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Full Length Research

Tree species diversity around some Mayas in Dinder National Park, Sudan

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ABSTRACT: This study was conducted in Dinder National Park, during the dry season from February to May 2016, with the aim to determine the density, relative density, frequency and abundance of trees in the five Mayas in Dinder National Park. Data was collected using the transect line sampling method in the five Mayas namely; Abdel Ghani, Musa, Ras-Amir, Ein- Elshamis and Gererrisa. Abundance of trees and densities per Kilometer^2 varied but highest abundance trees were *Acacia seyal, Ziziphus spp, Combertum, Balanitie aegyptiaca* and *Acacia polycantha*. *Acacia seyal* covers larger area in Dinder National Park and also one of the common and dominant tree species. So control of the spread of this species could be by cutting and selling them at local markets and nearby villages to avoid the entrance of people to the park for that purpose.

Key words: Transect line, densities, relative density, frequency, abundance.

INTRODUCTION

The vegetation is sparse in the desert zones of the Sudan and various species of Acacia occur in the regions near the Nile valleys. Large forested areas are found in the central Sudan, especially in the river valleys. Among the most common trees are (hashab) *Acacia Senegal*, (talih) – *Acacia seyal*, (heglig) – *Balanite aegyptiaca* and several species of *Acacia mellifera*. Other varieties of timber trees are found in White Nile basin (Kanno, 2004). The vegetation which includes forest and pastures is the most important element in Dinder National Park (Kanno, 2004). Without vegetation almost no life exists in the park. It is the main source of food for almost all wildlife species of the park and it prevents soil erosion. Vegetation decomposition increases soil fertility and compaction. Therefore, any deterioration in the vegetation means instability in the park ecosystem (Kanno, 2004). *Acacia seyal, Combertum hartmnnianum* and *Balanite aegyptiaca* formed the woodland with tall grass including sorghum species. The reverie forest is characterized by *Hyphaena thebacia*, *Acacia seibriana,Tamarindus indica* and dalbergiame lanoxylon. Harrison and Jackson (1958) gave a general classification of Sudan vegetation in which Dinder area is included in the *Acacia seyal - Balanite* savanna alternating with grass area zone, and *Anogeissus – combretum hartmannianum* savanna woodland zone. The description given by Desman (1972) differs from the rest, in that Desman has classified the vegetation of Dinder National Park into four categories, wooded grassland, open grassland, wooded land and riverine forest. Hakim et al. (1978) and Abdel Hameed (1983) recognized three types of ecosystem *Acacia seyal – Balanites* woodland, riverine ecosystem and the mayas (wetland ecosystem). Dinder is mainly and extensively made of savanna grassland, woodland and rain river forest with and a few hills and high land located along and near the Ethiopian border. The park has all the three ecosystems, each with its own plant and animal communities.

Dinner National Park is large area with high diversity of topographic, ecological zones which make the ground survey so difficult to cover the whole park. The vegetation cover in the Park is characteristically important because it relates to the wildlife management which provides the animals with food, water, shelter and cover. The aim of this study was to identify the trees species and their distribution, densities, relative densities, frequency and abundance in the park.

MATERIALS AND METHODS

Study area

Dinder National Park was established in 1935. It is the

Table 1. Densities, relative densities, frequency and abundance of trees in north and west direction of Abdel Ghani Maya in Dinder National Park.

Tree species	Transects									
	North					West				
	No of Trees	Density per km	Relative density	Frequency	Abundance	No of Trees	Density per km	Relative density	Frequency	Abundance
Acacia Seyal	46	7324.8	0.0722	0.65	7324.8	32	5095.5	0.03129	0.5	5095.5
Acacia nilotica	69	10987.2	0.108	0.15	10987.2	18	2866.2	0.0176	0.1	2866.2
Acacia Polycantha	123	19585.1	0.094	0.6	19585.1	425	67675.1	0.4157	0.7	67675
Acacia Sieberiana	0	0	0	0	0	0	0	0	0	0
Balaniteaeygtiaca	38	6050.1	0.0596	0.6	6050.1	53	8439.4	0.0518	0.6	8439.4
ZizphusSpp	0	0	0	0	0	13	2070.0	0.0127	0.1	2070.0
CombertumSpp	18	159.2	1.569	0.05	159.2	5	0	0	0	0
Cratevaadansonia	1	2866.2	0.028	0.4	2866.2	0	796.1	4.890	0.1	
Gardinaspp`	0	0	0	0	0	0	0	0	0	0
Total	295	101432.6				546	162796.9			

most important Wildlife reserve in southeast Sudan. The park is located in the north eastern Blue Nile state towards the Ethiopian border between latitudes (11 to 13°N) and longitudes (35 to 13°E) and about 550 km south east Khartoum. It situated between two seasonal rivers Dinder and Rahad. Dinder National Park covers about (100,446.8 Km^2). The climatic conditions of the park in general can be summarized as cool and dry in winter and wet and warm in summer (Hashim, 1987).

