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Effect of Human Activities on Forest Biodiversity in White Nile State, Sudan

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ABSTRACT: This study was carried out in White Nile State to determine effects of human activities on forest biodiversity. The area is rich with natural forests. The forestland is continuously deforested and the remaining forests are degraded because of agricultural practices and the absence of management plan. This study aims to investigate the forest cover changes and understand the vegetation dynamics in three zones, zone (I) which represents the tree cover that extends along khores and low lands, zone (II) represents the scatter trees defined as trees outside forests including areas as open grazing land; zone (III) is the agricultural land. Each of them is approximately 400 hectare. The components of each zone included land use categories of forest cover scattered. A social survey was conducted to assess the link between community practices and natural resource development. The questionnaire included a set of questions about tree and their status. The study reveals that the role of community participation is crucial in conservation and sustainable management of natural resources. However, this community solely relies on fuel wood as the main source of energy with a limited use of alternatives sources like kerosene and gas; this may necessitate a shift toward alternatives sources in order to reduce the consumption of wood.

KEYWORDS: Local community, wood, biodiversity, White Nile state, Sudan.

1 INTRODUCTION

Biodiversity conservation is becoming increasingly popular approach and has begun to attract international agencies in the 1990s. This approach focuses on learning and demonstrating the potential for systematic change rather than solving immediate site–specific problems [1]. Deforestation, a major aspect of desertification and land degradation, is one of causes of social suffering [2]. Forests provide enormous socio-economic and environmental values that are essential for sustainable development [3].

Reference [4] reported that forests are converted to mechanized farms at approximate 0.5 million hectares per annum. This estimate is very close to forest resource assessment conducted by FAO [5], which estimates an annual rate of forest clearance in the Savanna zone of 0.54 million hectares per annum. Deforestation in the Sudan has been reported to follow similar tends in tropical natural forests in Africa, where the rate of forest conversion is approximately 29 times the rate of reforestation [6], [7].

Local leaders and local administration system are considered useful support to formal institutions [8].

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Reference [9] stated that in response to the dramatic decline of forests cover and the growing threat of deforestation. The forest policy 1986 involved recognition and encouragement of the establishment of community, private and institutional forests [10]. Many studies showed negative effect of human activates on forest biodiversity. Reference [11] stated that the role of resource users is overlooked or underestimated; the result is the low performance of planned projects, deterioration of resources and failure to achieve targeted socio-economic goals. This work aimed at illustrates the role of local people on the on Forest biodiversity and to investigate the Forest biodiversity changes because of forest users and asocial survey conducted in order to develop linkages between community practices and natural resource development. The gathered information will provide the full information about the state to be used for better planning and decision-maker.

2 STUDY AREA

Study was carried out at White Nile State, between (11° 55'' and 15° 11'' North and 31° 3'' and 33° 15'' East) [12]. The area of the White Nile State is about 40060 Km Sq. population of state in 1998 was around 1,401,895 persons. Basement rocks generally flat, under lay landscape. The most noticeable feature of the landscape is the presence of elongated sand dunes, which cover the eastern and southern port of the area.

The water resources in the White Nile State include the White Nile, the underground water and surface water including Khores, Wadies and surface run-off. The vegetation coverage is gradually changing according to the amount of rainfall from northern to the southern part of the state.

The area forms transitional zone between the bank of White Nile River and ElHelba, which is mainly composed of natural rangeland with few scattered relics of the remaining natural forests and few scattered villages and semi-settled areas. The population of the White Nile State in 1998 was around 1,401,895 persons, about 5.8% of the total country population .Those who live in rural centres were 474,682 (39%), those in the rural area were 900,437 (64.2%) and the nomads 26,776 (1.9%). The most important tribes are Gemme, Bagara, Seliem, Hassania, Ahameda, Shekhnab, dar moharb (Sabaha and Bini Grare) Shwiahat, Most of the population practicing in the field of traditional farming and grazing, while a few of them practiced trade.

The study area lies within two distinctive climatic seasons, the dry warm winter and hot moist summer. The Climate of the area is characterized by a relatively long dry season and a short wet season and the rain ranges from 150 mm/annum in north to 500mm/annum in south. The mean annual rainfall ranges between 200-300 mm and within this range; rainfall increases south words [13].

3 METHODOLOGY

Recognized survey was conducted in a vast area of the semi-arid zone following the vegetation cover that developed according to the soil and land use system and classification. From this survey, three categories of plant communities were recognized and observed in a repetitive manner all over the area in different dimension.

