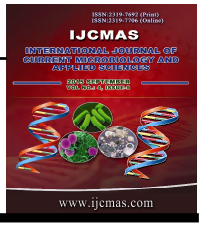
Int.J.Curr.Microbiol.App.Sci (2015) 4(9): 795-804

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 4 Number 9 (2015) pp. 795-804**
http://www.ijcmas.com



Original Research Article

Density of natural forests remain among unprofessional behaviour in Shomadi area, Renk, upper Nile State

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Keywords

Acacia, Biodiversity, Dominant, Frequency, Sustainable

A B S T R A C T

About 95% of the native people of Shomadi area are engaged in farming and forest activities. Few are engaged in animal breeding. Recently, due to poor crop yield and increasing poverty, most of the local community shifted their economic activities towards forest produce i.e firewood, charcoal and tapping Gum Arabic. Shomadi represents one of the areas that experienced serious vegetation cover change, biodiversity losses and socio-economic deterioration in the country due to the population dynamics, increase number of animal wealth, rapid expansion of Mechanized Rain-fed Farming System, frequent spells of drought, rainfall variability, low crop yield encourages people shift to other activities of quick income such as forest activities (logging, charcoal making, etc..The methodology vegetation samples were taken using the point-centered quarter method (PCQ). The aim was to determine the following parameters about the vegetation of the study area such as: density, types, dominant and distribution of plant species in the area. Then, the vegetation density was calculated in hectare (ha) according the following equation: Then, the vegetation parameters were the total distance (dt.), the average distance between trees ($\bar{dt}$ /n) meters, the average area occupied per tree ($\bar{d^2}$) meters^2 and the absolute density for all trees, (10 m) ^{2} / A^2 = trees/ha.The objectives is to assess the situation of the stands in the study area through the Identification of types, distribution and density of vegetation cover and to know if there is any change between the current and the past in vegetation cover due to malpractices in the area. The objective of the research is to come up with a strategy and methodology that facilitate monitoring and management of sustainable natural resources in sensitive environmental ecosystems likes that of shomadi area. The results show that the tree density varies from 26 to 1886, and the average density is found to be 980 trees/ha. The most endangered tree is *Acacia seyal*. Inspite of high regenerative capacity of *Acacia seyal*, it ranks the fifth tree area density wise, while in the last 40 years ago the interviewers confirmed that it was ranking the first.

Introduction

There is a relation between environment and natural resources base, because depletion became one of the most urgent problems at present time. The natural resources depletion

indicates a reduction in its value, regenerative capacity, productive and reproductive capacity. There are many factors contributing to resources depletion.

These factors may be natural i.e. drought, pests or anthropogenic factors such as industries, mining, farming, increased population, economic development and literacy. All these factors, collectively or individually cause unrest and imbalance to the environment. Generally, the phenomenon of ecosystem disturbance is an indication of deterioration, disintegration and depletion of natural resources base (Cox, et al, 1979).

The situation of the world vegetation cover

Several studies showed that the climate and earth in a big part of the world which is covered by arid and semi-arid zones that characterized by erratic rainfall and high rate of vegetation dynamics has undergone rapid transformation in both poor to rich environments (Herlocker ,1999) and Dahdough, et al., (2002).

Moreover, the world land that totaling up to 3,600 million hectares, which is equal to 70% of the world's arid lands are degraded, 10 million hectares of arable land deteriorates every year (Essahli, et al., 2008). Thus, the ecosystems in these zones are pressurized to display gravy and gloomy future picture that drawn by both, nature and man. Hellen, et al (1991), explained that; the deterioration of the semi-arid land is due to many interacting factors, among these are irregular precipitation and human activity, where Oba et al., (2000), and Gemedo et al., (2006) added more other factors such as pests, diseases and invasion of undesired exotic plant species.

Forest fragmentation

Fragmentation is one of the major threats for the conservation of the biodiversity and the ecological functions of forests (Loyn, et al., 2001). The causal of the threats are: (1) Area reduction, patches remain (2) Increased isolation of the fragments and loss of overall connectivity (3) Increased edge effect and disturbances from the surroundings (Saunders, et al., (1991), Haila (1999), and Santos, et al., 1999). Moreover, forest fragmentation affects the richness, abundance, and dispersal ability of forest-dwelling species (Iida, et al., (1995), Gill, et al., (1996), Gibson., et al. (1988), Merriam (1998), Haila (1999), Rochelle, et al., (1999), and Santos, et al,. (1999). Forest fragmentation is a form of habitat fragmentation. It happens when forests are cut down leaving relatively small, isolated patches of forest known as forest fragments or forest remnants. The area that separates the remaining woodland patches can be pasture, farmland, etc. depending on the intended purpose. It is said that the remnant woodland resembles islands of forest in a sea of fields, pastures etc. (Sahney, 2010).

