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Current State of Plant Species Composition in Boni Forest, Garissa County, Kenya

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Abstract: ***Globally, conservation of forest bioresources is hampered by lack of information on the resources and on how communities interact with the resources. In most of African countries, the interaction of local communities with resources such as forests through their Indigenous Knowledge Systems (IKS) has played a great role in the conservation of natural resources. Nevertheless, IKS is fast getting eroded due modernization. The aim of the study was to generate information on the forest status in terms of species composition. Vegetation data was collected from 6 transects sampled to represent the variety of ecological conditions in the forest. These were: Mararani (Coastal forests), Mangai (Acacia-Commiphora woodland), Bodhai (Riverine influence on forests), Sankuri (Lungi block of Boni Forest), Hulugho (Acacia–Commiphora woodland), Sangailu (Dryland forests & not gazetted). The data collected was analyzed using parametric and non parametric methods. The findings indicated that the forests of Ijara Sub County are rich in species composition with a total of 386 plant species recorded of which 130 were woody species. Dominant families, namely Mimosaceae and Euphorbiaceae accounted for 10.8% and 9.2% respectively of all plant species recorded. The study concludes that the current anthropogenic threats may lead to detrimental and irreversible ecosystem degradation and attendant loss of certain species.***

Keywords: Status, plant species, composition, Boni forest, Kenya

1. Introduction

Human society is increasingly becoming aware that ecosystem services are not only limited (United Nations, 2012), but are also threatened by anthropogenic activities (UNCTD, 2013). As early as 400 BC, Plato documented how ecosystems could provide more complex services to mankind and he demonstrated that deforestation could lead to soil erosion and the drying of springs (Gordon & Krech, 2012). Glanznig, 1995, studied the relationship between biodiversity and ecosystem functioning and noted that accumulated knowledge generally supports the idea that biodiversity promotes ecosystem functionality and stability, and thus contributes significantly to various ecosystem services.

A review of existing records reveals that there is inadequate data on natural resources in Ijara Sub County for planning the management of the resources. There is virtually no authentic comprehensive ecological documentation detailing the natural resources of Boni Forest, which means that the basis for decision-making for environmental management and conservation can be challenged. There is an increasing need for fresh biodiversity surveys (GOK, 2003) and inventories to allow for sound decision making for environmental planning and also for the purpose of documenting changes in the state of environment.

Whereas studies on species diversity and density have been conducted in various ecosystems in Kenya (GoK, 2005), none has been undertaken for Boni Forest (Gok, 1999). This means that the diversity and plant genetic resources of this forest remain unknown.

Increasingly there is evidence that serves to highlight the dangerous possibility that loss of biodiversity may result in a decline or loss of crucial ecosystem services (Jeffrey, (1990).

The extent and scale of the study area was Boni Forest including the household area 0-5 km away from the Forest where communities engage in different types of socio-economic activities. The area is particularly insecure due to warring communities, proximity to the lawless Somalia and more recently, the Al Shabaab threat.

2. Methodology

A total of 6 belt transects running from south to north each measuring 8 km long were located in the study area based on vegetation type and proximity to settlements. The study identified the local ecological resources and a niche, grouped into transects which formed the study units. Communicating with the local communities proved a challenge and could only be accomplished through an interpreter.

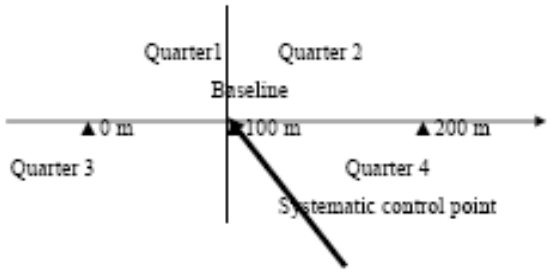
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Table 1: Location of transects and their features

Transect	*Location / Area*	*Vegetation zone*
1.	Mararani	In Boni Forest reserve on the southern side of Ijara Sub County. The vegetation was largely coastal with a variety of species and trees have a closed canopy
2.	Mangai	Located on the southern side of Ijara Sub County. Transect located outside Boni Forest on the northern side. The coastal effect on vegetation slightly reduced giving rise to Acacia-commiphora woodland. The transect crossed trails used by Boni community to reach water sources especially during drought.
3.	Bodhai	Located in Bodhai area which is on the south western side of Ijara next to the riverine forest of the Tana River. This comprised closed canopy forests due to the riverine effects and the adjacent coastal forests
4.	Sankuri	Located in Lungi block of Boni Forest. Transect started from the hilltop with thick forest. The forest had closed canopy.
5.	Hulugho	Located in northern side of Ijara Sub County where it is drier in Acacia- commiphora woodland. Area had high livestock and wildlife density.
6.	Sangailu	Located in the northern side of Ijara where it was generally dry. Land was communally owned and the forests were not gazzetted.

