Research Application Summary

Land use/land cover changes and their impact on the human-elephant conflict in Laikipia West District, Kenya

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Abstract

Changes in land use and cover between 1973 and 2008 in Laikipia West district, Kenya was studied. The district shares a boundary with a protected wildlife area that among others has elephants. These often raid crops in addition to competing for browse with livestock. The study carried out mainly using Geographical Information Systems (GIS) technology revealed that grasslands and plantations increased during the study period while the rest of the land use systems (indigenous forests, EwasoNarok swamp, dams and farms) decreased. In the same period, the elephant population increased while human conflict cases fluctuated. It is recommended that a migration corridor be established between Laikipia ranch and Rumuruti, Lariak, and Marmanet forests to allow movement of wild life without destroying crops.

Key words: Land cover, land use, protected areas, wildlife migration corridor

Résumé

Les changements dans l'utilisation des terres et la couverture entre 1973 et 2008 dans le district de Laikipia ouest, le Kenya a été étudiée. Le district partage une frontière avec une réserve d'espèces sauvages protégée, entre autres des éléphants. Ces derniers souvent envahissent les cultures en plus de concurrence avec le bétail. L'étude a été réalisée principalement au moyen des systèmes d'information géographique (GIS) et a révélé que les prairies et les plantations ont augmenté au cours de la période d'étude tandis que le reste des systèmes d'utilisation des terres (forêts indigènes, EwasoNarok marais, les barrages et les exploitations agricoles) a diminué. Dans la même période, la population d'éléphants a augmenté tandis que les cas de conflit de l'homme ont fluctué. Il est recommandé que le corridor de migration soit établi entre le ranch Laikipia et Rumuruti, Lariak,

et les forêts Marmanet pour permettre le mouvement de la vie sauvage, sans détruire les cultures.

Mots clés: Couverture du sol, utilisation des terres, zones protégées, couloir de migration de la faune

Background

Land use and land cover change is gaining recognition as a key driver of environmental change (Riebsame *et al.,* 1994).There is growing human population pressure on landscape as demands for resources such as food, water, shelter and fuel multiply. These factors dictate utilization of land regionally. Significant land transformation occurred in Laikipia district in 1904 when former pastoral land was taken over for agriculture by European farmers. This study was therefore, conceived with the objective of assessing changes in the land use/land cover between 1973 and 2008 in Laikipia West district of Kenya and examining trends in human-elephant conflict and establishing their relationship with land use/land cover change.

Literature Summary

Crop damage caused by raiding wildlife is a prevalent form of human–wildlife conflict along protected area boundaries (Naughton-Treves, 1998). Todate, most research on crop damage by wildlife has been conducted in Africa (Sitati*et al.,* 2003). Increase in rural human population densities is likely to lead to escalating incidents of crop raiding by wildlife in the future. Analysis of land cover change in Taita-Taveta district showed a loss of about 35% of original land cover to agricultural fields and sisal estates attributed to human population pressure, land tenure and water distribution (Kisoyan, 1995). Human population growth and wildlife numbers are inversely related (Kamande, 2008). In the study in Taita-Taveta district, wildlife numbers decreased with increase in population. A down ward trend in wildlife numbers between 1970s and 1990s indicated that increase in human-wildlife conflicts was not triggered by increase in wildlife. Human-wildlife conflict as a common malady of rural development is the result of rural growth, increase in human population density and increasing pressure on natural resources like browse and water. In Laikipia district, there is competition of browse material between wild herbivores and livestock as 69.9% of households own livestock whose numbers exceed the land carrying capacity.

Study Description

The study area comprises of the entire Laikipia West district which lies between 36^0 15'-$36^0$55'longitude and $0^0$00'-$0^0$50' latitude. Small scale maize and wheat farming, small scale

livestock farming and extensive livestock ranching are the predominant land use activities.Geo-referencing was carried out in order to obtain a scene of the study area. Classification of images was also done.This involved the identification of the elements, for example indigenous forests, farms, plantations, settlements, grasslands and bare ground, dams and other water masses which were the land use and land cover classes.

A change analysis was carried out using the IDRISI Land Change Modeler (LCM). Feature extraction using on screen delineation to create Geographic Information System (GIS) vector layers by using GEOVIS software was used for the 2008 image.

A quantitative approach on NDVI analysis was used to detect incidences of drought for each of the satellite images. A relationship between the vegetation vigour and environmental stress was then studied in relation to the level of human-elephant conflict.Human population data from Kenya National Bureau of Statistics was used to determine population trends in the district. Data on elephant populations was collected from KWS census reports and used to determine elephant population dynamics. Human-elephant conflict data for individual farmers affected by the conflict between January 1998 and November 2007 was collected from occurrence books located at KWS stations. Random sampling was used in selection of households for questionnaire administration. GPS positions of the villages plus some prominent features were taken using GPS Garmin Series 12X.