Human- environment interaction relation

The science of the environment is a complex. It is socially and politically situated rather than separable from the subjective location of human perception. Therefore, good understanding of the complexity of environment and environmental issues is a perquisite for resolving the environmental challenges that we face (Stott, et al., 2000). Evidence shows that many environmental problems arose such as land cover change, biodiversity loss, pollution, climate change, meanwhile we still pursue activities which perpetuate the problems. As the world's population increases, and the per capita

consumption of natural resources increases, we will have an even greater effect on these environmental problems, exacerbating them further, and there is even greater effect on these environmental problems. Therefore, it is said that, these environmental problems are so hard to resolve. However, Frances (2004) proposed the main reasons for the continuing environmental problems such as great number of stakeholders involved in both the causes and the solutions to environmental problems. Thus, it is not easy to organize them to act in a co-ordinate manner and resolving global environmental issues necessitates changes in human lifestyles and attitudes towards environment, and this needs commitment at personal as well as community levels, which none is willing to make.

Economic activities

About 95% of the native people of Shomadi area are engaged in farming and forest activities. Few are engaged in animal breeding. Recently, due to poor crop yield and increasing poverty, most of the local community shifted their economic activities towards forest produce i.e firewood, charcoal and tapping Gum Arabic because of quick and high income within a short period comparing to agriculture. There are many people who came from different parts of Sudan. Some of them are farmers, and others are traders. Shuluk and Falata are the most tribes engaged in fishing. Agricultural activity in Shomadi area consist of two main types of agricultural are practiced in this area:

Irrigated agriculture: This subsector began in the late 1940s and early 1950s as a private sector with the objective of producing long staple cotton crop as a cash crop along with sorghum and vegetable crops to sustain the farmers. By 1969, these schemes were nationalized to become public sector. The government took over the responsibility of availing credit and farm inputs to the farmers beside marketing the agricultural produces, especially, the cotton. This concept is similar to Geziera Board, the joint account which is based on crop production relations between the farmers and the government. In the late 1989 and the early 1990s, these schemes were privatized, and the farmers took over the responsibility of administration, while the role of the government confined to provision of basic infrastructure and technical support.The irrigated agriculture includes big schemes as well as the small gardens a long the White Nile with total area of 25, 000 ha. (59.525 fed.). The land is owned by both private and public sectors. Water pumps are used to draw water from the White Nile. Different field and horticultural crops are grown including, cotton, sorghum, maize, beans, peas, groundnuts, sunflower, guar, sesame and vegetables (Adam, 2007).

Rain-fed agriculture: This type of farming comprises the followings:

Mechanized Rain-fed agriculture: As the name implies, more technology (tractors, herbicides, combine harvesters etc.) are applied. Each Scheme is with an area ranging between 1190.5- 4762 ha. (500 - 2000 fed.). Historically, the Mechanized Rain-fed Farming was introduced to Renk area in 1959, when about 2099.95 ha (5000 fed) were allotted to farmers. In 1964 about 50,000 ha (119,050 fed.) was surveyed and distributed to farmers (table 4 and 5). During 1970-1975, about 419, 997.62 ha (420,000 fed.) were distributed. in 1984 and the total area became 1314166 ha (3,129,029.25 fed.). Therefore, agriculture expansion consumed most of the vegetation cover lands, Beside the rainfall mechanized area,

there is what is known as undemarcated farming (Kharij Al Takhtiet) which has grown very rapidly, and its total area became nearly equal to that of the demarcated lands. This is on the account of vegetation cover.

Traditional rain-fed agriculture (subsistence farming or shifting cultivation). It is a rainfall dependant farming with small areas 0.21- 0.84 ha. (0.5-2.0 fed.) depending on the family size. Most of work is carried out manually. The communal work is common. Several types of traditional farming are known in this area, among these:

Hareek cultivation: During the dry season, grasses are kept out of fire till rain starts, when new grasses germinate and reach certain stage, fire will be set on, so both the old and new grasses will be burnt and completely destroyed. The objective is to reduce the weeds and the frequent weeding. Although, fire may add minerals to the soil, but it has many negative impacts on different microorganisms and ecosystems (Adam, 2007). (ii).Jabareek: Lands in the vicinity of the residences are cultivated by what is called famine crops; which means crops that mature earlier so that to secure food, particularly during the critical seasons when the rainfall is scarce. These crops like pumpkins, okra, watermelon, maize, ground nut, beans etc.

