

Interactive effects of livestock and trees on nutrients and herbaceous layer production in a humid Kenyan savanna

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Abstract: Savannas are key ecosystems that provide vital services such as fodder for wild and domestic animals, recreation, biodiversity habitats, CO₂ sequestration and timber. Their characteristics and distribution make them relatively susceptible to disturbances such as land-use and climate change. This study was carried out to monitor seasonal changes in soil moisture, soil and plant nutrients, and grass primary production as well as establish the impacts of grazers and *Acacia* trees on ecosystem processes in a humid tropical savanna. Soil moisture, soil and plant N/C content and grass biomass were monitored in grazed, non-grazed, under canopy and open locations. Soil moisture was monitored through core method, N and C concentrations (%) were determined by means of elementary analysis while biomass was assessed through harvest method. The results indicated an increase in above ground biomass with progression of wet season with peaks of 1757.63±46 and 1906.75±115 g/(m²•a) recorded in grazed and non-grazed plots respectively. Understorey sites recorded significantly (p<0.001) higher peak aboveground biomass compared to open sites. Significantly higher soil and shoot N content, 0.35±0.1 and 0.93±0.28 %, respectively were observed in the understorey sites, while %C content declined with progress of wet season. In this humid ecosystem, grazers were responsible for keeping grasses low during the dry season; however, they had minimum influence on primary production during the growing season. *Acacia* species strongly influenced organic matter accumulation, soil moisture and biomass production under their canopies. The observed trends created a unique production mosaic of ecosystem function and productivity in the humid savanna. This ecosystem can therefore be a significant source and sink of both N and C with processes that control their emissions being complex and influenced by a variety of interrelated factors such as quality and rates of organic matter turn over. Therefore, processes in humid savannas are not a simple function of rainfall patterns or herbivory, but regulated by interactive effects of grazing and nutrients with trees acting as modifiers.

Keywords: Grazing, Understorey, Primary production, Nutrients, Ruma national park