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Monitoring Soil Moisture Patterns in an Agriculturally Used Wetland in Central Uganda

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Abstract

The recent changes in temporal and spatial precipitation patterns in rainfed agricultural communities of East Africa, has tremendously affected the agricultural production in the region. Due to their prolonged plant water availability throughout the year wetlands among the marginal land areas are under intensive pressures for agricultural food production. Intensive cultivation of wetlands may alter their biophysical status hence affecting soil water availability and other water related ecosystem services across. Therefore, this study aims at understanding the spatial and temporal soil moisture variability of various hydrological regimes of an inland valley wetland (1100 m a.s.l.) in Uganda, East Africa. Land use related soil physical properties and spatial and temporal patterns of soil moisture dynamics are analysed. The inland valley wetland is mainly characterised by a mosaic land use pattern of upland crops, arrow roots with few plots left as fallows all year. Based on a Sentinel 2 satellite image from 2015 and ground truth data, a land cover map is developed. Since September 2014, soil moisture dynamics along four transects in the wetland covering three hydrological regimes (centre, middle, and fringe) are monitored using a frequency domain reflectometry (FDR) system. Furthermore, stream and groundwater levels are continuously measured for the same period. Anova test revealed significance difference ($p < 0.05$) in soil moisture between the fringe and the other regimes while no statistical significant difference in soil moisture between middle and centre is observed. Average soil moisture levels are relatively high throughout the observation period due to high shallow groundwater tables and lateral flows from the adjacent slopes. Land use systems significantly influence soil moisture as arrow roots and fallow plots generally maintain higher mean soil moisture levels compared to upland crops plots situated at the valley bottom of the wetland. Soil organic carbon and texture was significantly variable ($p < 0.05$) across all wetland transects. This research is part of the GlobE wetlands project providing sustainable and scientifically based guidelines for inland valley wetland management in East Africa.

Keywords: FDR, soil moisture, Uganda, wetland

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