

Biomass and quality changes of forages along land use and soil type gradients in the riparian zone of Lake Naivasha, Kenya



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ABSTRACT

The recession of the water level of Lake Naivasha has incrementally exposed land surfaces creating a chronosequential transect representing durations of 1–30 years of exposure to grazing. This chronosequence provides a unique model to study the effects of land use duration on resource availability and resource base quality. Particularly, pasture quality changes in the riparian land of tropical fresh water lakes have so far not been studied. We assessed the effect of the duration of exposure to grazing on the biomass production, crude protein content and energy quality of pastures in a 4 × 4 latin square design (4 chronosequence positions × 4 soil types). Species composition was recorded and biomass was sampled at monthly intervals from February to August 2011. Soil moisture was recorded using frequency domain reflectometry sensors. Vegetation samples were analyzed for dry matter, nitrogen and metabolizable energy. Increased land use duration favored a shift in species dominance from *Pennisetum clandestinum* to *Cynodon plectostachyus*, which was associated with a reduction in dry matter yield and increased plant nitrogen content. All measured variables tended to be higher in soils formed on alluvial than in those formed on lacustrine deposits. Increased soil N and gravimetric moisture content stimulated biomass accumulation. The crude protein yield and metabolizable energy changed with phenological stages of the pasture and declined significantly towards maturity (seed setting of grasses). Continuous grazing and reduced soil moisture content, both during low rainfall and increased distance from the lake shore, affected the composition of pasture grasses as well as forage yield and quality. This may thus differentially affect the suitability of the riparian land as pasture ground and feed resource area for grazing animals.

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1. Introduction

Kenyan wetlands cover an area of approximately 14,000 km² (GOK, 2013). They fulfill important ecological, economic, and social functions. Although the characterization of wetlands has traditionally been sectoral, the “wise use” policy of Kenyan wetlands includes aspects of biodiversity conservation and allows agricultural exploitation (Kiai and Mailu, 1998). Among the recognized options under the “wise use” policy is the grazing by wildlife and livestock during the dry season, particularly during periods of drought in arid and semi-arid areas (Kiai and Mailu, 1998; GOK, 2013). There, pastoralism is recognized as the most important

livelihood strategy (Sanford, 1983). In Kenya, more than 80% of the land is classified as arid or semi-arid, and pastoralism is the dominant livelihood system (Bourn and Blench, 1999). Demographic growth and increasing pressure on the available land and water resources as well as increasingly variable and unpredictable precipitation patterns have recently enhanced the pressure by pastoralists on wetlands as sources of water and animal feeds. In the fringes of Lake Victoria, massively increased numbers of pastoralist livestock during the dry season have led to the degradation of the environment due to over grazing as the estimated carrying capacity of 3.57–6.75 ha/livestock unit was grossly overshot (Hongo and Masikini, 2003). In the Ewaso Narok swamp, a combined use by pastoralists and small scale farmers has led to the destruction of both the wetland and the rangeland and increased human-wildlife conflict (Thenya, 2001).

Dry season foraging zones in Kenya's rangelands have been studied with a view to understanding their dynamics, and

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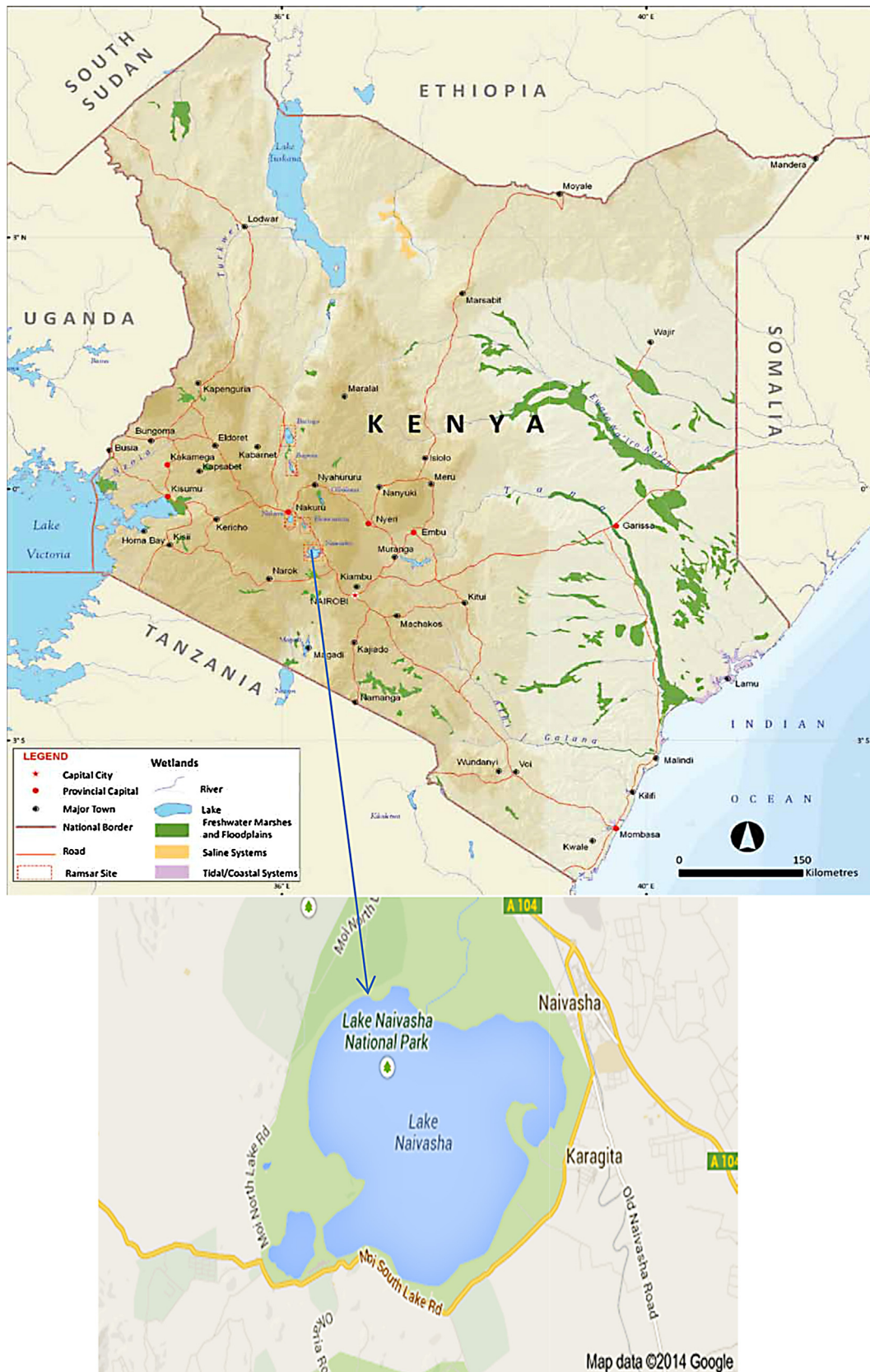


Fig. 1. Position of Lake Naivasha in Kenya.

identifying, protecting and restoring critical forage areas (Ngugi and Connant, 2008). Some of these resource areas are utilized sparingly as grazing reserves (Ruttan and Mulder, 1999), while

others are in constant use, both by pastoral ruminant and by wildlife grazers. The land of Lake Naivasha riparian is one such key resource area, where a portion of the lake fringe is accessible

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