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 Dellaan Locality of South Kordofan State, Sudan. Data were collected from 50 respondents randomly selected from two villages (purposively selected) 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 play a vital role for respondents in the study area; they totally depend 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 also revealed that 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 to ensure the sustainability of forests products to meet the inhabitants needs and aspirations of both present and future generations in the study area.

Introduction:

A forest 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
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 (the country 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 Kordofan State. 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 Dellanj Locality in the state.

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

Source: Modified from Ballal 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 Dellanj 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 than one 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 to 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          | #  | %  |
|-------------------|----|----|
| Sex               |    |    |
| Male              | 31 | 62.0 |
| Female            | 19 | 38.0 |
| Occupation        |    |    |
| Governments employees | 8 | 16.0 |
| Private sector employees | 3 | 6.0 |
| Family size* (N=92) |    |    |
| 5 and less        | 17 | 36.2 |
| 5 – 10 persons    | 20 | 42.5 |
| More than 10      | 10 | 21.3 |
| Building materials|    |    |
| Hut Grasses       | 15 | 30.0 |
| mud               | 4  | 8.0 |
| Bricks            | 6  | 12.0 |
| Bricks + grasses  | 9  | 18.0 |
| Bricks + mud      | 4  | 8.0 |
| Mud + grasses     | 12 | 24.0 |
| Monthly income    |    |    |
| No income         | 5  | 10.0 |
| Less than 500 SDG | 10 | 20.0 |
| 500 - 1500        | 16 | 32.0 |
| 1501 – 2500 SDG   | 8  | 16.0 |
| More than 2500    | 11 | 22.0 |

* The unmarried respondents not included

Forests distance
As illustrated in table 2 approximately 62% 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 Ziziphus 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 (Hyphaeneethebaica)”. 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 areas as 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.

| 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 correlation statistically significant between respondent's income and forest's uses degree for the purposes of both grazing and charcoal \((r = (-) 0.470 \text{ and } (-) 0.396 \text{ respectively, significant at 0.01})\), and also there is negative correlation between respondent's income and use of forest for both building materials and entertainment \((r = (-) 0.347, (-) 0.294 \text{ respectively, significant at 0.05})\). This mean that the respondents which have a poor monthly incomes are more dependent on above mentioned type of forest's uses either to providing their 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 \((r = 0.356 \text{ significant at 0.05})\), 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, entertainment and 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 \((3.226 \text{ and } 2.836)\) respectively, these are statistically significant at level 0.05. This may be due to the nature of these uses which needs hard workers and 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, 4.342 respectively, 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 to occupations 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 provide a 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 current and future generations in the study area, the study recommended the following:

1. Training the local residents to acquire basic 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 local people to use of forests in beekeeping.
5. Encourage the investors to invest in use of forests in tourism field and construct tourist’s villages.

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