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RESEARCH ARTICLE

Factors affecting forests' uses in South Kordofan State of Sudan.

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Abstract

The present study was conducted to determine the factors affecting the uses of forests in Dellanj Locality of SouthKordofan State, Sudan. Data were collcted from 50 respondents randomly selected from two villages(purposively seceted) based on availability of forests. A questionnaire was used to collect the primary data, while the secondary data were obtained from the relevant sources. The collected data were analyzed in form of frequency distribution, T-test, correlation and analysis of variance (ANOVA).The study findings revealed that forests paly a vital role for respondents in the study area they totally dependent on forests in all aspects of life such as energy, shelter, food, medicine, and off farm source of income. T-test results indicated that there are statistically significant differences between the male and female (in favor of male) in forests uses for the purpose of both fuel wood and grazing, where the T value reached (3.226, 2.836) respectively, significant at 0.05. No significant differences between males and females for forest uses regarding building materials, hunting, charcoal, furniture, trees product, furniture, entertainment and beekeeping, at 0.05 level. It is also revealed that there is a negative correlation statistically significant between respondent's income and forest's uses grazing and charcoal r = (-) 0.470 and (-) 0.396 respectively, at 0.01). It is alsorevealedthat there is negative correlation between respondent's income and forest uses for both building materials and entertainment r = (-) 0.347, (-) 0.294 respectively, at 0.05.The one-way analysis of variance (ANOVA) showed that respondents occupations are significantly affect the forest s uses for fuel wood, building materials, grazing, hunting, charcoal, and entertainment, (F= 10.444, 4.818,7.186, 5.260, 2.928, 4.342) respectively,at 0.05. The study proposed some recommendations toensure the sustainability of forests products to meet the inhabitants needs and aspirations of both present and future generationsin the study area.

Introduction:-

Aforest is usually defined by the presence of trees, under many definitions an area completely lacking trees may still be considered a forest if it grew trees in the past, will grow trees in the future was legally designated as a forest regardless of vegetation type (Kenneth, 2013) . There are three broad categories of forest definitions in use: administrative, land use, and land cover. Administrative definitions are based primarily upon the legal designations of land, and commonly bear no relationship to the vegetation growing on the land: land that is legally designated as a forest is defined as a forest even if no trees are growing on it (United Nations Environment Program, 2010).).Forests vary considerably in composition, structure and geographic distribution. It can be classified into

