SHRUBS ASSOCIATIONS IN RELATION TO ECOLOGY OF SAVANNAH RANGELANDS AT EL SUKI AREA, SENNAR STATE, SUDAN

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ABSTRACT

The first attempt to study the flora of the study area was in 1958, which included in the work of Harrison and Jackson about classification of the Sudan vegetation. The study area was very rich of plant diversity, especially trees and shrubs, because of the high rainfall. This study is an attempt to investigate and update the associations between the shrubs species to know their ecological positions among the vegetation cover. A field survey was conducted in the two seasons of 2011-2012 and 2012-2013 at the south-eastern part of Sinnar State. Five major transects were taken, each of 3000m length, 10m width in a total area of 150.000m^2. Results showed that *Acacia oerfota* is the dominant shrub species throughout the study area, with *Acacia mellifra* and *Combretum aculeatum* as ecological associates, because they were abundant, frequent and of high density, and less diversity in the savannah rangelands at El Suki Area, Sennar State, Sudan in the two seasons.

Keywords:

Acacia oerfota,
Acacia mellifra,
Combretum aculeatum,
El Suki

I. INTRODUCTION

The term of association was first coined by Alexander von Humboldtand formalized by the International Botanical Congress in 1910. (Barbour et al. 1999) (Willner, Wolfgang 2006).In community ecology and phytosociology an association is a type of ecological community with a predictable species composition; consistent physiognomy (structural appearance) which occurs in a particular habitat type (Barbour et al. 1999).

An association can be viewed as a real, integrated entity shaped either by species interactions or by similar habitat requirements or it can be viewed as merely a common point along a continuum. The former viewed was championed by American ecologist Frederic Clements, who viewed the association as a whole that was more than the sum of its parts, and by Josias Braun-Blanquet, a Swiss-born phytosociologist. On the other end of the argument was American ecologist Henry Gleason, proponent of the "individualistic concept" of plant associations (Barbour et al. 1999).

There was no single researches studied shrubs only, always comes with trees, woody species or flora. An outstanding contribution is the well-documented classification of the Sudan vegetation by Harrison and Jackson (1958), Ramsay (1958) studied central Darfur, Bruin and Massey (1929) stands as the best flora produced for the Sudan. Recently, more comprehensive studies were undertaken. These include: Hassan (1974) who studied the flora of Erkouit, Wickens (1976) presented a detailed multi-disciplinary studies of Jebal Marra. Gumma (1988) study was on Ingessana Hills, El Awad (1995) presented an eco-taxonomical study of the Red Sea Hills, Mohammed A.A. (2001) studied the ecology of Jebal AlFaw and surrounding area.

M. E. Adams (1967) reported that a bush-like form; the aerial parts branch just above the root crown, and the distal parts of the lower branches of a healthy tree brush the surface of the ground. Old moribund trees have a more tree-like form because these lower branches die. A shallow but extensive root system radiates from the root crown (Figure 1). Many of the roots extend 8-15 m from the stem, parallel to the surface and at a depth of 25 cm. The aerial parts are springy and, when a horizontal force is applied against them, will bend through 90°.

Acacia mellifera grows gregariously and forms impenetrable thickets. Consequently the ground flora is sparse, consisting of scattered plants of Aristida adscensionis and occasional herbs, such as Leonotis pallida. The sparse ground flora is not sufficiently dense to carry fires into the thickets, and thus they are fireproof. Isolated bushes are also difficult to burn because the branches and leaves of a young or mature bush form a dense, hemispherical mass, touching the ground all around the stem.

In many cases the negative effects upon neighbours arise from competition for light, with larger plants shading smaller plants. In other cases, there may be competition below ground for water, nitrogen, or phosphorus (Keddy 2001).

Frequency is usually expressed as a percentage and sometimes called a Frequency Index. The concept of frequency refers to the uniformity of a species in its distribution over an area. No counting is involved just a record of species present (Smith et.al 1986).

This study is an attempt to study the association of the shrubs in El Suki area to know their ecological positions among the vegetation cover.