The Point-Centred Quarter (PCQ) method was used to collect data on the woody vegetation in transects set for herbaceous data sampling. The PCQ is a distance method for sampling woody vegetation, composition and density (Mueller, 1974). Basically a minimum of 20 to 30 observations is recommended for better output (Herlocker, 1999; Mwaura & Kaburu, 2008)

Species richness was then considered as the total number of different woody species recorded in the four quarters of each sampling site. Samples of plant species not identified in the field were pressed and taken for identification at the national herbarium in the National Museums of Kenya in Nairobi.



Two sets of data were collected using PCQ method; plants higher than 3 meters to represent the upper canopy and plants less than 3 meters height for the lower canopy. Additional parameters collected to quantify structure of the communities included:

1) Stem diameter to enable computation of horizontal dominance –
2) Plant height to enable assessment of vertical stratification of the community –
3) Canopy diameter measured both along the transect direction and perpendicularly to enable estimation of vegetation cover –

2.1 Data analysis

Prior to Advanced Data Analysis (ADA), an exhaustive Exploratory Data Analysis (EDA) was performed. The EDA involved the computing of traditional univariate and bivariate statistics and plotting of histograms, correlation matrices, and scattergrams. Although univariate and bivariate measures provide useful summaries, they do not describe all the spatial features of the data.

The ADA included regression analysis, Analysis of Variance (ANOVA), and Principal Component Analysis (PCA). All statistical analyses were performed using procedures contained in Statistical Packages for Social Sciences - SPSS (Release 6.0, SPSS Inc., 1989-1993), EXCEL (Microsoft ® Excel 1997) and SYSTAT (SYSTAT 5.03, SYSTAT inc., 1990-1993). Only those relationships exceeding the normal acceptable level of statistical significance at $p < 0.05$ were considered.

3. Results and Discussion

A total of 386 plant species both woody and herbaceous, representing 81 families were recorded in the study. The complete checklist of the species in the forest is presented in Appendix 5. The vernacular names indicated in some of the subsequent tables were derived from respondents among the Boni and Somali communities and it can be noted that for some species there were no vernacular names while some species shared vernacular names.

The most dominant family in this forest was *Mimosaceae* with 12.4% of all species identified in the study belonging to this family (Table 1). The family *Mimosaceae* had a variety of members ranging from trees, woody shrubs to annuals. The second most dominant family was *Euphorbiaceae* which included the genus *Croton, Bridelia* and *Drypetes* among others. It had a species occurrence of 9.3% of the data for all plant families encountered in the study. The other important families included, *Rubiaceae*, the coffee family, *Combretaceae* and *Papilionaceae* accounting for 5.43%, 4.65% and 4.65% respectively of all the species recorded in the study area. Less common plant families included *Olacaceae, Icaceaceae, Rhamnaceae, Rhizophoraceae, Zamiaceae, Simaroubaceae, Verbanaceae* and *Zygophyllaceae* each of which had a species composition of less than 1% of all species recorded.

Natural ecosystems provide a wide variety of plants that are important for traditional medicines and modern pharmaceutical products including enhancing ecosystem function. A total of 130 plant species identified were woody belonging to 52 families. Most of these were from the families of Mimosaceae, Euphorbiaceae and Papilionaceae.

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Table 4:2: Ranking the major plant families based on percentage dominance

Rank	*Family*	*Percentage composition*
1.	Mimosaceae	12.40
2.	Euphorbiaceae	9.30
3.	Rubiaceae	5.43
4.	Combretaceae	4.65
5.	Papilionaceae	4.65
6.	Sapindaceae	3.88
7.	Anacardiaceae	3.10
8.	Apocynaceae	3.10
9.	Caesalpinaceae	3.10
10.	Loganiaceae	3.10
11.	Sapotaceae	3.10
12.	Annonaceae	2.32
13.	Burseraceae	2.32
14.	Capparaceae	2.32
15.	Celastraceae	2.32
16.	Ebenaceae	2.32
17.	Sterculiaceae	2.32

4. Conclusion and Recommendations

The forests in the study area are rich in plant species composition which implies richness in biodiversity. At least 300 plant species were recorded in the study, of which 130 were woody species. The species richness is more towards the southern parts of the study area.

The composition and structure of the forest appeared superficially to be relatively uniform over large regions, suggesting a broad similarity in key environmental conditions. The uniformity in appearance was due in part to the remarkably similar physiognomy of the dominant canopy trees, no doubt a reflection of their origins in the Caesalpinioideae. Differences in species composition, diversity and structure were more apparent at a local scale.

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