different types based on the following criteria: a. Based on spontaneity: natural and artificial forest b. Based on indications of human activity: primary/frontier and secondary forest c. Based on leaf longevity: evergreen and deciduous forest d. Based on leaf broadness: broadleaf tree, coniferous trees or mixed forest e. Based on geographic zone: temperate forest, sub-tropical and tropical moist forest, sub-tropical and tropical dry forest f. Based on physiognomy: old growth and second growth g. Based on dominant species (Olagnuju, 2015). Although forests are viewed as an important natural resource and a main source of wood yet they receive great importance as well due to their innumerable environmental, economic and social benefits (FAO, 2011). Forests are important to sustainability of the earth and hence the existence of man. Broadly, functions of the forest can be categorized as a. Environmental function which include; biodiversity protection and conservation, moderation of weather elements e.g. rainfall, temperature etc., carbon sequestration and soil management,and b.Socio-cultural function and economic function which include food security, provision of medicinal products, source of fuel wood, source of employment and income, source of raw materials for industries, source of national revenue and exchange income earnings, provision of religious and cultural sites and aesthetic and sporting (Olagnuju, 2015). Various studies also indicated that forests provide timber, non-forest timber products (NFTs), and habitats for wildlife and help in carbon sequestration, maintaining gene pool, serving as the rich source of food, stimulating rainfall, protecting soils from the erosion hazards and regulating and filtering the downward moving water into the soils while becoming the part of hydrological cycle (FAO 2011, Agbogidi and Eshegbeyi, 2008, 2003; Lipper, 2007; and Rawat et al., 2008). According to the Alaska Department of Natural Resources, 92010) forests reduce and restrict moving dust particles and air pollution, primarily causing environmental issues (cited in Al-Subaiee, (2014). FAO (2011) also stated that forests help in protecting from floods, increasing soil moisture, improving water quality, and maintaining reserves of underground water. Forests also improve air quality and do help in minimizing harmful emission effects of greenhouse gases, through CO_2 absorption from the atmosphere and oxygen release. In addition forests do regulate climate, conserve biodiversity and wildlife (Schindler et al., 2011) and promote recreation and environmental and eco-tourism (Khamfeua and Tosuchiya, 2012). In spite of the various beneficial functions of forests, it is been threaten with deforestation, forest degradation and fragmentation. While deforestation is simply the conversion of forest areas to non-forest areas, forest degradation is the reduction in the density or structure of forest and forest fragmentation is the conversion of a continuous forest area into patches of forest separated by non-forest lands. Deforestation is a menace in many part of the world, highest in countries of Africa, then Latin America and part of Asia. Worldwide, Brazil has the highest annual net loss of forest areas but Nigeria has the highest deforestation rate of its primary forest and Comoros has the highest rate of annual reduction of forests of all sorts. The agents that bring about deforestation include slash-and-burn farmers, commercial farmers, cattle ranchers, livestock herders, loggers, commercial tree planters, firewood collectors, mining and petroleum industrialists and land settlement planners while the main causes of human-induced deforestation include logging, agriculture croplands and pasture expansion, urbanization, fuel wood collection, mining and resource extraction, hunting and, slash and burn practices(Olagnuju, 2015). He also stated that food security is the accessibility of people to adequate quantity and safe food that enhance healthy living at all times. According to Suleiman et al (2009) food security is a term that evolved in the mid-1980s after realizing the non-applicability of the food self-sufficiency approach of the 1970s. The concept of food security explicitly and/or implicitly advocate for both supply and access to food. Access to food could be attained through different forms such as availability in the market in affordable prices (market access) and /or increasing income through employment opportunities generation with improving purchasing power of consumers. Deforestation directly impact on food security through the loss of biodiversity that are source of food to man and indirectly through its effect on soil degradation and alteration of the weather elements which in turn reduce agricultural productivity. Approaches to combat deforestation include environmental education and literacy, agroforestry practice, increasing of protected area, development of alternatives, development of policy and enforcement strategies, and furthermore, reforestation, afforestation and avoided deforestation(Olagnuju, 2015).

Harrison and Jackson (1958) estimated the tree cover in old Sudan (thecountry was separated into two countries: Sudan and South Sudan in 2011) at 36-43%. Extrapolation from the Forest Resources Assessment by FAO in 2005 indicated a tree cover of 29% (Forests National Corporation, 2006). Forests in Sudan provide protection for variety of genetic resources of plants and animals. The country embraces diverse biological resources which present an important national assets and heritage. There are some 535 trees species in Sudan 25 of which are exotic(The Higher Council for Environment and Natural Resources-Sudan (2009).

Objectives:-

The major objective of this study was to determine the factors affecting the uses of forests in the surrounding forests. The specific objectives are to:

1. Know the socio-economic characteristics of the respondents.
2. Identify the factors affecting the uses of forests in the study area in particular and the Nuba Mountains in general.
3. Explore the relationship between the locals' dependence on forests and some of their socioeconomic characteristics.

Hypothesis:-

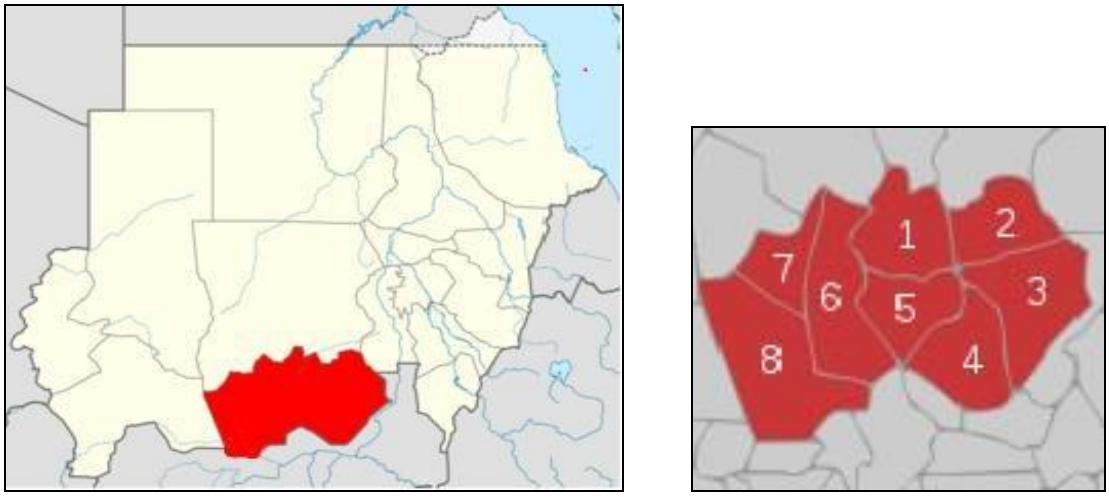
1. There is no significance relationship between forests uses and respondent's sex, monthly income and occupations.
2. There is no significance relationship between the forest uses and the distance of forest from respondent's houses.

