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Effect of Macroporosity on Physical Property Estimates for Peat Soils

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Hydrophysical soil properties play an important role in regulating the water balance of peatlands and are known to be a function of the status of peat degradation. The objective of this study was to revise multiple regression models (pedotransfer functions, PTFs) for the assessment of hydrophysical properties from readily available soil properties. We selected three study sites, each representing a different state of peat degradation (natural, degraded and extremely degraded). At each site, 72 undisturbed soil cores were collected. The saturated hydraulic conductivity (K_s), soil water retention curves, total porosity, macroporosity, bulk density (BD) and soil organic matter (SOM) content were determined for all sampling locations. The van Genuchten (VG) model parameters (θ_s, α, n) were optimized using the RETC software package. Macroporosity and the K_s were found to be highly correlated, but the obtained functions differ for differently degraded peatlands. The introduction of macroporosity into existing PTFs substantially improved the derivation of hydrophysical parameter values as compared to functions based on BD and SOM content alone. The obtained PTFs can be applied to a wide range of natural and degraded peat soils. We assume that the incorporation of macroposity helps to overcome effects possibly resulting from soil management. Our results suggest that the extra effort required to determine macroporosity is worth it, considering the quality of parameter estimates for hydraulic conductivity as well as the soil hydraulic VG model.