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Journal homepage: www.Sjournals.com**Original article****The effect of human activities on growth and survival of acacia tortilis habila area, White Nile State, Sudan****A.H. Fatima^{a,*}, A. Mai Mamoun^b**

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ABSTRACT

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Acacia tortilis subsp. raddiana (sayal) plays an important role in the life of desert animals, is a major source of livestock feed, and firewood for the pastoral rural societies in Habila area, White Nile state Sudan. low regeneration has been reported in recent years leading to the decline in population size and number of this species. This study aims to determine if A. tortilis subsp. raddiana reduction population correlates or associates with Soil seed banks or the decrease of tree density in rangeland. Observations were conducted on the natural regeneration species and mature population in three selected sites (inside forest, forest boundary and outside forest) the study was done through counting the trees and natural regeneration and samples were taken for soil seed bank analysis. The result shows natural regeneration and soil seed bank of sayal affected by different factors such as drought and human interference including over-grazing, over-cutting, over-collecting, and habitat destruction have threatened this species by increasing the mortality of mature trees and reducing natural regeneration. Social demonstration must be involved in the preservation and managing this most valuable tree in arid dry area.

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1. Introduction

Acacia tortilis is important trees for rural population in low-rainfall savannah. It tree species that resistant to dry conditions, harsh environments, suitability for dry conditions and fluctuation in the climate providing fodder for livestock in addition to food, medical treatment, fuel and shelters to human described by a number of authors (Belsky et al. 1989; Dean et al. 1999) 200 mm). Its environment beneath include the reduction the extremes temperatures and able to tolerate extreme drought. (In the range of 20 to 200 mm) (Valiente-Banuet & Ezcurra 1991; Suzan et al.1996).provision of suitable amounts of photosynthetically active radiation; (PAR) to understorey plants (Smith et al. 1987). Acacia tortilis enhance soil fertility and increase nitrogen, organic carbon, phosphorus and microbial biomass (Charley & West 1975; Franco Nobel 1989; Nobel 1989; Franco-Pizana et al. 1996). Increase soil moisture (Belsky 1994) and protection against predators (McAuliffe 1984; Suzan et al. 1996). The function of deep-rooted perennials in hydraulic lift shown by Caldwell et al. (1991). The effects of these trees on the vegetation described in terms of higher above ground productivity (Belsky et al. 1989; Belsky 1994) and facilitate seedling establishment (Franco & Nobel 1989). Several studies evaluated the effects of A.tortilis on soil quality and understorey vegetation (McNaughton 1983; Belsky et al 1989). Acacia tortilis represent more than 80% of natural forest tree composition in the region. Acacia tortilis deteriorated in density and number .The aims of the study to give information about Acacia tortilis density, natural regeneration, distribution of heights and soil seed bank to learn the situation of sayal and its suitability to the environment and manage in a way to maintain the natural density and improved.

2. Materials and methods

2.1. The study area

It pastoral area lies between latitudes 14° and $14^{\circ} 11'N$ and $32^{\circ} 02'$ and $32^{\circ} 11'E$.The climate is a typical tropical continental characterized by warm dry winters and hot rainy. Generally, it characterized by high temperatures for most of the year, with means of $37^{\circ}C$ and $21^{\circ}C$ for maximum and minimum summer temperature, respectively. The rainy season extends from June to October and most of the rains fall during July and August; declined from 330mm to 248mm (variations in rainfall are characteristic of arid climates (. The mean relative-humidity percentage is the lowest in April (10%) and the highest in August April (2.00mm) and the lowest in August (10.8mm). Clouds prevail almost six months in the year whereas the mean sunshine is 3650 hours/year. North-east or northerly trade winds prevail during the winter, whereas the south-east winds prevail during the autumn. The dust storms (haboobs) are common in the summer seasons.