Study Methodology:-

The study area:-

The present study was conducted at Dellanj Locality in South KordofanState.The state lies between latitudes 9° and 12° N; longitudes 27° and 32° E., and covering an area of 13.44 million ha(Ballal et al 2014). Vast areas of the state are covered with hill catena intersected by seasonal watercourses, valleys and depressions where fertile alluvial soils deposition occurs seasonally. The main soil type is vertisols, so-called cracking clays, in addition to sandy clay soils, locally known as gardud, which has a hard crust that hastens water runoff. Sandy soils characterize the northern parts of the State. The mean annual rainfall ranges from 350 mm in the north to 850 mm towards the southern boundaries of the state (Ballal et al 2014). Map 1 shows the location of DellanjLocality in the state.

Map1. South Kordofan State and its Localities (1. Dellanj Locality)



Source: Modified fromBallal et al 2014

Sample selection and data collection:-

This study was carried out in January- March 2015 to determine the uses of forest and the factors affecting on these uses .Purposive sampling procedure was used to select 2 villages in Dallanj locality based on availability of forests. These villages were Gardood AL-tabaldi and AL-samaseem. A total of 50 respondents were selected randomly (25 respondents from each village). A questionnaire was used to collect the primary data, while the secondary data were obtained from the relevant sources. The collected data were analyzed in form of frequency distribution, independent T-test, correlation and analysis of variance (ANOVA).

Results and Discussion:-

Respondent's socio-economic characteristics:-

Table 1 shows that the majority of the respondents (62%) were males, while the female are (38%). Regarding the family size as shows in table 1 approximately more thanone third of the married respondents (36.2%) their family were consisted of less than 5 members, while the majority (42.5%) their families were consisted in rang of 5 t0 10 members. Regarding respondent's occupation the table 1 shows that 16% were worked in government institutions, 6% were worked in private sectors, while more than one third (36%) were worked as farmers and the livestock breeder constituted 16% and there was housewives among the respondents have no paid work. As shown in the table there is a diversity in materials were used to build a respondent's houses, the grasses material involved in three categories (hut grasses 30%, bricks + grasses 18% & Mud + grasses 24%) with total of 72% of respondents were used dry grasses or straw to constructed their houses. Regarding monthly income the result revealed that some respondents (10%) have no income (housewives), while 20% of respondents were gained monthly less than 500 SDG, and 32% were gained monthly in range of 500 to 1500 SDG, and (22%) of respondents gained monthly more than 2500 SDG.

Table 1.Distribution of respondents according Socio-economic characteristics(N= 50)

Category	**#**	**%**	**Category**	**#**	**%**
Sex			**Occupations**		
Male	31	62.0	Governments employees	8	16.0
Female	19	38.0	Private sector employees	3	6.0
Family size* (N=92)			Merchants	4	8.0
5 and less	17	36.2	Farmers	18	36.0
5 – 10 persons	20	42.5	Workers	4	8.0
More than 10	10	21.3	Livestock breeders	8	16.0
			Housewives	5	10.0
Building materials			**Monthly income**		
Hut Grasses	15	30.0	No income	5	10.0
mud	4	8.0	Less than 500 SDG	10	20.0
bricks	6	12.0	500 - 1500	16	32.0
Bricks + grasses	9	18.0	1501 – 2500 SDG	8	16.0
Bricks + mud	4	8.0	More than 2500	11	22.0
Mud + grasses	12	24.0			

* The unmarried respondents not included

Forests distance

As illustrated in table 2 approximately62% of respondents reported that their houses are away less than 5 km from the nearest forest, while approximately 38% of respondents said that the distance were in range of 5 to 15 km.