Problem

Shomadi represents one of the areas that experienced serious vegetation cover change, biodiversity losses and socio-economic deterioration in the country due to the population dynamics, increase number of animal wealth, rapid expansion of Mechanized Rain-fed Farming System, frequent spells of drought, rainfall variability, low crop yield encourages people shift to other activities of quick income such as forest activities (logging, charcoal making, etc..), poverty: the levels of poverty increased due to low income and oil exploration and exploitation. During the last decades, even today, only little information is known about vegetation cover change in this area. This situation created a great desire to assess vegetation cover and to provide recommendations that enable planners to take the right decisions. Moreover, this study will contribute to the sustainable management of natural resources and environment in the area and beyond. There are several objectives, among these are: To identify types, distribution and density of vegetation cover in Shomad area, to know if there is any change between the current and the past in vegetation cover and to come up with a strategy and methodology that facilitate monitoring and management of sustainable natural resources in sensitive environmental ecosystems like that of shomadi area.

Materials and Methods

Vegetation samples were taken using the point-centered quarter method (PCQ). The aim was to determine the following parameters about the vegetation of the study area such as: types of plant species in the area, the dominant plant species, density of plant species in the study area and distribution (Frequency) of plant species in the study area.

Sampling method

Randomly, well located points within the vegetation stands were assured. Hundred (100 meters) meters transect tape that does not extend beyond the stand was used. Samples were limited to the homogeneous areas (i.e. soil type, topography). In area

with slope, the elevation contour of the slope was followed. The meter tape was stretched to its full length. At each 10 meters of the tape, sample points were marked at interval along the tape where an individual tree was sampled once at successive points. At each sample point, "X" was defined as an imaginary point to define four quadrants from sample point to the tree were recorded. The process was repeated for three times, and then the average for point was obtained. This average was considered the reading of the point. Moreover, other plant species such as grasses were identified. The records of each sample were arranged in a table (1). Then, the above mentioned vegetation parameters were calculated according the following equations.

Step 1. Calculation of the total distance (dt.)

$$dt = \sum_{i-1}^{n} di = \ldots\ldots\ldots\ldots\text{meters.}$$

Where dt is the total distance, di is the distance to tree number i, and n is the total number of trees.

Step 2. Calculate the average distance between trees, ($\bar{d}$):

$$D = \bar{dt} /n\ldots\ldots\ldots\ldots\ldots\ldots\text{meters.}$$

Step 3. Calculate the average area occupied per tree, (A):

$$A = \bar{d^2} = \ldots..\text{meters}^2.$$

Step 4.Calculate the absolute density for all trees, (Da), in trees per Hectare (ha).

$$Da = (10\ m)^2 / A^2 = \ldots\ldots\ldots\ldots\text{trees/ha.}$$

Results and Discussion

The statistical analysis of the 18 tree species identified in the study area showed that *Acacia mellifera* (Kitir) is the dominant species (Table 1) especially in the middle and Southern parts of the study area, followed by *Cadaba rotundifolia* , *Boscia senegalensis* and *Acacia nubica* (Laowat), particularly in the Northern part. Meanwhile *Acacia senegal* and *Acacia seyal* rank the fourth and fifth respectively. Arrad and Gargadun being in the tail of the list.

Table (2) explains that the frequency for *Acacia mellifera* is 96 which is equal 24% of the total trees in the study area. On the other hand *Dalbergia melanoxyion*, *Albizia sericocephala* ,*Abutilon figarianum* and Murdukh are records the low frequencies in the area which is equal 0.2 % from the total trees .

Table (3) shows that the high trees density is 1886 trees /ha in sample point number 8 while the low density is 26 trees/ha in sample point number 10. The calculation gives the average density which is equal to 980 trees /ha in the total area. This explained that the tree stands were subjected to disturbances through the human activities.

Factors contribute to deforestation forests

Forest in the study area becomes a livelihood for many people; therefore it is subjected to severe destruction. The study reflected that the horizontal expansion of mechanized rainfed farming has swallowed big forestland, where trees are massively devastated manually and sometimes heavy duty machines are used to devastate many hectares within an hour.

Beside the agricultural expansion. However, as a result, several tree species are endangered as due to selectivity and discriminated cuttings, among these *Acacia seyal* (Talih), *Balanites aegyptiaca* (Hehlij) and *Acacia mellifera* (kitir). Moreover, fire setting by people engaged in forest activities

and herders who set fires for two reasons, to combat Ticks and to promote grass growth . Fires burn all grasses, shrubs, tree branches and sometimes the tree trunks. Fire also has negative impacts on habitats, macro and microorganisms and the other ecosystems. Other activities related to forest such as Lobbing (Plates 1), charcoal making (Plate 2), building materials, fire woods , opening new roads (Plate 3) and petroleum exploration and exploitation , all contributed and accelerated the rate of forest deterioration in the study area.