The three categories are (I) which represents the tree cover that extends along khores and low lands, category (11) represents the scatter trees defined as trees outside forests including areas as open grazing land; category (111) is the agricultural land. The extent of each category is depending mainly on the land use type different approaches for information collection and gathering such as meetings, observation, questionnaire, group discussion and individual interviews was conducted, covering villages in three sites of studying area. The questionnaire included a set of questions about tree and their status. The questionnaire was supported by SSP analysis.

4 RESULTS AND DISCUSSION

The age distribution and analysis (Table1) reflect that all the age groups in the range of ≤ 20 to ≥ 60. This means that, all age categories are available and should be considered in the planning process of any project for rural development.

Education is a way forward towards public awareness raising. The education facilitates the dissemination of extension. Educated people can read written extension messages besides the chances for using other media.

Table 1. Age Groups

Age-group	Frequency	Percent	Valid Percent
≤ 20	5	3.7	3.7
21-30	43	31.9	31.9
31-40	33	24.4	24.4
41-50	24	17.8	17.8
51-60	14	10.4	10.4
>60	16	11.9	11.9
Total	135	100.0	100.0

The level of education in general determines the career of the dwellers. Table (2) shows high illiteracy where the majority of people, constituting more than 55% percent of the population are not educated. Khalwa education represents 11.9% in the study area. This channel of education is based on religious system within the rural community where people learn Koran in addition to reading and writing.

The relationship between forests and the local people in the study area is not only limited to uses such as forest products. Forests in the area provide various services including residence. The majority of livestock owners prefer living inside or very close to the forests.

Table 2. Education level in the study area

Character	Frequency	Percent	Valid Percent
Illiterate	75	55.6	55.6
Khalwa	16	11.9	11.9
Primary	36	26.7	26.7
Secondary	7	5.2	5.2
University	1	.7	.7
Total	135	100.0	100.0

Table (3) shows that 25.2 % of people settle inside forests as their homes and 40% live at forest boundary. Close relationship between the forests and people is accordingly enjoyed by 65.2 % of the people. People living outside the forest area, whether in villages or towns constitute 34.8 % of the total respondents.

Table 3. Main activities and sources of living

Activity	Frequency	Percent	Valid Percent	Cumulative Percent
Agriculture	102	75.6	75.6	75.6
Pasture	9	6.7	6.7	82.2
Trade	14	10.4	10.4	92.6
Other	10	7.4	7.4	100.0
Total	135	100.0	100.0	

Tables (3&4) indicate that local people activities are connected with the natural resources, whether they are using forests for settlement, land for agriculture or other vegetation for products and services. This relation reflects the connection of people with the resources that they know and can evaluate.

Table 4. a list of tree species known to the communities in villages and nomads group and their uses

Tree species	Local name	people who know in %	Benefit from tree
Acacia tortilis	Seyal	100	fodder, shelter
Acacia seyal	Talih	60	poles, fuel, honey
Balanites aegyptiaca	Hegleig	40	Fruit, fodder, wood, hony
Ziziphus spina-christi	Sidir	40	Foder, agroforestry
Acacia mellifera	Kitir	25	Fodder
Acacia ehrenbergiana	Sumur	25	Sticks, fodder
Calotropis procera	Tundub	20	Fodder
Faidherbia albida	Haraz	12	Fodder
Salvadora persica	Arak	10	Medicinal, tooth brush

The understandings of the local people about tree dominance in the area (Table 5) indicate that the dominant tree species; they know throughout the study area, include three species dominating over other species. These are Acacia tortilis (Seyal), Acacia ehrenbargiana (Sumur) and Acacia mellifera (Kitir).