Table 2.Respondent's distribution according to distance of forest from their houses (N= 50)

Distance	#	%
Less than 5 km	31	62.0
5 – 15 km	19	38.0
More than 15 km	0	00

Forests uses:-

The table 3. Indicates that 14% of respondents were not depended on forest to obtain fuel wood, may depended on cooking gas and charcoal, while a few respondents(2%) were depended in low degree on forest as source of fuel wood, 30% were depended in medium degree and finally more than half of respondents (54%) were depended in high degree in forest to obtained fuel wood with mean 3.24 and SD 1.0411 which considered as the highest mean. Fuel wood are widely used in NMs region for many purposes such as cooking,bakery and ambushes bricks, due to the lacks of other energy sources like gas and electricity. The FNC (1996) reported that the rural families obtained about 82% of their energy needs direct from the nearest forests. However, in the same context the The Higher Council for Environment and Natural Resources-Sudan ,2009) commented that Sudan depends mainly on forestry sector as energy source, forests contribute by a total of 4.11 million T.O.E representing 70 - 81 percent of energy supply in the country". FNC (2007) added that "recent projections revealed that still there will be an increase in total

quantities demand from wood fuels, even if the level of substitution of petroleum fuels for cooking in household sector is increased manually by 15%". Regarding the respondent's depending on forest as a source of building materials 12% were reported that they were not deepened on forest to obtain building materials (i.e. they constructed with fixed materials), while 8% &34% were depended with low and medium degrees respectively, and the majority (46%) were depended with high degree to forest as source of building materials which achieved the 2nd highest mean 3.14 and SD 1.0103. the dominant building styles in the region are characterized by simplicity and uncomplicated using cheap materials for construction like dry straw and woods which obtained from nearest forests. The uses of forest for animal grazing gained the 3rd highest rank with the mean 3.06 and SD 1.1141. While the uses of forest for charcoal obtained the 4th rank with the mean 3.00 and SD 1.1428, theDallanj Locality in NMs region is considered as the main sources of charcoal to big cities especially the capital Khartoum. Trees products collection were obtained the fifth position with the mean 2.74 and SD 1.1919, the collected fruit and seeds and other trees products (leaves, branches, roots, and bark) are used as indigenous for many purposes, some uses as food (like Gudeim from *GrewiaTennax*, Lalob fruit from *Balanitesaegptiaca L*, Napaq fruit fromZiziphus spina-christi and Aradiab fruit fromTamarindusindica L…etc.), others tree products using as drugs to cure many diseases (the bark of Almahoqani tree "Khayasenegelensis" and seeds of Sonut trees " acacia nilotica" are used in the treatment of stomach disorders and treatment for colds and flu and cough. some trees (bark & leaves) is administered as a cure for colds and muscular pains. Some acacia trees products "namely acacia seyal and acacia Senegal" were used by married women as tools accessories by burning the tree's branches and uses the smokes as sauna to whole body. Also there is a fiber crops like Doum palm (locally named Zaaf) were used in many rural industries as a raw materialsfor handicrafts like ropes and bedspreads. As indicated by The Higher Council for Environment and Natural Resources-Sudan (2009) more than 30 species indigenous to Sudan are used for fiber production, many of them grow in the wild, and the widely used is the Doum Palm (*Hyphaenethebaica*)". In other hand the NMs region is considers as the main source of Arabic gum. In a recent survey it was found that, on average 19% of total household income is gained from activities related to gum Arabic (national report 2009). The entertainment achieved the sixth position with the mean 2.62 and SD 1.1933. Some respondents especially in dry season utilized the forest for recreation particularly in weekends and religious and social ceremonies. The uses of forest as a source of wood furniture achieved the seventh position with the mean 2.40 and SD 1.2616. while forest's uses for hunting purposes were gained eighth position with the mean 1.56 and SD 078662, and the uses of forest for beekeeping were gained only 1.04 mean and SD 0.2828 which considered as the lowest mean.

