JOURNAL OF ADVANCED
BOTANY AND ZOOLOGY

Journal homepage: http://scienceq.org/Journals/JABZ.php

Research Article Open Access

Phytoecological Study of Uma Forest (Kisangani City, Democratic Republic Of The Congo)

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Received: June 3, 2015, Accepted: July 7 2015, Published: July 7, 2015.

ABSTRACT

UMA forest is among the few forests in the surroundings of Kisangani city, and still reserved as well presenting ecological interests that deserve to be studied and valued. The geostrategic position of the UMA forest (in the Northwest of Maiko Park) made it a priority area and of much attention for the ecological and scientific interests. A study on the floristic diversity of this region (PK 97), specifically on the hill of Babolongo is presented in the present work especially the quantitative analysis concerned the abundance of species and families of the base to the top of the mountain. A total of 1335 plants were identified in three plots, distributed in 160 species belonging to 32 families with a basal area of 83.61 m²/ha. The plot at the foot of the mountain was stood out (or marked down), with 520 against 446 plants in the median and 369 at the top; then 103 species at the foot against 98 species at the top and 94 species in the median. Out of 32 families identified, 31 families were present in the foot and the top, 27 families in the median. The basal area were 35.08 m²/ha, 26.16 m²/ha and 22, 36 m²/ha for respectively the base of the mountain, the median and the top. The plot installed at the foot of the mountain is more abundant and diverse. As the transient part (boundary between the field and the primary forest), the present study confirm the hypothesis of intermediate disturbance predicted by Grime stating that the highest specific species diversity is achieved beneath the disturbance regimes of medium intensity and/or frequency.

Key words: Floristic composition, Priority area, Community Forest, UMA Forest, Kisangani city

INTRODUCTION

The Congo Basin, whose the major part is located in the Democratic Republic of Congo constitutes a large terrestrial biome considered on a global scale (like the Amazon and Borneo - Mekong basins) as a reservoir of biodiversity. In Democratic Republic of the Congo, forests cover approximately 62% of the national territory. This is the second largest block of tropical forest in the world and harbors approximately half of the continent's rainforests [1-3].

In developing countries, several charges were brought against man due to his behavior of allocating land for her rural subsistence activities. The strong disturbance of landscapes is considered as one of the major factors of the biodiversity loss at the regional or global level. Some species can tolerate or even take advantage of the degradations due to man, but for many others, even a very limited human disturbance-can lead to their extinction [4]. The role of disturbance on the flora richness remains a central theme in ecology and its effect depends on its intensity and frequency. This disruption often affects species abundance and floristic composition of the area. It is well known that the species composition is one of the key features of the forests. It influences the levels of resources and therefore the composition and the lushness of the flora [5].

By its policy and strategy against the climate change and sustainable management of the biodiversity, the Democratic Republic of the Congo wants to go from 11% to 17% of the national territory devoted to the protected areas, the environment citizenship education, and participatory management of the community forest. To reach that target, preliminary studies are planned by ICCN (Congolese Institute for the Nature Conservation) in order to reassess the protected areas and study the priority zones in order to know the available resources that can lead to the allocations and/or the disposals of protected areas. Generally, the priority areas for conservation are areas of high/hotspot biodiversity, areas harboring endangered species or habitats with special characteristics [6]. UMA forest is an asset to this latter. Hills are limiting factors for accessing the biological resources by the local communities in UMA forest and thus such biotope represents a priority zone for the nature conservation because it can constitute a place of refuge for endangered fauna.

Some research topics related to the floristic richness evaluation of the Congolese tropical rainforest were reported in the literature [7-12]. Although, the study on the plant biodiversity of the UMA forest have not been previously reported. The present research was undertaken with the aim of studying the floristic biodiversity of this forest.