2.2. Materials and methods

The sampling method took an area of one hectare in each site to represent a sample size in which circular sample plot of 0.1 hectare were systematically located to represent the category area in three sites (1, 2 and 3) at study area (Mueller and Ellenberg, 1974). The three sites selected according to population home (inside forest, outside forest and rangeland) All trees counted and recorded in forms with their and number. Trees further tabulated in a way according to their height classes; layering (upper, middle and low layer) to represent different stories, Natural regeneration is tree not more than 1 m in height Calculates in each site. For soil seed, bank soil sample took to determine the quantity and quality of seeds stored in the soil on the dimensions of the $10 \times 10 \text{ cm} \times 15 \text{ cm}$. 250 grams of each soil sample, washed with water on the screeners with holes 0.1, 0.25, 0.5, 1 mm after placing the sample on screeners watering, leaving the seeds in a sieve by size. Social survey containing democratic characteristics and relations between the communities and the trees conduct.

3. Result and discussion

From Fig. (1) it is clear that the sayal exists in all layers but decreasing in number by layering which reflect natural competition impact through time with Acacia tortilis advance in age. This finding prove its suitability to environment and competitor to other species in this sites so it easy to manage and perform administrative operations to improve its situation. sayal exist in layer low which may reflect Advisor exploitation face sayal led

to disappearance in the upper layer . This situation requires special treatment to manage it in a sustainable manner through raising awareness of the importance of maintaining the sayal upper layer and middle layer



Fig. 1. The sayal presence in different sites in terms of tree density with different layers.

Fig. (2) show there is no live or dead seeds in the site one. This is differing from sayal layers above the soil surface in this site. It may be sample took not appropriate or the soil face a certain problem like deep ploughing or other human activities which affect soil or seeds in soil lead to distributed the seed outside the site . In the second and third site number of seed dead was differ. Therefore, it is necessary to compare the situation between the various sites in terms of dealing with soil or various activities to explain this discrepancy.

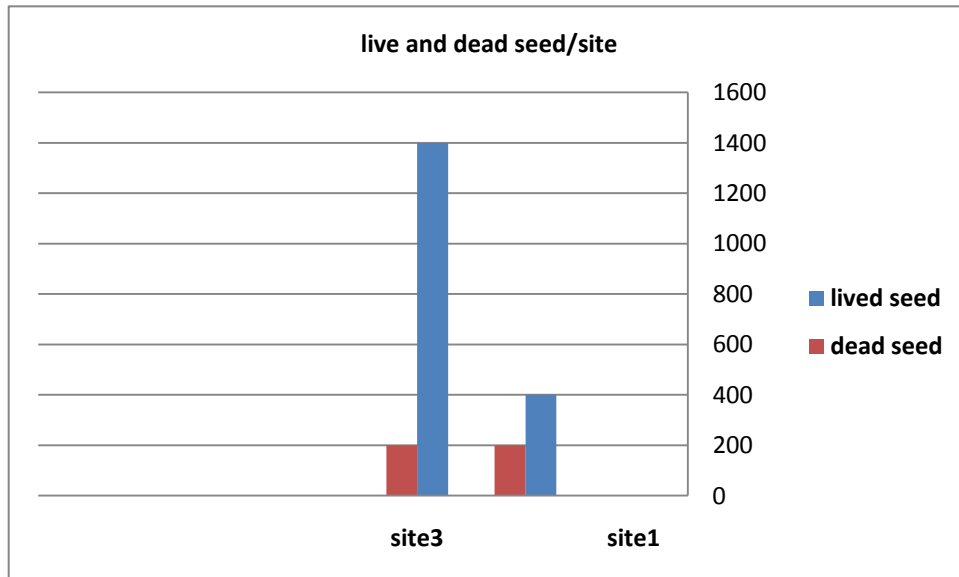


Fig. 2. The sayal presence in different sites in terms of seed stocks.