Table 3 shows that the dependent of respondents on above mentioned forests products is relatively medium with general mean 2.53 and SD 1.00277.This result indicate that forests play important social and economic roles in the the study areaas a source of energy. Income and other community needs.This result is in line with the National report to the convention on biological diversity (2009) which stated that the most important role of non-wood forests products NWFPs is its provision of self-reliance, employment and food security to local economy. Many communities receive income from collection, processing and marketing of these products.

Table 3.Respondent's distribution according to degree of dependency on forest products (N = 50)

Type of uses	Uses degree								Mean*	SD
	Not at all		Low		Medium		High			
	#	%	#	%	#	%	#	%		
Fuel wood	7	14.0	1	2.0	15	30.0	27	54.0	3.24	1.04119
Building materials	6	12.0	4	8.0	17	34.0	23	46.0	3.14	1.01035
Animal grazing	7	14.0	8	16.0	10	20.0	25	50.0	3.06	1.11410
Charcoal	9	18.0	5	10.0	13	26.0	23	46.0	3.00	1.14286
Tress products	11	22.0	10	20.0	10	20.0	19	38.0	2.74	1.19198
Entertainment	13	26.0	9	18.0	12	24.0	16	32.0	2.62	1.19335
Furniture	18	36.0	9	18.0	8	16.0	15	30.0	2.40	1.26168
Hunting	29	58.0	16	32.0	3	6.0	2	4.0	1.56	0.78662
Beekeeping	49	98.0	0	00.0	1	2.0	0	00.0	1.04	0.28284
Grand total									**2.53**	**1.00277**

Maximum degree 4 points (1= not at all, 2= low, 3= medium, 4= high)

The effect of income on forests uses degrees:-

Table 4. reveals there is a negative correlationstatistically significant between respondent's income and forest's uses degree for the purposes of both grazing and charcoal (r = (-) 0.470 and (-) 0.396 respectively, significant at 0.01), and also there is negative correlation between respondent's income and use of forest for bothbuilding materials and entertainment (r = (-) 0.347, (-) 0.294 respectively, significant at 0.05). This mean that the respondents which have a poor monthly incomes are more dependent on above mentioned type of forest's uses either to providingtheir needs or to sells these products to gain money and improve their incomes. The significant correlation was not observed between income level and forest's uses for the purposes of fuel wood, hunting, trees products, furniture and beekeeping.

Table 4. Correlation matrix showing relationships between respondent's income and degrees of use (n = 50)

Degree of uses	Respondent's income
fuel wood	-0.105
Building materials	-0.347(*)
Animal grazing	-0.470(**)
Hunting	-0.179
Charcoal	-0.396(**)
Trees products	-0.252
Furniture	0.010
Entertainment	-0.294(*)
Beekeeping	0.229

**Correlation is significance at the 0.01 level (2-tailed)

* Correlation is significance at the 0.05 level

The effect of forest's distance on uses degree:-

Table 5 revealed that significant and positive relationship have been observed between the degree of forest's uses for animal grazing and forest's distances (r = 0.356 significant at 0.05),this mean that the livestock breeders are grazed their herds in faraway forests. The findings also indicate that the degree of forest's uses for fuel wood, building materials**,**hunting, charcoal, trees products, furniture, entertainmentand beekeeping was not significantly correlated to forest's distance.

Table 5. Correlation results showing relationships between forest's distance and degree of uses (N = 50)

Degree of uses	**forest's distance**
fuel wood	-0.021
Building materials	0.188
Animal grazing	0.356 (*)
Hunting	0.110
Charcoal	0.114
Trees products	0.277
Furniture wood	-0.106
Entertainment	- 0.067
Beekeeping	-0.112

**Correlation is significance at the 0.01 level (2-tailed)

* Correlation is significance at the 0.05 level

The effect of sex on forest's uses:-

Table 6 shows that there are statistically significant differences between the male and female (in favor of male) in uses of forests for the purpose of both fuel wood and grazing, where the T value reached (3.226 and 2.836) respectively, these are statistically significant at level 0.05. This may be due to the nature of these uses which needs hard workersand this suitable for males because they have physical abilities. Whereas there are no significant differences between males and females for their uses of forests in the purposes of building materials, hunting, charcoal, furniture, trees product, furniture, entertainment and beekeeping, at 0.05 level.