*Table 5. Species disappeared * Reasons for disappear Cross-tabulation*

Species		failure reasons					Total
		felling	grazing	diseases	fire	others	
sayal	Count	1			1		2
	% within failure spp	50.0%			50.0%		100.0%
	% within failure reasons	1.2%			10.0%		1.5%
	% of Total	.7%			.7%		1.5%
samur	Count	10	1	6	4	2	23
	% within failure spp	43.5%	4.3%	26.1%	17.4%	8.7%	100.0%
	% within failure reasons	11.8%	12.5%	26.1%	40.0%	22.2%	17.0%
	% of Total	7.4%	.7%	4.4%	3.0%	1.5%	17.0%
talih	Count	72	7	17	3	6	105
	% within failure spp	68.6%	6.7%	16.2%	2.9%	5.7%	100.0%
	% within failure reasons	84.7%	87.5%	73.9%	30.0%	66.7%	77.8%
	% of Total	53.3%	5.2%	12.6%	2.2%	4.4%	77.8%
sunt	Count	2			2		4
	% within failure spp	50.0%			50.0%		100.0%
	% within failure reasons	2.4%			20.0%		3.0%
	% of Total	1.5%			1.5%		3.0%
others	Count					1	1
	% within failure spp					100.0%	100.0%
	% within failure reasons					11.1%	.7%
	% of Total					.7%	.7%
Total	Count	85	8	23	10	9	135
	% within failure spp	63.0%	5.9%	17.0%	7.4%	6.7%	100.0%
	% within failure reasons	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	63.0%	5.9%	17.0%	7.4%	6.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.202	16	.001
Likelihood Ratio	25.106	16	.068
Linear-by-Linear Association	.662	1	.416
N of Valid Cases	135		

Table (6) shows that people know more about trees because of their economic importance. They know more trees than the existing ones, probably because of their existence and uses in the past like Faidherbia albida and Salvadora persica, which are more useful for non-wood products. Fodder constitutes the major benefit to the people who are agro-pastoralists and semi-settled pastoralists.

Table 6. a list of tree species known to the communities in villages and nomads group and their uses

			success reasons			Total
			rain	Protection	adaptable	
dominant species	sayal	Count	87	23	12	122
		% within dominant spp	71.3%	18.9%	9.8%	100.0%
		% within success reasons	98.9%	65.7%	100.0%	90.4%
		% of Total	64.4%	17.0%	8.9%	90.4%
	sumur	Count		9		9
		% within dominant spp		100.0%		100.0%
		% within success reasons		25.7%		6.7%
		% of Total		6.7%		6.7%
	kitir	Count	1	3		4
		% within dominant spp	25.0%	75.0%		100.0%
		% within success reasons	1.1%	8.6%		3.0%
		% of Total	.7%	2.2%		3.0%
Total		Count	88	35	12	135
		% within dominant spp	65.2%	25.9%	8.9%	100.0%
		% within success reasons	100.0%	100.0%	100.0%	100.0%
		% of Total	65.2%	25.9%	8.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.956	4	.000
Likelihood Ratio	32.159	4	.000
Linear-by-Linear Association	5.872	1	.015
N of Valid Cases	135		

Five cells (55.6%) have expected count less than 5. The minimum expected count is 36.

Table (7) shows that, Acacia seyal (talih) is the main species that provides wood fuel, hence it is themost subjected to felling according to people confirmation.

*Table 7. Species disappeared * settlements Cross-tabulation*

			Home			Total
			inside forest	forest boundary	outside forest	
spp disappeared	yes	Count	34	54	47	135
		% within spp disappeared	25.2%	40.0%	34.8%	100.0%
		% within Home	100.0%	100.0%	100.0%	100.0%
		% of Total	25.2%	40.0%	34.8%	100.0%
Total		Count	34	54	47	135
		% within spp disappeared	25.2%	40.0%	34.8%	100.0%
		% within Home	100.0%	100.0%	100.0%	100.0%
		% of Total	25.2%	40.0%	34.8%	100.0%

Chi-Square Tests

	Value
Pearson Chi-Square	a.
N of Valid Cases	135

a No statistics are computed because spp disappeared is a constant.

Table (8) shows that the rain is on the top of the reasons as mentioned by 98.9 % of the respondents as in favour of Acacia tortilis (seyal). On the other hand, Acacia mellifera (Kitir) was mentioned by only 1.1% while Acacia ehrenbergiana (Sumor) recorded zero. The perception of the local people reflects the suitability of climate for Acacia tortilis (seyal) to develop itself by having the largest quantities of seeds, producing the largest stock of seedling and that resulted in the highest frequency and abundance. These results show that the scientific findings and the indigenous knowledge complement with each other.

Table 8. Respondent's distribution with respect to type of energy used in the study area

Energy type	Number of respondents	Percent of total
Firewood	106	78
Charcoal	95	70
LPG	16	12
Kerosene	8	6
Agriculture residues	6	4

Chi-square test (Table 9) indicates that the local peoples have different reasons for high dominancy of Acacia tortilis, some believes that is due to good adaptability of this species to the prevailed climatic condition, while others attribute this to protection practices. On the other hand, some attribute this to the both above mentioned factors.