MATERIAL AND METHODS

Study Area

The UMA land (PK 79-97, figure 1) abound with several forest types, located at the East of Kisangani city, along the National Road No. 4; in the community of Bakumu-Kilinga which was our study area. The research work has been performed in BASUKUAMBULA village (00 ° 33,152 'N, 025 ° 55 462 E and 471 masl.), mainly on the Mabolongo hill, located in the South-East of the village, with an altitude of 791 m at the top.

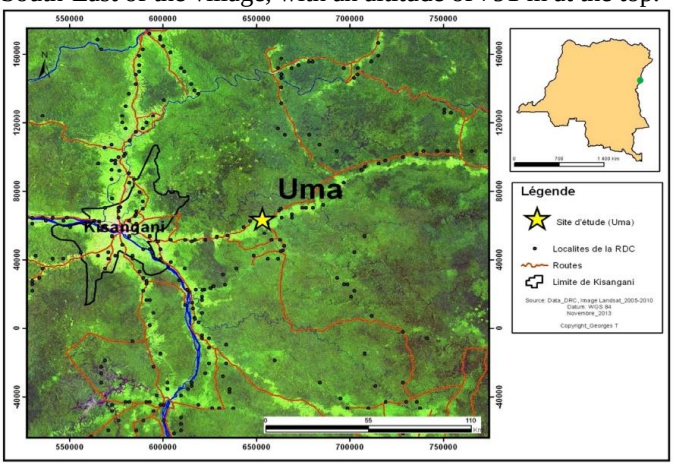

Figure 1: Location of UMA land from the city of Kisangani (ADIKIS/CCC, 2010).

Vegetation

From the village at the base of the hill, we have a fallow dominated by *Musanga cecropioides*, interspersed with the riparian forests. From the base to the ¾ of the hill, observations made clearly show a different type of vegetation where in the beginning, a transition zone between the bush fallow and primary forest. Our plot 1 concerned this part we call here transition forest, where on the one hand dominated by species of the old secondary forest on the other hand by those of the primary forest. The undergrowth is clear and easy to access and it is dominated by *Alchornea floribunda, Megaphyrnium macrostachyum, Eremospata aulevileana, Treculia brieyii, Voacanga africana, Pycnocoma sp, Scaphopetalum sp, cola sp, Palisota ambigwa, Thomandersia hensii, Scadoxus cinnabarinus, Geophila sp* etc. Concerning the top of the hill, once again we encountered another type of vegetation which is in fact a primary forest that was repeatedly the victim of non-human disturbance. It is characterized by the permanent presence of Chablis and liana. The undergrowth is dominated by shrubs less accurately known by the team but belong to the families of Ebenaceae (*Diospyros cf. zenkeri*), of Malvaceae (*Cola sp*), of Rubiaceae (*Oxyanthus unilocularis, Vangeriella sp, Psychotria sp, Rothmannia sp*), of Ochnaceae (*Campylospermum sp*) and of Sapotaceae (*Synsepalum sp*), etc.

METHODS

Trees greater than 10 cm DBH (diameter of breast height) were used as biological materials. Trees that have not been identified in the field constituted sample collections for subsequent identification and Voucher specimens are on deposit at the herbarium of 'Centre de Surveillance de la Biodiversité'. From down to up, plots with homogeneous dimension with 1 ha of land/plot were installed equidistantly (from 1-2 and 2-3) and the whole is three hectare. Trees having a dbh greater than or equal to 10 cm were measured at chest height or at 1.30 m. For quantitative analysis, parameters such as specific density, specific abundance, specific dominance and Jaccard and Sorensen coefficient were calculated. Shannon, Simpson, Fairness, Fisher alpha indices were calculated to analyze the environmental parameters. All these indices were calculated using PAST software package (version 1.94b). The difference between the three communities was tested using ANOVA at a probability threshold of 0.05.

The figure 2 gives the conceptual diagram of the mountain and shows how the sampling point plots were placed for better comparison.