Fig. (3) show that sayal regenerate naturally, especially in the first and third sites. As previously mentioned, the first site free from seeds but not without natural regeneration while the second site have seeds, but low very natural regeneration , indicating that the first sector was influential on soil seed bank in the read-only . decades, drought and human interference including over-grazing, over-cutting, over-collecting, and habitat destruction have threatened this species by increasing the mortality of mature trees and reducing natural regeneration. As a result, it has undergone severe fragmtation and reduction in population number and sizes (Moustafa et al., 2000; Zaghloul et al., 2007). Such populations are prone to extinction due to stochastic demogra- phic, environmental, factors as well as the deterministic processes which caused lowered numbers in the first place within tree species (Hamrick and Menges, 1992; Widén, 1993; Van Treuren et al., 1993a) Site three situations resembles site one. Therefore, we need to deal with the second site differently and try to involve social dimension in preservation and managing this site We notice that the optimum position for the sayal presence in third site, in terms of density and natural regeneration and soil seed bank.

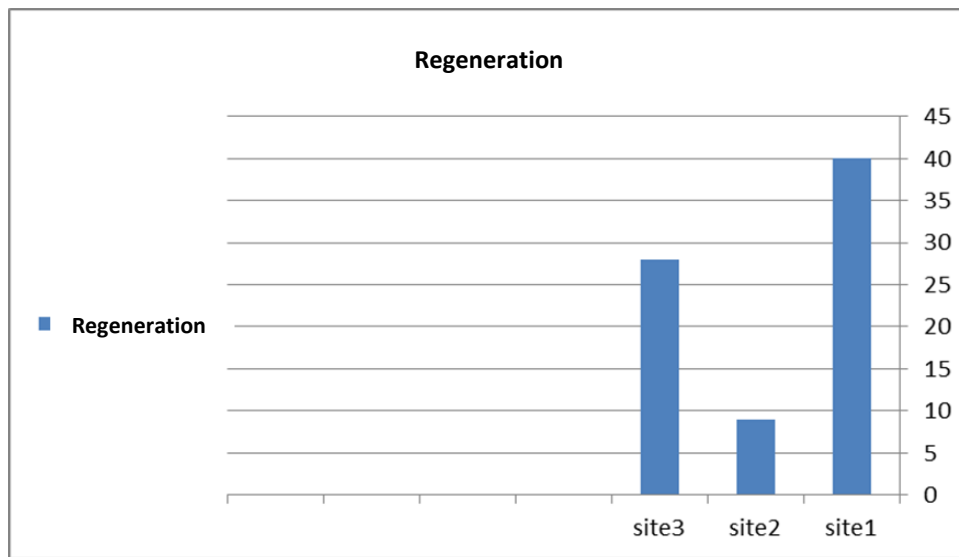


Fig. 3. The sayal presence in different sites in terms of natural regeneration density.

This ideal situation changing as in the secondary site, the sayal gradient exists naturally on different layers, although the presence of seeds and little natural regeneration (Fig. 4). The situation in the first site where the picture above of soil, the sayal in all layers and graded the soil seed bank does not reflect this ideal picture; there is no seed in it despite the presence of natural regeneration in large quantities. This image emphasizes the dynamic presence of the sayal in the various sites affected by such other factors as dynamic in the first site.

Age groups in rural areas have special importance whenever communal work is under focus. As it appears in Table (1) the age group less than 20 years is represented by 3.7%, while 31.9% is for the group range between 21-30 years, 24% is for the age group range between 31-40 years, 17.8% recorded for age group 41-50 years. Between (21 – 50) Successful activities attained by directing the work towards the population with age range between 20-50 years which represented by 74.1 %, The age group in the range 51 – 60 years represented by 10.4 % constitutes the most experienced and wise group who can contribute in activities based on their experience or physical contribution. These two groups embrace a high percentage of people almost 84.5% of the population. The results of age distribution reflect the fact that all the age groups in the range of ≤ 20 to age group ≥ 60 represented in this study, which means that all age categories could 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. The level of education in general determines the career of the dwellers.

