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VEGETATION CHARACTERISTICS OF ECOSYSTEM IN TERMS OF DIVERSITY AND STRUCTURE OF CHEPALUNGU FOREST BOMET COUNTY, KENYA

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Abstract: **Biodiversity values at ecosystem depend on how people use, manage and interact with the forest trees and trees outside the forest. Between 1990 and 2010 Kenya"s forest cover significantly reduced by 6.5%. The aim of this study was to assess vegetation characteristics of ecosystem in terms of diversity and structure of chepalungu forest.Primary data constituted responses from randomly sampled local community, the herbalist, cultivators and foresters interviewed. Their response rate was 96%, 100%, 100% and 60% respectively that were analyzed in SPSS. Obtaining firewood, grazing fodder, honey, herbs among others occurred very frequently in 88%, 83% 93% and 90% respectively. Cutting, trampling and browsing as disturbance on trees accounted for 73%, 15% and 12% respectively. 98%, 81%, 75% and 40% of the respondents considered charcoal making, grazing, and browsing and firewood collection to be very destructive human activities occurring in CF respectively. The forest has decreased in a margin of 9% between 1985 and 2010 in its area with 7% attributed to clear-cutting established using change detection technique. CF has a tree diversity of 0.6, 0.4 and 0.3 in the edge, core and middle zones respectively measured on Simpson Species Diversity Index. It is dominated by *Acokanthera schimperi, Teclea simplifolia and Euclea divinorum* with common height of 3 m and range of 1 m to 7 m. The forest department to develop inventory on what they are conserving to allow periodic audit that will guide conservation strategies. Determine and guide annual allowable cut. The forest department to embrace participatory management by encouraging and supporting the formation of community forest association.**

Keywords: **Density, Dominance, Ecosystem, Ecotones.**

1. INTRODUCTION

Human activities such as grazing, wood collection, trampling and cultivation influence forest vegetation to the extent that forest ecosystems are degraded.

Forests play a significant role in the mitigation of climate change and improving the livelihood of people directly and indirectly across the world as source of food and water. illegal logging threatens 65% of forests which has devastated public forest around the globe, major disruptions usually set up chain of reaction within the ecosystem because they have been little understood and have not been predicted (Areole, 1991).

Uncontrolled timber harvesting, conversion of forest to farm and pasture land, increased human population road construction, firewood collection have been identified as the main drivers of deforestation (Mahapatra and Kant, 2005).

Kenya breakdown of forests 2010 Matiru (2010).

Forest type		
Primary forest (1,000 ha % of forest area)	654	19
Other naturally regenerated forest (1,000 ha % of forest)	2,616	75
Planted forest (1,000 ha % of forest area)	19	6

The concept of limiting factors and especially of the need to restrict man"s use of the natural resources is of paramount importance since the rate of replacement of renewable resources is in itself limited.

Statement of the Problem

Rapid population increase exerts pressure on natural resources. Human activities influence vegetation dynamics in Chepalungu Forest; wood logging, firewood collection, grazing and browsing, charcoal making, cultivation and bee keeping are some of the human activities carried out in the forest. Vegetation exhibits continued change in canopy structure, species density abundance and dominance and species richness driven by the impact of unregulated human activities. Degradation of natural ecosystem is an environmental concern currently. Wetlands are being converted to farmland, cultivation along riverbanks, mountain top cultivation, deforestation to pave way for settlement, all lead to loss of such fragile habitats.

Illegal activities include forest clearing, tree poaching, setting on fire vegetation, charcoal making using traditional kilns and driving goats into the forest. Being a gazetted forest property of the government, the community has alienated itself from their resource allowing over exploitation. This situation should be managed to avoid total loss of natural habitat. Chepalungu Forest is at verge of extinction. In view of this problem, there was need to determine key factors in degradation and viable conservation strategies in protection, reforestation and restoration for optimal conservation.