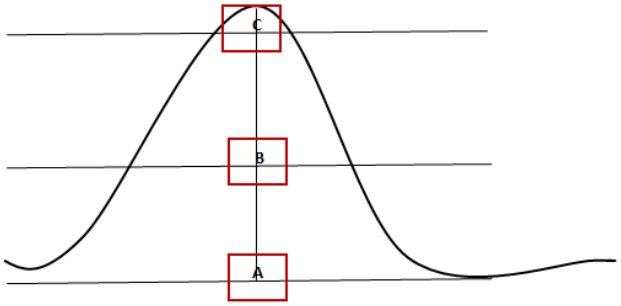

Figure 2. The three plots of harvesting data.

RESULTS AND DISCUSSION

A total of 1335 plant individuals were identified in three plots, distributed in 160 species, 32 families with a basal area of 83, 61 m²/ha. 520 individuals were identified at the foot of the mountain considered as a transient zone (boundary area between the crop and the forest) with 103 species belonging to 31 families and in the median 446 plant individuals distributed in 94 species and belonging to 27 families and in the top, 369 plant individuals distributed in 98 species and belonging to 31 families. The basal area values were respectively 35.08 m^2/ha at the base of the mountain (A); 26.16 m^2/ha at the medium area (B) and 22.36 m^2/ha at the summit of mountain (C).

Table 1. Calculated values of some indices for the three sampling areas

Parameters	Calculated values		
	Base (A)	Median (B)	Top (C)
Number of taxa	103	94	98
Individuals	520	446	369
Dominance_D	0,03147	0,02556	0,02288
Simpson_1-D	0,9685	0,9744	0,9771
Shannon_H	3,98	4,047	4,126
Equitability_J	0,8588	0,8807	0,904
Fischer alpha	38,52	39,44	42,15

The number of plants decreases in the upward phase. The base of the mount is more diversified (103 species) that the median (94 species) and the top or the summit (98 species). Environmental analyzes show that the three populations are poorly diversified. The relative abundance is usually measured

by different diversity indices such as Simpson index (1-D), Shannon-Wiever index (H) and Pielou equitability (J) or regularity (R). 1-D and J range from 0-1; more it approaches 0, more the chance of getting individuals of different species are high. While the Shannon-Wiever index value is usually situated between 1 and 4.5 but rarely above.

In our case, we got 1-D and J similar in all the plots, which means in this specific context that there is a weak diversity among the three sampling areas. The values of biodiversity index obtained in this study are consistent with previously reported work [12]. As for H, all sampling areas displayed similar values indicating also a low diversity between A, B and C.

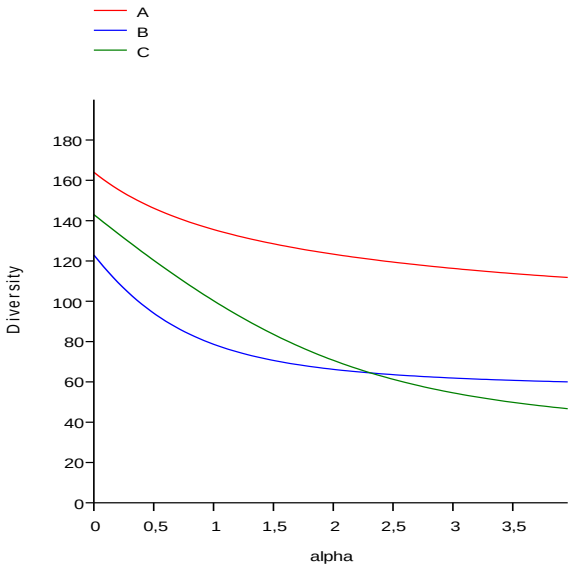

Figure 3. The trend line for the three sampling areas: A = base, B= median, and C = top of the mountain)

The figure 3 shows that the diversity and abundance decrease from the base to the top of the mountain, with a good regeneration throughout all the trends (A, B and C).