II. MATERIAL AND METHODS

In the two consecutive seasons of 2011- 2012 a field survey was conducted in the south-eastern part of Sinnar State to investigate the association between the shrubs species to know their ecological position among the vegetation cover. The study area (Figure 2) is located at latitude N: 12.80404 and longitude E: 34.26082 in the central clay plains of the Sudan. It has a semi-arid tropical climate with high temperature during summer and relatively low temperature during winter. Relative humidity varies with maximum of 67% in winter, and minimum of 47% in summer. The soil was dark cracking with very high clay content, characterized by high swelling and shrinking characteristic (Abdelaziz ,2010).

Five major transects were taken, each of 3000m length, 10m width within a total area of 150.000m2 (Figure 2). Sampling precision was obtained by long narrow rectangles crossing contour lines, according to Barmann (1953). Four parameters were taken; density, abundance, frequency and diversity, to measure associations between shrubs species. Analysis was done by using formulae of the above parameters.

III. RESULTS AND DISCUSSIONS

3.1 Density:

Results obtained in this study, as shown in table (1) revealed that Acacia oerfota had a high density in all transects in the two seasons, while Combretum aculeatum had a high density in transects 4 in season 2011. When in season 2012 Acacia mellifra had a high density in transects 4. This high density maybe due to their underground roots which extend 8-15 m from the stem and when a horizontal force is applied against them, will bend through 90°. This result in agreement with M. E. Adams (1967) who reported that many of the roots extend 8-15 m from the stem, parallel to the surface and at a depth of 25 cm. The aerial parts are springy and, when a horizontal force is applied against them, will bend through 90°. And also in agreement with (Keddy 2001) who reported that; in other cases, there may be competition below ground for water, nitrogen, or phosphorus.

3.2 Shrubs abundance, frequency, diversity and density:

In season 2011-2012 and 2012-1013 at all of the study area Acacia oerfota had a high abundance, density and frequency with Acacia mellifra (Table 2). This result may be due their extended roots which make several new plants around the main plant. This result in agreement with M. E. Adams (1967) who reported that many of the roots extend 8-15 m from the stem, parallel to the surface and at a depth of 25 cm. The aerial parts are springy and, when a horizontal force is applied against them, will bend through 90°.

IV. CONCLUSION

It is to be concluded that, Acacia oerfota is common throughout the study area with Acacia mellifra and Combretum aculeatum as ecological associates, because they showed high abundances, frequency and density in both seasons.

V. RECOMMENDATION

It is to be recommended that further researches are needed in the study area to know the ecological relations between shrubs species.

Table (1): Shrubs density 2011/ 2012

Species	*Season 2011*					*Season 2012*				
	TR 1	TR2	TR 3	TR 4	TR 5	TR 1	TR2	TR 3	TR 4	TR 5
Acacia oerfota	92.25	86.89	96.63	33.33	99.28	72.73	90.81	95.08	38.46	97.22
Acacia mellifra	6.68	10.78	0.48	31.91	0.36	21.21	8.46	2.84	48.95	0.00
Combretum aculeatum	1.07	0.21	0.00	33.33	0.18	0.00	0.00	0.00	12.59	0.00
Capparis decidua	0.00	0.42	1.69	0.00	0.18	6.06	0.37	0.76	0.00	0.00
Cadaba forinosa	0.00	1.69	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00
Grewia tenax	0.00	0.00	0.96	0.00	0.00	0.00	0.37	1.14	0.00	0.00
Calotropis procera	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.19	0.00	0.00
Aerva jovanica	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00
Stereospermum kunthianum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78

