Navigating the Role of Shallow Groundwater in Sustainable Agriculture and Water Management: Insights from Ghana‘s Cocoa Farming Landscape

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Introduction

- Shallow groundwater plays a pivotal role for domestic water supply and transforming cocoa farms in Ghana to address climate change
- Managing shallow groundwater requires knowledge of soil physical properties affecting water flow patterns
- Limited soil data and groundwater recharge estimations in tropical agroforestry systems

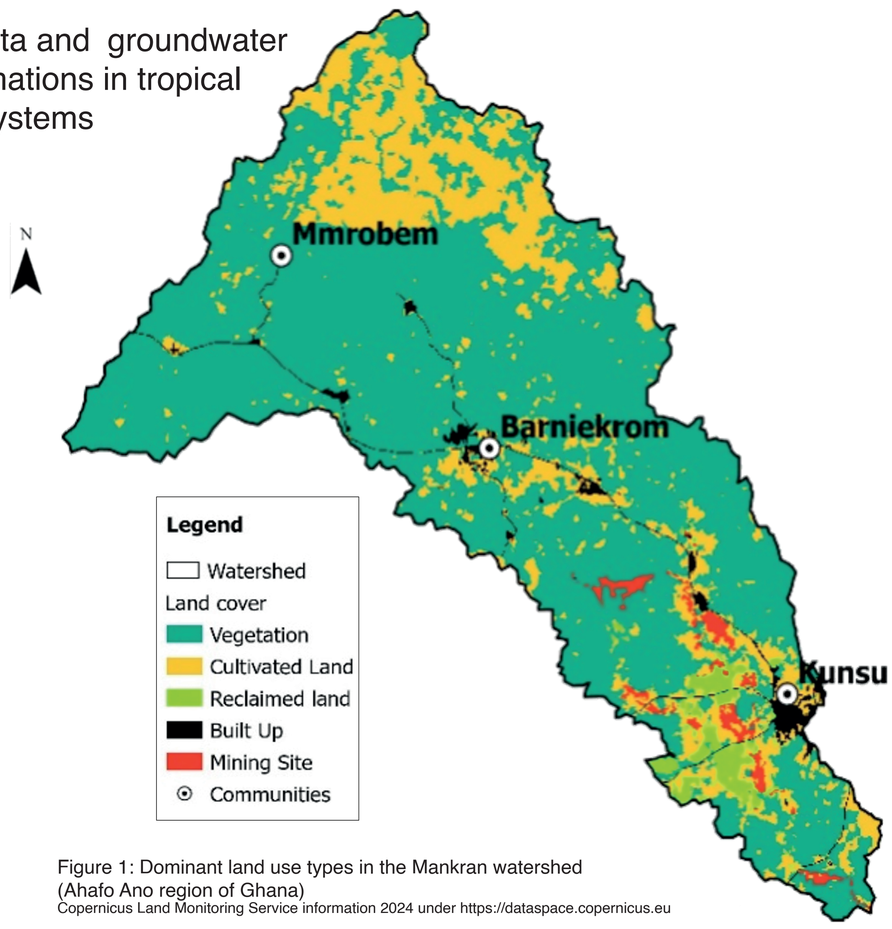

Figure 1: Dominant land use types in the Mankran watershed (Ahafo Ano region of Ghana)
Copernicus Land Monitoring Service information 2024 under https://dataspace.copernicus.eu

Material and Methods

- Measurements of soil physical properties

Figure 5: From left to right: Soil sampling of bulk density, texture and infiltration (Kfs)

- Chloride Mass Balance (CMB)