Table.1 Recording method of vegetation sampling, Shomadi Area (2010)

1	2	3	4	1	2	3	4
Point No	Quad. No.	Species type	Distance (mets)	Point No.	Quadrat. No.	Species type	Distance (mets)
Stand 1	1	Kitir	2		28	Kitir	6
	2	Mukheet	3	8	29	Mukheet	4
	3	Hashab	2		30	Laawot	2
	4	Hashab	1		31	Laawot	1
2	5	Hashab	2		32	Hashab	4
	6	Mukheet	2	9	33	Kurmot	4
	7	Talih	3		34	Kitir	3
	8	Laawot	2		35	Laawot	4
3	9	Kurmot	2		36	Laawot	4
	10	Talih	5	10	37	Mukheet	3
	11	Kurmot	3		38	Kitir	4
	12	Kurmot	2		39	Kurmot	4
4	13	Kurmot	2		40	Hashab	3
	14	Mukheet	3	m=10	n=40		dt=109
	15	Kitir	3				
	16	Mukheet	2			Tree spp.	Frequency
5	17	Kitir	2			1.kitir	10
	18	Talih	1			2.Mekheet	7
	19	Kitir	3			3.hashab	5
	20	Kitir	2			4.Talih	3
	21	Kurmot	1			5.Laawot	6
	22	Mukheet	3			6.Kurmot	9
	23	Laawot	2			Total	40
	24	Kurmot	1				
7	25	Kitir	4				
	26	Kitir	2				
	27	Kurmot	3				

Table.2 Frequency distribution of tree species in Shomadi area (2010)

Tree species	Frequency	%	Valid %	Cumulative %
Acacia mellifera (Kitir)	96	24.0	24.0	24.0
Boscia senegalensis (Mekheet)	51	12.8	12.8	36.8
Acacia senegal (Hashab)	34	8.5	8.5	45.2
Acacia seyal (Talih)	33	8.2	8.2	53.5
Acacia nubica (Laawoot)	44	11.0	11.0	64.5
Cadaba rotundifolia (kurmot)	59	14.8	14.8	79.2
Copparis decdua (tontub)	4	1.0	1.0	80.2
Grewia tenax (Gedeem)	17	4.2	4.2	84.5
(kadad)	3	.8	.8	85.2
Balanites aegyptiaca (Heglej)	28	7.0	7.0	92.2
Dalbergia melanoxyion (Abanos)	1	0.2	0.2	92.5
(Murdukh)	1	0.2	0.2	92.8
Leptadenia byrotechnica (Merikh)	3	.8	0.8	93.5
Cobretum glutinosum (Habeel)	7	1.8	1.8	95.2
Albizia sericocephala (Arrad)	1	.2	.2	95.5
(Sahab)	7	1.8	1.8	97.2
Lannea fruticosa (Leyoon)	10	2.5	2.5	99.8
Abutilon figarianum [(Gargadan(teckoya)]	1	.2	.2	100.0
Total	400	100.0	100.0	

Table.3 Calculation of trees stands parameters in study area 2010

Sample point no.	dt = Σ di/m	D = $\overline{dt}$ /n/m	A = $\overline{d^2}$/m	Da = (10 m) ² / A²/ trees/ha
1	109	2.7	7.4	1351
2	129	3.2	10.4	961
3	137	3.4	11.7	854
4	185	4.6	21.4	487
5	103	2.6	6.6	1515
6	148	3.7	13.7	729
7	99	2.5	6.1	1639
8	92	2.3	5.3	1886
9	212	5.3	28.1	357
10	90	2.3	5.1	26
Total	1304	32.6	115.8	9804
Average	130.4	3.26	11.58	980.4

Plate.1 Tree lobbing

Plate.2 Tree cutting down for making Charcoal

Plate.3 Trees removal for opening new roads

In conclusion, although the human factors are the main derivers for land use land cover changes, natural factors also promoted the land use land cover changes in Shomadi. The popularly held view that expansion of cultivation is a primary force of vegetation clearing and environmental degradation is found to hold true in the period considered as land-cover conversion to cropland is a major phenomenon in the study area. Meanwhile, rangelands showed continous increase which is a good indicator from economic and environmental point of view. The displayed that the pattern of vegetation type, density and distribution in the study area is associated with the amount and duration of moisture and soil type.

Recommendations

References to the findings of this study, the following recommendations are made:

Due to the rapid undergoing land use and land cover change in the study area, for better understanding of the trend, magnitude, impacts and the future direction of the changes. the focus of future research should be on digitalized high research accuracy that integrates high temporal and spatial resolution satellite images with field work and observations

To ensure long term balance between population dynamics and the physical environment, sound policies to be formulated based on the pattern of current environmental changes.

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