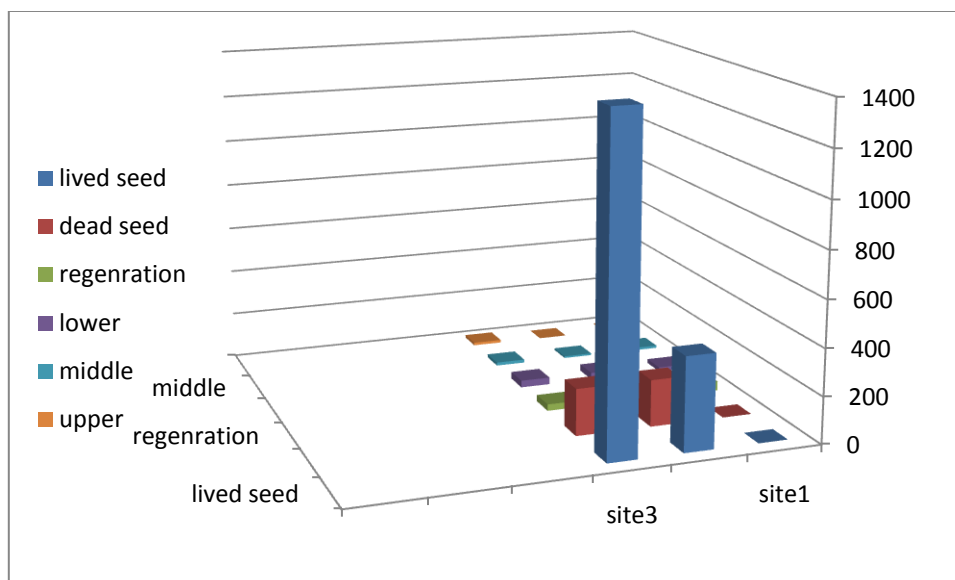


Fig. 4. The sayal presence in different sites in terms of seed stocks and natural regeneration density with different layers.

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

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 based on religious system within the rural community where people learn Koran in addition to reading and writing. However, In spite of the new modern schools development in the rural area, people there continue to send their children to Khalwas. In most cases, Khalwa represents pre-school education, which prepares children for future organized education. The primary education constituted 26.7%, secondary education constituted 5.2% and the university education recorded only 0.7%. These three categories total 32.6%.

The type of relationship between people, the forests and forestry tree authorities is an important base upon which tree cover development built (Glover 2005). The relationship between forests and the local people in the study area is not only limited to uses such as tree products. Trees in the area provide various services including residence. The majority of livestock owners prefer living inside or very close to the forests.

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 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. Land use in the area is based on animal rearing or cultivation, which is both influencing factors of rural people towards the natural resources affecting the vegetation cover. Economic activities of the communities should aim at communities'

welfare in addition to development and conservation of the natural resources based on project or depending on the way that rural people can use the land.

In the study area, the subsistence needs of people achieved through agricultural practices. Table (3) shows that more than 75% of the local people practice agriculture. Traditional agriculture, whether terrace cultivation along the White Nile or on sand dunes and top gazes cropping, shows no enhancement of agricultural system. However, the majority of people live on agriculture, which represents the main activity for 75.6 %. In addition, people may also practice animal husbandry and other activities where 6.7% practice rearing on natural pasture and 10.4% practice trade and 7.4 % has other jobs like forest practices that provide them with some support for home use. They collect wood and non-wood products. Prevailing jobs at community reflect the economic status of the families and the stability of community that influence other aspects of life like education, health, economic activities and environmental stability.

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

Settlements with regards to forests.

	Frequency	Percent	Valid percent	Cumulative percent
Inside forest	34	25.2	25.2	25.2
Forest boundary	54	40.0	40.0	65.2
Outside forest	47	34.8	34.8	100.0
Total	135	100.0	100.0	

Table (3) and (4) indicate the types of land use practices of the local people that connect them with the natural resources whether they are using the 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. It is clear that agriculture constitutes the major activity.

The relationship of people with the natural resources based on the benefits and services, that people get from the resources. This relationship qualifies people to know about the resources components like trees, pasture and the land. The perception of people about trees and tree development is well recognized. People know trees names and trees status of conservation or danger. Table (5) and figures (5) show the understanding of the local people about tree dominance in the area indicating that the dominant tree species; they know throughout the study area, include three species dominating over other species. These are *Acacia tortilis* (sayal), *Acacia ehrenbargiana* (sumur) and *Acacia mellifera* (kitir).