Research Application

Supervised classification of the images indicated losses and gains in various land use and land cover types. There was also a further decrease in the area covered by EwasoNarok Swamp, which was replaced by farms.

There was a significant loss in the indigenous forest, whose area showed decreasing trends. Results showed a sharp decline in EwasoNarok Swamp with the area of swamp and other rivers decreasing from 118.0 km^2 (2.4%) in 1973 to 30.7 km^2 (0.6%) in 2000, 16.6 km^2 (0.3%) in 2003 and 1.8 km^2 (0.04%) in April 2008 with an overall decline of 98%. The area of grassland and bare land however increased, from 1192 km^2 (24.1%) in 1973 to 1604.6 km^2 (32.5%) in 2000, 4890.1 km^2 (99.1%) in 2003 and 3423.9 km^2 (69.4%) in April 2008. The area of plantations in 1973 was 53.4 km^2 (1.1%) while in 2000 it was

152.3 km^2 (3.1%) and 68.2 km^2 (1.4%) in 2003. GIS cross tabulation procedures showed changes in areas of individual cover types between earlier and later years of interpretation. Comparisons of the landsat images showed a decrease in the hectarage of indigenous forests, farms and settlement while human-elephant conflict over the same period was increasing. Ground truth data showed increase in land subdivision with 44% of respondents having subdivided their land for the time they had lived on it. The predominant land use was rain fed mixed crop and livestock farming/crop, livestock and woodlot (65%). Bare ground or grassland was observed to have increased by 5%.

There was an increase in human population since the 1999 census which grew at a rate of 3% between 1999 and 2006, further increasing to 3.86% between 2006 and 2007. The rate reduced to 1.15% between 2007 and 2008. The trend in elephant populations from 1990 to 2008 is shown in Figure 1, while Figure 2 shows the trends in human conflict cases between January 1998 and November 2007.

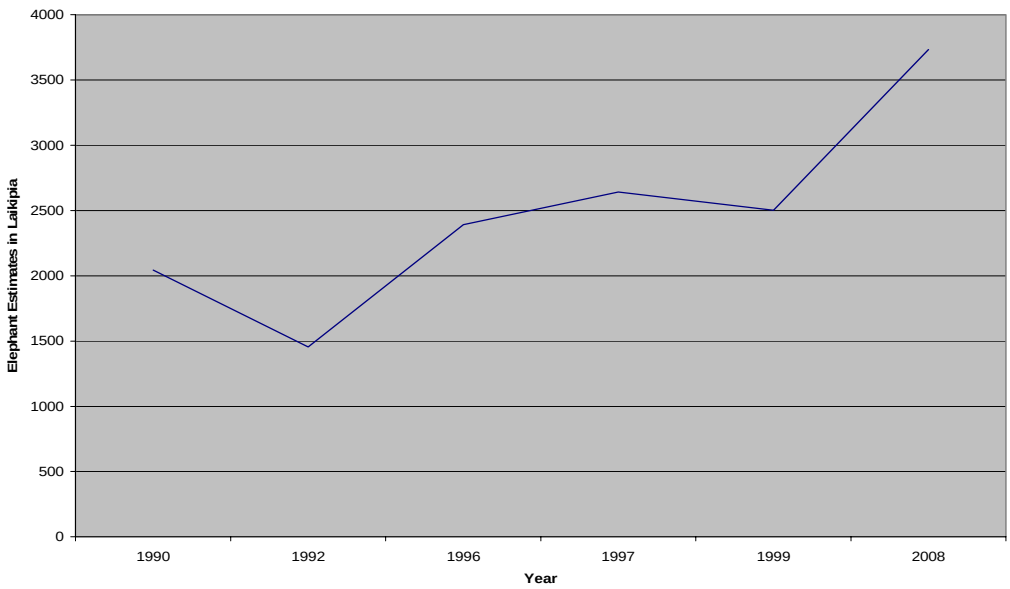

Figure 1. Trends in elephant populations.

There was a steady increase in the number of conflict cases from the year 1998 to 2004 after which they declined sharply up to the year 2006 then they started rising.

NDVI values for year 2000, 2003 and 2008 were negative, indicating environmental stress. All the years show

Figure 2. Trends in human conflict cases between January 1998 and November 2007.

environmental stress although it was less severe in 1973 and 1986. Of all the farmers, 87% reported receiving no benefit from wildlife conservation while 12% indicated that they had benefited from projects done with cash from wildlife conservation.

Recommendation

There is need to establish a migration corridor between Laikipia Ranch, Rumuruti forest, Lariak forest and Marmanet forest. The deforestation of remaining forests should be averted and land use intensification e.g. agro-forestry need to be promoted.

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