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Peat soil properties and erodibility: what factors affect erosion and suspended sediment yields in peat extraction areas?

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Peatland drainage and peat extraction operations change soil properties and expose bare peat to erosion forces, resulting in increased suspended sediment (SS) loads to downstream water bodies. SS yields from peat extraction areas are known to vary significantly between sites, but the contribution of peat properties and catchment characteristics to this variation is not well understood. In this study, we investigated peat erosion at 20 Finnish peat extraction sites by conducting in situ and laboratory measurements on peat erodibility and associated peat properties (degree of humification, peat type, bulk density, loss on ignition, porosity, moisture content, and shear strength), and by comparing the results with monitored long-term SS concentrations and loads at each catchment outlet. Here, we used a cohesive strength meter (CSM) to measure direct erosion thresholds for undisturbed soil cores collected from each study site. The results suggested that the degree of peat decomposition clearly affects peat erodibility and explains much of the variation in SS concentration between the study sites. According to CSM tests, critical shear stresses for particle entrainment were lowest (on average) in well-decomposed peat samples, while undecomposed, dry and fiber rich peat generally resisted erosion very well. Furthermore, the results indicated that two separate critical shear stresses often exist in moderately decomposed peat. In these cases, the well-decomposed parts of peat samples eroded first at relatively low shear stresses and remaining peat fibers prevented further erosion until a much higher shear stress was reached. In addition to peat soil properties, the study showed that the erosion of mineral subsoil may play a key role in runoff water SS concentration at peat extraction areas with drainage ditches extending into the mineral soil. The interactions between peat properties and peat erodibility found in this study as well as critical shear stress values obtained can be used for several purposes in e.g. water conservation and sediment management planning for peat extraction areas and other bare peat-covered catchments.