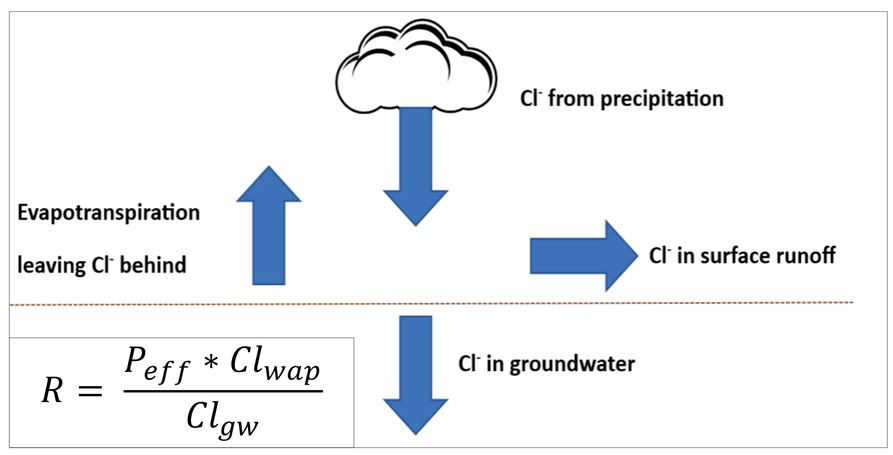

Figure 6: Schematic chloride pathway and equation of CMB

- Water Table Fluctuation (WTF)

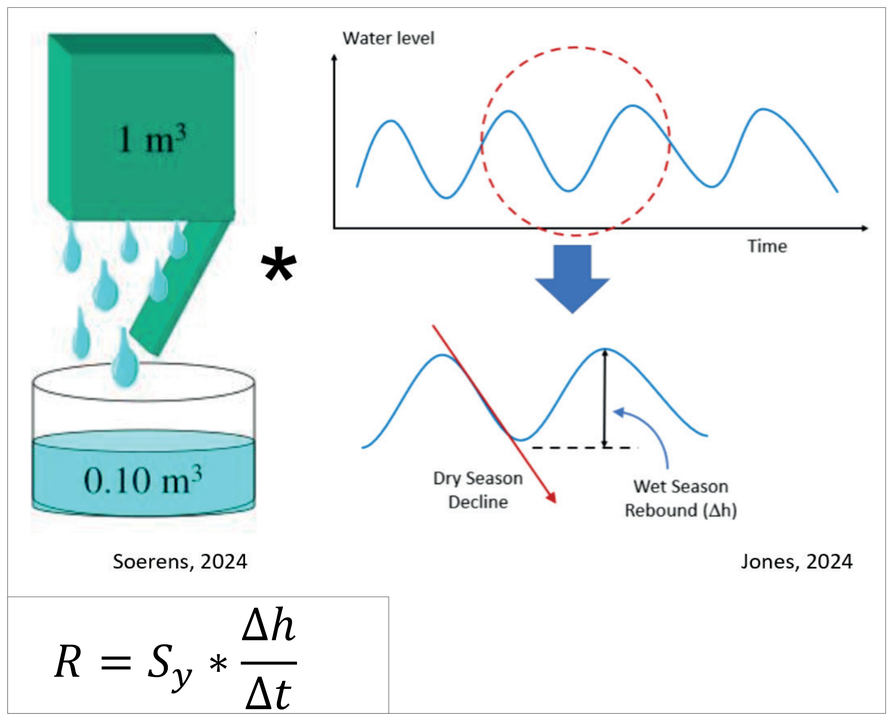

Figure 7: Water table fluctuation method with Specific yield (Sy) as crucial component

