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Impact of alpine meadow degradation on soil hydraulic properties over the Qinghai-Tibetan Plateau

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Alpine meadow is one of widespread vegetation types of the Qinghai-Tibetan Plateau. It is undergoing degradation under the background of global climate change, human activities and overgrazing. Soil moisture is important to alpine meadow ecology for its water and energy transfer processes, therefore soil hydraulic properties become key parameters for local eco-hydrological processes studies. However, little research focus on the changes and it's mechanisms of soil hydraulic properties during the degradation processes. In this study, soil basic and hydraulic properties at 0-10 cm and 40-50 cm soil layer depths under different degraded alpine meadow were analyzed. Pearson correlations were adopted to study the relationships among the investigated factors and principal component analysis was performed to identify the dominant factor. Results show that with increasing degree of degradation, soil sand content increased while soil saturated hydraulic conductivity (Ks) as well as soil clay content, soil porosity decreased in the 0-10 cm soil layers, and organic matter and root gravimetric density decreased in both the 0-10 cm and 40-50 cm soil layers. For soil unsaturated hydraulic conductivity, it reduced more slowly with decreasing pressure head under degraded conditions than non-degraded conditions. However, soil moisture showed no significant changes with increasing degradation. Soil Ks was significantly correlated ($P = 0.01$) with bulk density, soil porosity, soil organic matter and root gravimetric density. Among these, soil porosity is the dominant factor explaining about 90% of the variability in total infiltration flow. Under non-degraded conditions, the infiltration flow principally depended on the presence of macropores. With increasing degree of degradation, soil macropores quickly changed to mesopores or micropores. The proportion of total infiltration flow through macropores and mesopores significantly decreased with the most substantial decrease observed for the macropores in the 0-10 cm soil layer. The substantial decrease of macropores caused a cut in soil moisture and hydraulic conductivity.