Methods

The study was conducted in Dinder National Park during the dry season from February to May 2016. The vegetation data were collected along two randomly placed (in different directions) 1 km long transects at each of the five Mayas.

The starting point of transects was taken from the edge of the Maya along to the woodland. Along each transect a circular plots of each 10 meters radius were established (totaling to 20 plots) and the tree species inside the circle were identified, counted and recorded in all the 20 plots. The area of each plot was calculated according to the formula $A = \pi r^2$ then multiplied by 20 to deter-mine the total area surveyed along the transect (1km).

The summation individual number of stems of each tree species was computed. Then, the density, the relative density, frequency, and abundance of each tree species were calculated.

The data was calculated according to formula:

$$\text{Density} = \frac{\text{Total number of individual}}{\text{Area sampled}}$$

$$\text{Relative density} = \frac{\text{Density of a given species}}{\text{Total density of all species}} \text{ x } 100$$

$$\text{Frequency} = \frac{\text{Number of plots species occur}}{\text{Total number of plots}} \text{ x } 100$$

$$\text{Abundance} = \frac{\text{Number of individuals}}{\text{Number of plots in which species occur}}$$

RESULTS AND DISCUSSION

The dominant tree species in Abdel Ghani Maya was *Acacia polycantha*, with density of (19585.1) per km^2 followed by *Acacia nilotica* (10987.2), *Balanities aegyptiaca* (6050.1) *Acacia seyal* (7324.8) and *Combertum spp* (2866.2). *Zizyphus spinachristi* and *gardenia spp* were not observed. *Acacia seyal* showed the highest densities along the transect laid out in northern direction than the one in western direction and this may be attributed to the availability of baboon (*Papio anubis)* in that area who contributed significantly in distribution of these trees. *Acacia nilotica* showed higher density in northern direction and this may be attributed to the availability of water in that area (Table 1).

The number of tree species were higher in western direction than in north of the Musa Maya. The dominant trees species were *Acacia seyal* with the density of 99044.5 per km^2 followed by *Zizphus spp*, *Acacia nilotica*, *Balanit eaegyptiaca* and *Combertum spp* (Table 2).

Table 2. Densities, relative density, frequency, and abundance of trees in north and west direction of Musa Maya in Dinder National Park.

Tree species	Transects									
	North					West				
	No of Trees	Density per km	Relative density	Frequency	Abundance	No of Trees	Density per km	Relative density	Frequency	Abundance
Acacia Seyal	90	14331.2	0.3405	0.7	14331.2	622	99044.5	0.78182	1.8	99044.5
Acacia nilotica	56	8917.1	0.2119	0.2	8917.1	3	477.7	3.7708	0.1	477.7
Acacia Polycantha	8	1315.8	0.0312	0.1	1315.8	2	318.4	2.5133	0.1	318.4
Acacia Sieberiana	2	318.4	7.566	0.05	318.4	2	318.4	2.5133	0.1	318.4
Balaniteaeygtiaca	19	3025.4	0.0718	0.5	3025.4	7	1114.7	8.7990	0.15	1114.7
ZizphusSpp	68	1082.0	0.2573	0.35	1082.0	108	17197.4	0.1347	0.5	17197.4
CombertumSpp	12	1433.1	0.0340	0.1	1433.1	9	6461	0.0510	0.05	6461
Cratevaadansonia	9	1910.9	0.0454	0.35	1910.9	4	1433.1	0.0113	0.2	1433.1
Gardinaspp`	0	0	0	0	0	2	318.4	2.5133	0.2	318.4
Total	264	42079.9				759	126683.6			

Table 3. Densities, relative densities, frequency and abundance of trees in north and west direction of Ras Amir Maya in Dinder National Park.

Tree species	Transects									
	North					West				
	No of Trees	Density per km	Relative density	Frequency	Abundance	No of Trees	Density per km	Relative density	Frequency	Abundance
Acacia Seyal	138	21974.5	0.6301	0.9	21974.5	32	5095.5	0.2580	0.25	5095.5
Acacia nilotica	0	0	0	0	0	15	2388.5	0.1209	0.15	2388.5
Acacia Polycantha	12	1910.9	0.05479	0.15	1910.9	2	318.4	0.01612	0.1s	318.4
Acacia Sieberiana	0	0	0	0	0	5	796.1	0.0403	0.15	796.17
Balaniteaeygtiaca	16	2547.8	0.07305	0.4	2547.8	22	3503.1	0.1774	0.5	3503.1
ZizphusSpp	8	1273.9	0.03652	0.15	1273.9	47	7484.0	0.3790	0.4	7484.07
CombertumSpp	20	3980.9	0.1141	0.1	3980.9	0	159.2	0.0628	0.05	159.2
Cratevaadansonia	25	3184.8	0.0913	0.35	3184.8	1	0	0	0	0
Gardinaspp`	0	0	0	0	0	0	0	0	0	0
Total	264	34872.8				124	19744.8			

In Ras- Amir Maya the dominant tree species are *Acacia seyal* with the density of 21974.5 per km^2 followed by *Zizphus spp*, *Crateva adonensonia*, *Balanitie aegyptiaca* and *Combertum spp*. In general we found that the densities of tree species in northern direction is greater than that in the western direction and this may be attributed to the dryness of that part (Table 3).