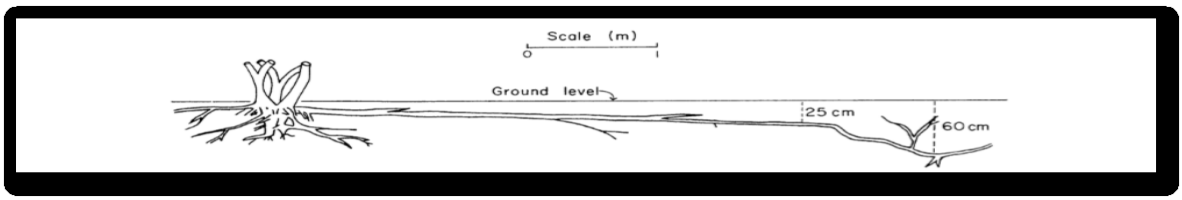
TR = Transect

Table (2): Shrubs abundance, frequency and diversity 2011/2012

Species	Season 2011				Season 2012			
	A	F	SiD	Density%	A	F	SiD	Density%
Acacia oerfota	351.2	100	1.3	89.64	207.6	100	1.3	87.08
Acacia mellifra	25	100	247.5	6.38	23	100	108.3	9.65
Combretum aculeatum	13.3	80	1391.8	2.71	9	40	4639.5	1.51
Capparis decidua	3.3	60	42619.1	0.51	2.3	60	33801.7	0.59
Cadaba forinosa	4.5	40	53273.9	0.46	0	0	0	0.00
Grewia tenax	4	20	319643.5	0.20	3.5	40	33801.7	0.59
Calotropis procera	1	20	0	0.05	1	20	0	0.08
Aerva jovanica	1	20	0	0.05	0	0	0	0.00
Stereospermum kunthianum	0	0	0	0	6	20	47322.4	0.50

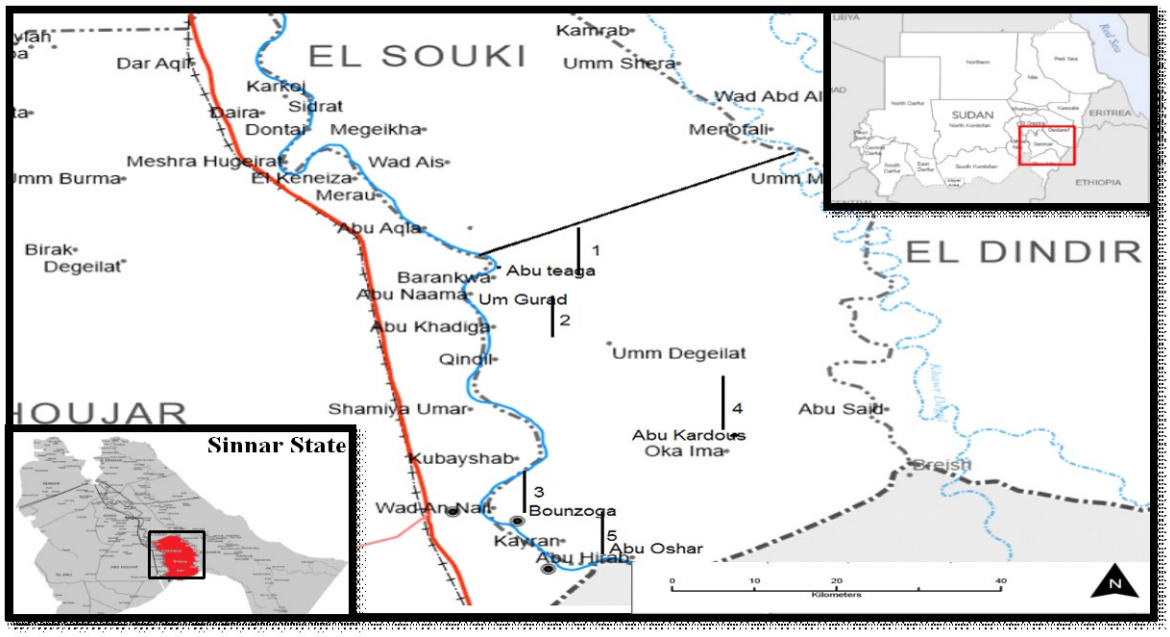
A = Abudance, F = Frequency, SiD = Diversity

Figure 1: The root system of *Acacia mellifera* (mature bush).



Source: Journal of Applied Ecology

Figure 2: Study area



Source: OCHA (2012

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