

Research Application Summary

Land cover and use changes in the rangelands of Central-Uganda: Impacts on soil quality and pasture productivity

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Abstract

This study determined the patterns and magnitudes of land cover and use changes, their driving factors and impacts on soil quality and pasture productivity in Nakasongola district. Satellite data (1970 - 2009), surveys, soil and pasture sampling techniques were used. Woody and bare encroachments are major changes affecting soil quality and pasture productivity. Changes in fire regimes, poor stocking densities, termites, climatic variability and tree cutting are major drivers of the land cover and use changes. Sustainable management practices are required to avert current trends of degradation if the integrity of rangelands and pastoral livelihoods are to be saved from extermination.

Key words: Land cover, rangeland, woody encroachment and pasture productivity

Résumé

Cette étude a déterminé les tendances et l'ampleur des changements de couverture et d'utilisation de terre, leurs facteurs moteurs et les impacts sur la qualité des sols et la productivité des pâturages dans le district de Nakasongola. Les données satellitaires (1970 - 2009), des enquêtes et les techniques d'échantillonnage des pâturages et des sols ont été utilisées. Les empiètements boisés et vides sont les changements majeurs qui affectent la qualité des sols et la productivité des pâturages. Les changements dans les régimes d'incendie, les densités de stockage pauvres, les termites, la variabilité climatique et la coupe des arbres sont les principaux moteurs des changements de la couverture et de l'utilisation de terre. Les pratiques de gestion durable sont nécessaires pour éviter les tendances actuelles de dégradation si l'intégrité des pâturages et les moyens de subsistance des éleveurs doivent être sauvés de l'extermination.

Mots clés: Couverture des terres, pâturages, empiètement boisé et productivité des pâturages

Background

The accelerating pace of land cover and use changes in the rangelands of Uganda and the increasing complexity of their drivers are presenting substantial problems for rangeland management. The patterns and magnitude of these changes can be quite different depending on the anthropogenic influences in specific areas (Roques *et al.*, 2001; Mwavu and Witkowski, 2008). As such the integrity of rangelands is subsequently declining with reduction in the quality and quantity of services they provide to dependent communities (NEMA, 2006). Monitoring land cover and use changes is an underlying tenet for understanding vegetation dynamics and is essential if natural resources are to be used in a sustainable manner (Gibbens *et al.*, 2005). In this study, the patterns and magnitudes of land cover and use changes will be determined, their driving factors identified and impacts on soil quality and pasture productivity determined.

Literature Summary

Drylands cover about 45% of the Earth's land surface (Schimel, 2010), 66% in Africa and 44% in Uganda (NEMA, 2006). However, despite the enormous services provided by drylands, they have continuously received less attention and are poorly studied (Schimel, 2010). Rangeland ecosystems are common throughout semi-arid regions of the world and are characterized by their mixed tree-grass composition (Salzmann, 2000). Although fire, herbivory and their combined effects (Cumming, 1997) are often noted as primary factors that maintain the integrity of rangelands, hydrological aspects also play important roles (Todd *et al.*, 2005). Changes in the intensity and frequency of these factors drive gratuitous changes in the rangeland ecosystems that reduce their productivity. Land cover and use changes, especially the encroachment of shrubs in rangelands is a global problem over years (Burrows *et al.*, 1990). However despite the wide extent of this occurrence, little is known about the dynamics and drivers of encroachment in Ugandan rangelands, as they keep on alternating between successional and event-driven pulses.

Study Description

The study is being conducted in the rangelands of Nakasongola District, located in the central region of Uganda on Bombo – Gulu road, 114 km North of Kampala city. The area experiences a bi-modal rainfall regime (500–1000mm p.a), mean daily maximum temperature is 30°C, soils have high sesquioxide content (*Haplic Ferralsols*) and is dominated by open savanna woodlands (FAO, 1998). The methodology uses satellite data from the Landsat Enhanced Thematic Mapper (ETM) (1970 –

2000) and Moderate-Resolution Imaging Spectroradiometer (MODIS) (2000 - 2009) sensor and field data. Vegetation classification will be based on derived phenological vegetation properties from ETM and MODIS multi-temporal data analysis (DeFries *et al.*, 2000; Hansen *et al.*, 2002). Focus group discussions, key informant and household interviews will be conducted in Nakitoma and Nabiswera sub-counties to obtain information relating to the drivers of change. Soil and pasture samples will be collected in grassland, bare, woodland and cultivated land for analysis of selected physical and chemical properties (soil), and biomass, species composition and nutritive value (pasture).

Findings

Results obtained so far indicate an increase in woody species composition and bare ground over the years, a limited to complete elimination of fire, poor soil quality and a low pasture biomass production. Low and high animal stocking densities, increased termite activity, climatic change, indiscriminate tree cutting for fuel and poverty have been noted as major drivers of change. The current trend of woody and bare land encroachment onto grazing lands has greatly reduced the quantity and quality of services provided by rangelands with increased soil erosion and sedimentation of water reservoirs and jeopardized the income resource base and way of life of dependent communities.

Research Application

This study will provide scientific information on the extent of land cover and use changes and their driving factors. The information will enhance the formulation of informed policies to support sustainable rangeland management and rehabilitation practices for increased natural resource protection, resilience of rangelands to changing climates and pastoral livelihoods.

Recommendation

Although woody species provide alternative sources of income to rangeland communities through selling of wood, charcoal and envisioned carbon sequestration, this is far less than that obtained from livestock production activities on properly managed grazing lands. There is an urgent need to revamp rangeland management practices in Uganda, especially in light of fire use, woody species control, production practices and stocking rates considering the present and anticipated environmental changes as well as the life styles of pastoral communities.

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