Results

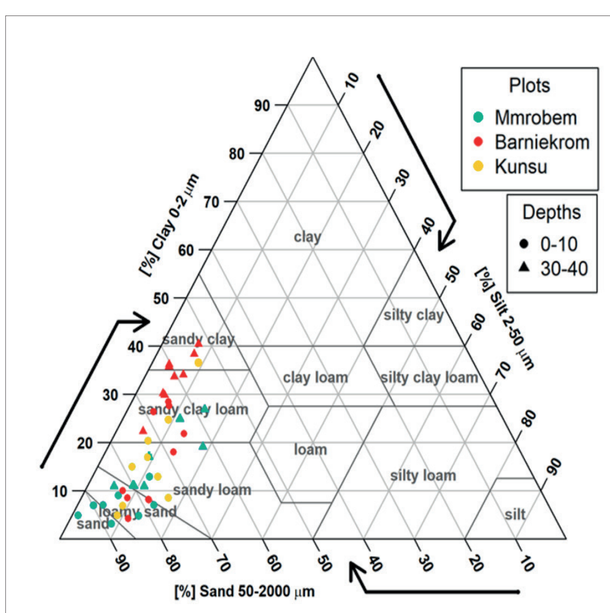

Figure 2: Collected soil samples categorized after USDA soil texture triangle

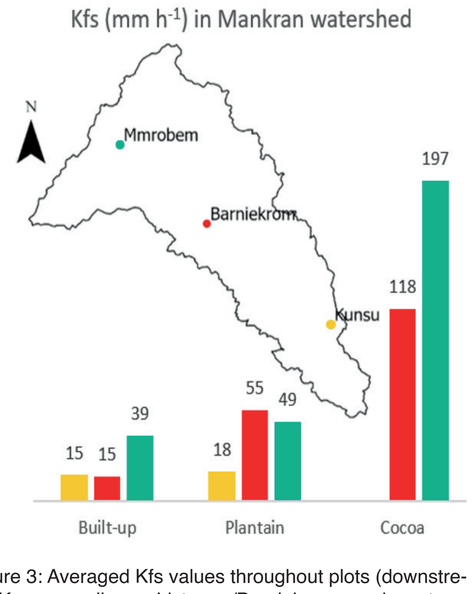

Figure 3: Averaged Kfs values throughout plots (downstream/Kunsu = yellow; midstream/Barniekrom = red; upstream/Mmrobem = green) and subplots (Built-up, Plantain, Cocoa)

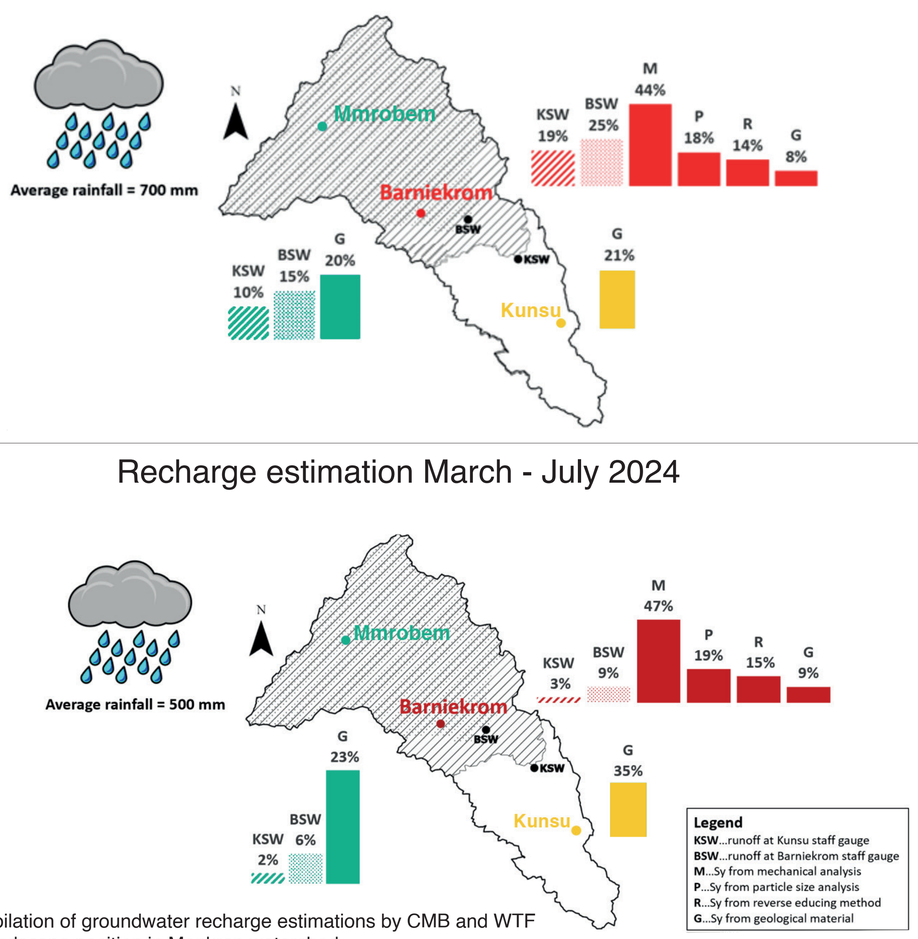

Figure 4: Compilation of groundwater recharge estimations by CMB and WTF according to landscape position in Mankran watershed

Conclusion

- Inconsistent variation of soil physical properties
- Discrepancy: Soil physical properties/groundwater recharge estimates
- CMB and WTF deliver different results