In southern side of Ein- Elshmis Maya the number of tree species in the south is greater than that of the northern one. The dominant tree species

Table 4. Densities, relative densities, frequency and abundance of trees in north and south direction of Ein- Elshamis Maya in Dinder National Park.

Tree species	Transects									
	North					South				
	No of Trees	Density per km	Relative density	Frequency	Abundance	No of Trees	Density per km	Relative density	Frequency	Abundance
Acacia Seyal	150	23885.3	0.5136	0.85	23885.3	45	212	33757.9	0.670	1
Acacia nilotica	0	0	0	0	0	0	0	0	0	0
Acacia Polycantha	63	10031.8	0.2157	0.85	10031.8	20	15	2388.5	0.047	0.25
Acacia Sieberiana	0	0	0	0	0	0	0	0	0	0
Balaniteaeygtiaca	2	318.4	6.847	0.1	318.4	86	58	9235.6	0.183	0.6
ZizphusSpp	3	477.7	0.0102	0.5	477.7	27	72	11464.9	0.227	0.4
CombertumSpp	74	0	0	0	0	42	0	0	0	0
Cratevaadansonia	0	11783.4	0.253	0.8	11783.4	0	24	3821.6	0.075	0.55
Gardinaspp`	0	0	0	0	0	0	0	0	0	0
Total	292	46496.6				220	381			

Table 5. Densities, relative densities, frequency and abundance of trees in northern and southern direction of Grerrisa Maya in Dinder National Park.

Tree species	Transects									
	South					West				
	No of Trees	Density per km	Relative density	Frequency	Abundance	No of Trees	Density per km	Relative density	Frequency	Abundance
Acacia Seyal	57	9076.4	0.2896	0.75	9076.4	85	13535.0	0.338	0.75	13535.0
Acacia nilotica	2	318.4	0.0101	0.1	318.4	10	1592.3	0.0398	0.05	1592.3
Acacia Polycantha	45	7165.6	0.2286		7165.6	2	318.4	7.966	0.1	318.4
Acacia Sieberiana	1	129.2	4.1226	0.05	129.2	0	0	0	0	0
Balaniteaeygtiaca	7	1114.7	0.0355	0.15	1114.7	20	3184.8	0.0796	0.05	3184.8
ZizphusSpp	9	1433.1	0.0457	0.15	1433.1	101	16082.8	0.402	0.35	16082.8
CombertumSpp	61	2070.0	0.0660	0.15	2070.0	32	0	0	0	0
Cratevaadansonia	13	9713.3	0.3099	0.76	9713.3	0	5095.5	0.127	0.5	5095.5
Gardinaspp`	2	318.4	0.0101	0.1	318.4	1	159.2	25350.3	0.05	159.2
Total	197	31339.1				251	39968			

in Ein –Elshamis Maya were *Acacia seyal* with the density of 33757.9 per km^2 followed by *Combertumspp, Zizphuaspp, Acacia polycantha* and *Balanite aegyptiaca* (Table 4).

Gardenia spp showed fewer densities in Gererrisa Maya and the number of trees in western direction is higher than the southern one. The dominant tree species in Gererrisa Maya were *Zizphus spp* with the density of 16082.8 per km^2 followed by *Acacia seyal, Acacia polycantha, Combertum spp* and *Balanite aegyptiaca* (Table 5).

The general dominant tree species was *Acacia*

seyal in all area searched and this is in line with the findings of (Desman, 1972). *Acacia seyal* and *Balanite aegytiaca* association changes into *Anogeissus leiocarous* and *Combretum spp* (Hakim and Nimir, 1983).

The recent study revealed that in burnt areas almost 90%of the regenerated growth is of *Acacia seyal* which is more resistant to fire than the other two dominant` species, *Balanite aegyptiaca and Combretum hartmannianum* and this agreed with the findings of Abdel Hameed et al (1999)

Form the above discussion ,the expansion of these dominant tree species at the account of open grass land has a negative impact on wildlife species that prefer open grass land as their hahitat.

Conclusion

The densities of the tree species in the five Mayas are different. The highest densities were observed in Abdel Ghani Maya followed by Musa, Ein-Elshamis, Ras-Amir and Gererrisa. *Acaia seyal* showed the highest densities in comparison with other tree species. *Acacia seyal* covers larger area in Dinder National Park and also one of the common and dominant tree species.

Recommendation

i. Control the spread of *Acacia seyal* could be by cutting and selling them at local markets and nearby villages to avoid the entrance of people to the park for that purpose.
ii. Establishment of fire lines to control the annual fires incident.
iii. Mayas should be excavated to avoid their phasing out and to increase their water holding capacity.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

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