*Table 9. Species disappeared * Reasons for disappear Cross-tabulation*

Species		failure reasons					Total
		felling	grazing	diseases	fire	others	
sayal	Count	1			1		2
	% within failure spp	50.0%			50.0%		100.0%
	% within failure reasons	1.2%			10.0%		1.5%
	% of Total	.7%			.7%		1.5%
samur	Count	10	1	6	4	2	23
	% within failure spp	43.5%	4.3%	26.1%	17.4%	8.7%	100.0%
	% within failure reasons	11.8%	12.5%	26.1%	40.0%	22.2%	17.0%
	% of Total	7.4%	.7%	4.4%	3.0%	1.5%	17.0%
talih	Count	72	7	17	3	6	105
	% within failure spp	68.6%	6.7%	16.2%	2.9%	5.7%	100.0%
	% within failure reasons	84.7%	87.5%	73.9%	30.0%	66.7%	77.8%
	% of Total	53.3%	5.2%	12.6%	2.2%	4.4%	77.8%
sunt	Count	2			2		4
	% within failure spp	50.0%			50.0%		100.0%
	% within failure reasons	2.4%			20.0%		3.0%
	% of Total	1.5%			1.5%		3.0%
others	Count					1	1
	% within failure spp					100.0%	100.0%
	% within failure reasons					11.1%	.7%
	% of Total					.7%	.7%
Total	Count	85	8	23	10	9	135
	% within failure spp	63.0%	5.9%	17.0%	7.4%	6.7%	100.0%
	% within failure reasons	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	63.0%	5.9%	17.0%	7.4%	6.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.202	16	.001
Likelihood Ratio	25.106	16	.068
Linear-by-Linear Association	.662	1	.416
N of Valid Cases	135		

The study indicates that tree species have different potentialities for provision of forest products and this may have its impact on the tree species management. Wood energy constitutes an important forest product as mentioned by 80% of the local people, since they depend on forests as a source of wood energy (Table 10). To obtain wood energy, it is necessary to fell trees.

*Table 10. Species disappeared * settlements Cross-tabulation*

			Home			Total
			inside forest	forest boundary	outside forest	
spp disappeared	yes	Count	34	54	47	135
		% within spp disappeared	25.2%	40.0%	34.8%	100.0%
		% within Home	100.0%	100.0%	100.0%	100.0%
		% of Total	25.2%	40.0%	34.8%	100.0%
Total		Count	34	54	47	135
		% within spp disappeared	25.2%	40.0%	34.8%	100.0%
		% within Home	100.0%	100.0%	100.0%	100.0%
		% of Total	25.2%	40.0%	34.8%	100.0%

Chi-Square Tests

	Value
Pearson Chi-Square	a.
N of Valid Cases	135

a No statistics are computed because spp disappeared is a constant.

Tables (11 & 12) indicate that the people know very well that forests constitute the main source of energy to them and that may justify why they know the trees that provide them wood energy and to some extents food.

Table 11. Wood energy sources in the study area

Wood energy Source	Number of respondents	Percent of total
Forest	108	80
Local market	81	50
Agricultural land	8	6
Community forests	4	2
Private source	4	2

Table 12. Respondent's distribution with respect to type of energy used in the study area

Energy type	Number of respondents	Percent of total
Firewood	106	78
Charcoal	95	70
LPG	16	12
Kerosene	8	6
Agriculture residues	6	4

5 CONCLUSION AND RECOMMANDATION

The study reveals that the local community of the study area depends on its natural resources for wood, housing materials and food. Therefore, participation of local community in management and conservation of natural resource is essential for sustainable use of these resources. Moreover, adoption of this community for alternative energy resources is highly recommended since they do not used alternative ones like kerosene and gas which will certainly reduce the consumption of wood for sake of energy.

This study indicates that communities know exactly the importance of forests, since it provides them with wood, food and housing, therefore, there is a need for set up of a practical prudent policies to govern mutual benefits between people and forests.

Based on these finding the following recommendation can be stated:

- Developing national policies for grazing and forest protection.
- Encourage people to work for the protection of the natural environment.
- Indicative campaigns organized by the Forestry Commission to raise the awareness of citizens about the importance of forest.

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