Research Hypotheses

Chepalungu Forest is a protected area managed by Kenya Forest Service of the Ministry of Forestry and Wildlife with authorized and non-authorized human activities taking place in the forest. This study formulated the following research hypotheses:

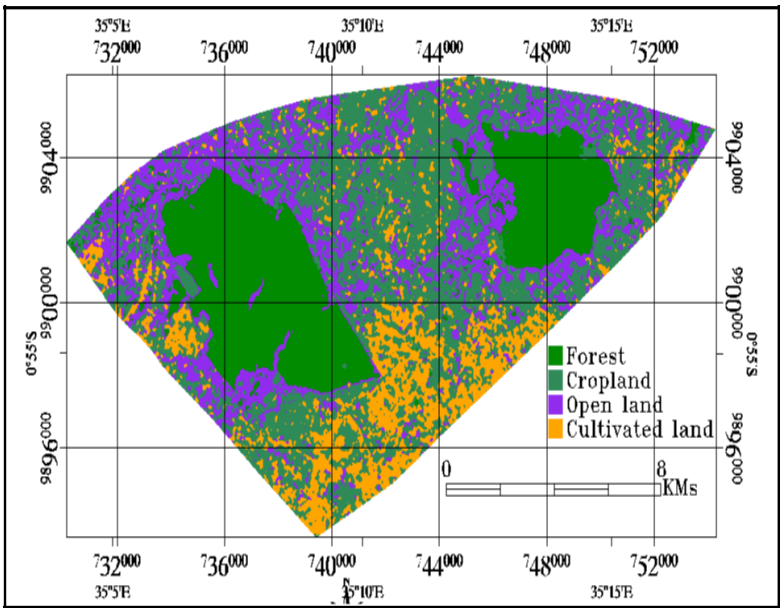
H0 1.There is no significant relationship between vegetation characteristics and Chepalungu Forest Reserve habitat.

2. RESEARCH METHODOLOGY AND DESIGN

Descriptive research design was employed focusing on the study site; Chepalungu forest and methods data collection by highlighting target population for participatory rural appraisal and number of quadrats, sampling techniques and sample size, tabulation of study variables, tool / instrument and pilot study.

3. RESULTS AND DISCUSSION

The computed land cover extent from 1985 to 2010 was illustrated for every 10 year period using images for the tenth year and tabulated area extent compared in square kilometres and changes in class distribution computed and compared for two subsequent dates and finally cumulative change over the period 1985–2010 as seen below;



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Class distribution in Chepalungu forest in 1995

Class	Area (Km²)	Percentage
Cultivated land	53.3151	17.33
Forest	44.1522	14.36
Open land	33.7005	10.96
Cropland	40.2822	13.10

Changes in land use are apparently spill into the forest area triggering modification in cover. When trees outside the forest are cleared for crop planting, forest area become the alternative source of wood needed by the local people and livestock are driven into the forest for alternat

Area (Square Km) change detection 1985–1995

		Initial state			
	Class	**Cultivated land**	**Forest**	**Open land**	**Cropland**
Final state	Unclassified	0.00	0.00	0.00	0.00
	No data	0.02	0.01	0.03	0.05
	Cultivated land	11.61	0.41	13.98	27.27
	Forest	0.03	39.89	3.57	0.65
	Open land	4.21	1.47	14.16	13.84
	Cropland	7.84	0.32	7.29	24.81
	Class Total	23.70	42.10	39.03	66.62
	Class Changes	12.10	2.21	24.88	41.80

The change detected in this period Table 4.19 indicates 51% of cultivated land changing into other classes with the largest share being conversions to cropland by 33 %, the forest land-class loss is 5 % whereby its large proportion into open land is attributed to clearing / logging. Open land changed by 64% giving 36% to cultivated land. On the other hand, cropland

change is 63 % largely 41% into cultivated land.

Change detection percentage 1985–1995

		Initial State of Classes			
	Class	**Cultivated**	**Forest**	**Open land**	**Cropland**
Final State of Classes	Unclassified	0.000	0.000	0.000	0.000
	No data	0.084	0.015	0.076	0.069
	Cultivated	48.963	0.964	35.810	40.930
	Forest	0.140	94.756	9.159	0.977
	Open land	17.748	3.495	36.269	20.779
	Cropland	33.065	0.770	18.687	37.245
	Class Total	**100.000**	**100.00**	**100.000**	**100.00**

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Class changes

Lot of opening in the forest area following clear-cut, cropland and open land have increased as compared to previous years

Change detection statistics 1995 – 2005 percentage

Initial state

Final state	Class	Forest	Cultivated	Cropland	Open land
	Forest	76.112	0.483	0.543	1.578
	Cultivated land	8.859	39.351	24.624	46.268
	Cropland	2.778	30.753	50.147	25.723
	Open land	12.239	29.265	24.628	26.292
	Class Total	100	100	100	100
	Class Changes	**23.888**	**60.649**	**49.853**	**73.708**

The forest area in decreased by 5 % of which 3% is attributed to open land and is the largest loss during this time. Cultivated land changed by 46% into open land, open land by 41% into forest land Cropland on the other hand receded by 66% with a large portion of 47% to open land.

