No significant difference was found in vertical Ks before and after driving (medians 8.6 x 10-5 and 6.6 x 10-5 cm s-1 respectively). Horizontal Ks was significantly greater after driving (median 2.2 x 10-3 cm s-1) than before (median 3.7 x 10-4 cm s-1). Post-hoc testing highlights variability in response to treatment and topographic position. We suggest that this surprising result is related to rapid regrowth of new vegetation (particularly Sphagnum) through the mesh of the track, which was more dominant on horizontal Ks than the compression from low-ground-pressure vehicle use. Our results indicate that mesh tracks have a significant impact upon hydrology; however response is variable dependent upon topographic and seasonal factors. These findings can be used to inform land-management decision-making for the use of mesh tracks in peatlands.