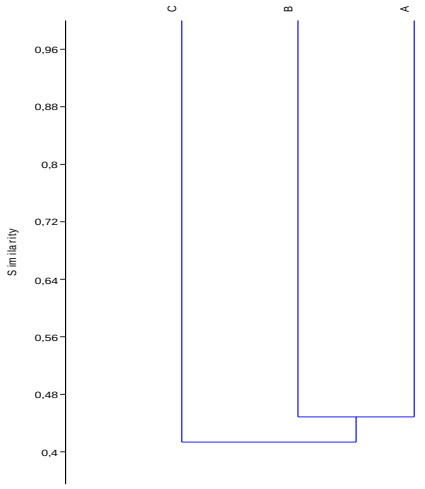

Figure 4. Dendrogram (distance measurement) presenting plot similarity between the three sampling areas: A = base, B = median, and C = top of the mountain). The Nearest Neighbors method was used based on the Jaccard coefficient.

The analysis of this dendrogram reveals a very weak similarity between A and B and A, B and C.

The figure 5 gives the plant species number families' in the UMA forest

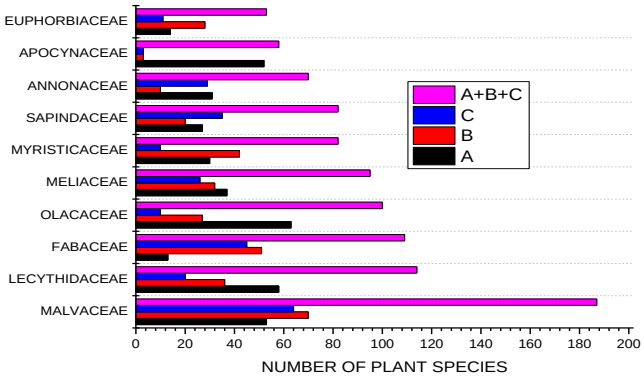

Figure 5. Plant species number families' importance in the UMA forest

In the three stations of investigation (A, B, C) there is high plant families' diversity (10). The dominant families concerning plant species number are Malvaceaea, Lecythidacea, Fabaceae, Olacaceae, Meliacea, Myristicaceae, Sapindaceae, Annonaceae, Apocynaceae and Euphorbiaceae. About plant individuals cumulative number the most dominant families are Malvaceaea, Lecythidacea, Fabaceae, Olacaceae (superior or equal to 100 individuals). In a similar study carried out in Guyana [13], it was reported that, the population of a forest site is still extremely diverse. The species richness varied between 140 and 210 species of trees per hectare and exceeds 400 species for 10 hectares of the forest. In his study on the structure and flora of the primary forest dominated by *Dipterocarpaceae* in the Eastern of Kalimatau, Sist [14] had found an average of 182 species per hectare and the average density was 530.7 stems/ha in the control plots. Basal area was 31.5 m^2/ha. Thus, UMA forest is a territory that abounds with a forest largely undisturbed with its reliefs that limit certain human actions on its biodiversity.

CONCLUSION

The interest for the biodiversity recently increased in response to the damage caused to ecosystems by human activities and the phenomena of climatic change. The present study revealed that UMA forest is a biodiversity rich ecosystem and plant abundance decrease from the base to the top of the mountain, with a good regeneration throughout all the trends. The Jaccard coefficient evaluated by the Nearest Neighbors method revealed a very weak similarity between the sampling areas location. ULMA forest has high proportion of trees morphological types. This could bring vulnerability to this terrestrial ecosystem through human disturbance attracted by timber and charcoal extraction as source of energy. As means of prevention, it is thus desirable that one encourages, exploitation of non-timber forest products such as leaves, fruits and seeds as medicines for primary health care. This form of exploitation is

more suitable and constitutes a sustainable and ecologically strategy for the forest management.

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Citation: Koto-te-Nyiwa Ngbolua *et al*.. (2015). Phytoecological Study of Uma Forest (Kisangani City, Democratic Republic Of The Congo). J. of Advanced Botany and Zoology, V3I2. DOI: 10.15297/JABZ.V3I2.01.