Change detection statistics percentages 2005 – 2010

Initial State of land covers classes

Final state of land cover classes	Class	Forest	Cultivated	Open land	Cropland
	Forest	95.424	32.833	40.918	9.709
	Cultivated land	0.458	12.708	16.665	9.591
	Open land	3.315	45.951	34.454	47.143
	Cropland	0.803	8.508	7.963	33.556
	Class total	100	100	100	100
	Class Changes	**4.576**	**87.292**	**65.546**	**66.444**

Initial state of land cover classes

Final state of land cover classes	Class	Forest	Cultivated	Open land	Cropland
	Unclassified	0	0	0	0
	No data	0	0	0	0
	Forest	91.265	14.493	32.508	23.836
	Cultivated land	0.763	19.373	11.077	12.657
	Open land	6.578	47.107	44.644	43.005
	Cropland	1.394	19.027	11.771	20.502
	Class Total	100	100	100	100
	Class Changes	**8.735**	**80.627**	**55.356**	**79.498**

The forest has since changed in area by a margin of 8% which is quite a significant loss in a forest which is barely, 50 sq. km and this rate is alarming. In 25 years‟ time, it may reduce by 20% of the total area if no conservative measures are undertaken. As noted earlier, the single biggest contributor is the open land at 7%. This leads to the conclusion that the forest reserve is facing real time effects of human activities responsible for this change detected.

The edge of the forests, the main disturbance on vegetation is cutting with 81% while browsing is significantly reduced due to the fact that the edge is dominated by non-palatable species *Acokantheras chimperi* and *Teclea simplicifolia*

Survey research provide for a questionnaire or numeric description of trends, attitudes or opinions of population by studying a sample of that population. Questionnaires or structured interviews are used for data collection with the interest of generalizing from a sample to a population (Creswell, 2009).

Hypothesis Testing for Human Activities and Vegetation Characteristics

This study had hypothesized that there is no relationship between human activities taking place in the forest and the vegetation characteristics. The responses to the destructive activities as cases were subjected to chi-square operation to establish any significant difference in the rating of the destructiveness of these activities and if they are really destroying the forest. This is carried out with the assumption that by respondents rating any of the activities very destructive or otherwise does not affect the subsequent events rating as in Table 4.30. The expected value was derived from the mean of the cases representing tendencies from very destructive to least destructive.

Destructive activities rating in Chepalungu forest

Activity	Observed (O)	Expected(E)
Charcoal burning	193	168
Logging	168	168
Browsing	148	168
Cultivation	135	168
Bee keeping	191	168
Herb collection	182	168
Trampling	164	168
Grazing	159	168

Chi-square results of destructive activities rating in Chepalungu forest

Calculated value	17.48
Decrees of freedom	7
Critical value at 0.5	14.1

On considering that the calculated value is larger than the table value at 0.5 critical level and 7 decrees of freedom, the H_0 was rejected and concluded that the human activities known to take place in Chepalungu forest in reality destroys the fores

Vegetation Characteristics

The second objective of this study was to determine the vegetation characteristics in Chepalungu forest. The researcher sub-divided the study area into three distinct zones, namely; forest edge, middle and core. Samples were drawn from each zone in quadrat size determined using the „minimum area principle

Degraded forest edge of Chepalungu forest indicates adverse edge effects. This is a forest edge which as a result of persistent disturbances due to its close proximity to human settlement has lost mature trees and left bare.

species are captured representing the tree species in the entire habitat. It is notable that 11 species exist in the core, middle, 25 species while 19 are in the edge. The core only species 0, middle only species 8, edge only species 3. It is evident that 11 species are generalist species existing in all the three zones.

Alpha Diversity

The diversity within a particular area or ecosystem; usually expressed by the number of species. This research established that the species richness of the edge was 19 that of the middle were 25 while the core was 11 indicated in Table 4.40.

Beta Diversity

If we examine the change in species diversity between these ecosystems then, we are measuring the beta diversity. The researcher used Table 4.35, 4.46, and 4.37 to count the total number of species that are unique to each of the zones being compared. Three species were not in the middle but in the edge, eight were not in the edge but in the middle giving a beta value of 11 for edge compared to middle.

4. RECOMMENDATIONS FOR FURTHER RESEARCH

According to the findings of the study and gaps identified, the study recommends that other studies should replicate on:

-Ways of involving the public in forest conservation, participatory forest management for sustainable forest use.

-Gender and forestry with focus on influence on forest dynamics. Restoration opportunities for degraded forests.

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