Table 4

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	

Table (5) and Fig. (5) Indicates that *Acacia tortilis* (sayal) mentioned by 90.4% while the two other species recorded 6.6% and 3.0% respectively. The status of dominance of *Acacia tortilis* (sayal) stated by the majority of the local people

It is clear 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*. Trees are more useful for non-wood products than for wood. Fodder constitutes the major benefit to the people who are agro-pastoralists and semi-settled pastoralists. Because of the various benefits that trees and forests provide, people follow tree development represented in peoples' knowledge about seeds production and seedlings development.

Table 5
Dominant species known to the local people.

Species	Frequency	Percent	Valid percent	Cumulative percent
sayal	122	90.4	90.4	90.4
Samur	9	6.7	6.7	97.0
Kitir	4	3.0	3.0	100.0
Total	135	100.0	100.0	

Table (6) shows that *Acacia tortilis* (sayal) was mentioned by 97.8% of the respondents as the specie producing the largest quantities of seeds while *Balanite aegyptiaca* (hegleig) produces limited quantities as mentioned by 2.2 %.

Table 6
Seeds producing species.

Species	Frequency	Percent	Valid percent
<i>Acacia tortilis</i> (sayal)	132	97.8	97.8
<i>Balanites aegyptiaca</i> (higleig)	3	2.2	2.2
Total	135	100.0	100.0

Table (6) shows people response about tree species that are the most productive of seeds while table (7) shows people observation about the tree species having the most abundant seedlings. With respect to regeneration, *Acacia tortilis* (sayal) observed by 86.7% of the respondents to have the highest stock of regeneration compared to other species (Table 7). Other species observed to have regeneration include *Acacia ehrenbergiana* (samur), *Acacia seyal* (talih) and *Acacia nilotica* (sunut) as mentioned by 6.7 %, 5.2 % and 1.5 % of the respondents respectively.

Table 7
Species observed to have regeneration.

Species	Frequency	Percent	Valid percent
<i>Acacia tortilis</i> (sayal)	117	86.7	86.7
<i>Acacia ehrenbergiana</i> (samur)	9	6.7	6.7
<i>Acacia seyal</i> (talih)	2	1.5	1.5
<i>Acacia nilotica</i> (sunut)	7	5.2	5.2
Total	135	100.0	100.0

Scientific knowledge is compatible with the indigenous knowledge with regards resource conditions. Local people perception about the linkages between species dominance and the reasons that facilitated their dominance investigated using the questionnaire. Table (8) shows the list of reasons in the understanding of the people that facilitated the success of dominant species. The rain was on the top of the reasons as mentioned by 98.9 % of the respondents as in favor of *Acacia tortilis* (sayal). Protection as another reason mentioned by the local people indicates that *Acacia tortilis* (sayal) becomes the species of highest occurrence as mentioned by 65.7 % of the

people However, adaptability mentioned by 100 % of the people that *Acacia tortilis* (seyal) was the most adapted.) Local people understand the relationship between the natural resources and the environment. This is a field of scientific work. Chi square test (Table 9) indicates that there was no significant differences with regards to people understanding of the reasons that *Acacia tortilis* (seyal) was the most successful to develop in the area because the climatic conditions as they perceive, are suitable and that the species is adapted as well as the species is protected.

Table 8

Dominant species * success reasons cross-tabulation.

	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%	

Table 9

Chi-square tests.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.956	4	0.000
Likelihood Ratio	32.159	4	0.000
Linear-by-Linear Association	5.872	1	0.015
N of Valid Cases	135		

Table 10 indicates that forests represent the major source for energy which is basically firewood or charcoal. However, the change to other alternative sources that may enhance conservation of the forests is becoming necessary. This raises the need for increasing the availability of gas and kerosene in the market.

Table 10

Respondents' 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

4. Conclusion

Natural regeneration and soil seed bank of sayal affected by different factors such as drought and human interference including over-grazing, over-cutting, over-collecting, and habitat destruction have threatened this species by increasing the mortality of mature trees and reducing natural regeneration social dimension must involve in preservation and managing this most valuable tree in arid dry area.

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