Table 6. Independent T-Test results for significant differences in forests uses according to respondent's sex (N = 50)

Types of uses	Male (N=31)		Female (N=19)		T	Significance
	Mean	SD	Mean	SD		
Fuel wood	3.58	0.71992	2.684	1.24956	3.226	0.002
Building materials	3.25	0.81518	2.94	1.26814	1.057	0.296
Grazing	3.38	0.95490	2.52	1.17229	2.836	0.007
Hunting	1.67	0.79108	1.36	0.76089	1.360	0.180
Charcoal	3.03	1.16859	2.94	1.12909	0.252	0.802
Trees products	2.96	1.11007	2.36	1.25656	1.762	0.084
Furniture	2.41	1.17684	2.36	1.42246	0.137	0.891
Entertainment	2.48	1.23480	2.84	1.11869	-1.031	0.308
Beekeeping	1.00	0.00	1.10	0.45883	-1.286	0.205

The effect of respondent's occupations on forest's uses:-

As shown in Table 7 a one-way analysis of variance (ANOVA) showed that respondent's occupations are significantly affect the uses of forests for the purposes of fuel wood, building materials, grazing, hunting,charcoal, and entertainment, (F= 10.444, 4.818,7.186, 5.260, 2.928,4.342respectively, a = 0.05), this mean the respondents who work in occupations related to rural areas and natural resources more widely used the forest's products (occupations like farmers, livestock breeders and workers). In other hand as showed in table 7 the results indicates that the respondent's occupations did not significantly affect the forest's uses for the purposes of trees products, furniture and beekeeping (F= 2.120, 1.717,1.612 respectively, a = 0.05).

Table 7.ANOVA for significance variances in forest's uses according tooccupations variable (N = 50)

Forest uses	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
fuel wood	Between Groups	31.503	6	5.251	10.444	0.000
	Within Groups	21.617	43	0.503		
	Total	53.120	49			
Building materials	Between Groups	20.109	6	3.351	4.818	0.001
	Within Groups	29.911	43	.6960		
	Total	50.020	49			
Animal grazing	Between Groups	30.451	6	5.075	7.186	0.000
	Within Groups	30.369	43	.7060		
	Total	60.820	49			
Hunting	Between Groups	12.834	6	2.139	5.260	0.000
	Within Groups	17.486	43	.4070		
	Total	30.320	49			
Charcoal	Between Groups	18.564	6	3.094	2.928	0.017
	Within Groups	45.436	43	1.057		
	Total	64.000	49			
Trees products	Between Groups	15.892	6	2.649	2.120	0.070
	Within Groups	53.728	43	1.249		
	Total	69.620	49			
Furniture	Between Groups	15.075	6	2.513	1.717	0.140
	Within Groups	62.925	43	1.463		
	Total	78.000	49			
Entertainment	Between Groups	26.327	6	4.388	4.342	0.002
	Within Groups	43.453	43	1.011		
	Total	69.780	49			
Beekeeping	Between Groups	0.720	6	0.120	1.612	0.167
	Within Groups	3.200	43	.0740		
	Total	3.920	49			

Conclusion and recommendations:-

In conclusion,forests remain one of the most important sources of renewable energies which providinga wide range of economic and social benefits for all human societies especially in developing countries. Forests play vital roles for respondents in the study area they totally dependent on forests in all aspects of life such as energy, shelter, food, medicine, and off farm source of income. To ensure the sustainability of forests products to meet the needs and aspirations of both persent and future generations in the study area, the study recommended the following:

1. Training the local residebnts to acquire basics skills and knowledge of forests management and conservation
2. Develop alternative energy sources such as cooking gas
3. More studies should be taken to study indigenous uses of forests products in food and medicine fields
4. Encourage the lpcal people to use of forests in beekeeping.
5. Encourage the investors to invest in use of forests in tourisms field and construct tourist's villages.

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