# ABSTRACT

The demand for agricultural land is driving the conversion of moist Kenyan savannah into agroecosystems (grazing fields and croplands) and together with altered rainfall patterns, is likely modifying soil moisture, soil respiration and carbon store in the ecosystem. Nevertheless, the carbon dynamics of moist savannas plus of the converted ecosystems are poorly understood yet planning for sustainable use of the ecosystem need to be based on scientific knowledge. While previous studies in the savanna have been based on isolated land use plots receiving ambient rainfall, the ongoing transitions in land use and rainfall are occurring simultaneously, hence the need to identify the interactive influence of the environmental factors on the ecosystem. Measurements were conducted between June and November 2012, in Lambwe Valley, Kenya to determine the effects of climate and land use changes presently witnessed in moist savanna on soil moisture, soil respiration and soil carbon (C) storage. The study objectives were to (i) determine the influence of rainfall simulation on soil moisture under varying savanna management regimes, (ii) determine the response of soil respiration to management and soil moisture availability and (iii) determine the influence of savanna management on soil carbon store. The experimental design was split-plot, comprising land uses (grazed, ungrazed and abandoned) as main blocks and rainfall simulation as split plots, which were nested within the main plots. Ambient rainfall was reduced or increased by 50% using rainout shelters constructed above the canopy of the herbaceous layer. Soil water content (SWC) was significantly different ($p<0.05$) among the plots as well as rainfall treatment. In grazed, ungrazed and abandoned plots, rain addition led to increase in SWC by 18%, 5% and 12% respectively while rain reduction led to decline in SWC by 6%, 10% and 2% in the respective plots. The targeted 50% manipulation may have not been achieved due to soil structural differences resulting in varying soil water losses and retention. Abandoned and ungrazed plots had significantly high SWC than grazed plot, this was linked to low bulk densities in the former plots, which enhanced soil water percolation and increased vegetation cover, hence reducing water evaporation from soil. Abandoned and ungrazed plots had significantly high mean root biomass than grazed plots at both treatments and this was attributed to high SWC and vegetation cover. Significantly high respiration rates in abandoned and ungrazed plots were linked to high root biomass and lower bulk densities. The significantly high soil carbon in grazed plots was linked to increased animal excreta. The soil carbon and soil $CO_2$ efflux rates provide valuable data for refining ecological models for precise estimation of C budget both regionally and globally.