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Uses and Management of *Balanites aegyptiaca* (Heglig) Tree in Sudan: Local People Perspective

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Abstract:

The aim of this study was to explore local uses and management of *Balanites aegyptiaca* (L.) Del. (desert date). The study was conducted in Sinnar and Blue Nile States. A survey involving 120 respondents was conducted using a structured questionnaire. Furthermore, checklist-based semi-structured interviews were carried out with Forest National Corporation staff and forestry researchers. Finally, participatory rural appraisal sessions were held with the selected members of the local community to clarify all the points and remove inconsistencies. The findings of the study indicated that the tree is useful and all its parts are used for different purposes (food, medicine and fodder) and are used by all household members. Results of the study, on the other hand, showed that the tree in general is not planted but retained on farms. According to the study lack of seeds, seedlings, overgrazing are constrains facing growing Balanites tree and conservation of newly natural regeneration of *Balanites aegyptiaca* is the solution to this problem. The study showed that climbing the tree and cutting branches and twigs is done for leaves collection while fruits are generally collected after they have fallen under the tree.The study revealed no management practices were applied to Balanites trees growing in the wild while trees growing on farm land benefits from weeding associated crops. The study recommended that methods of leave harvesting need to be addressed to sustain the resource base. Raising community awareness about the potential role of the tree is more essential for improving rural livelihood and finally incorporating local knowledge on tree management when planning management activities.

Keywords: Balanites tree, Local knowledge, Utilization, conservation and management.

Introduction

Balanites aegyptiaca tree; known as desert date in English or Heglig and laloub in Arabic. It is one of the most important tree species in Sudan where it is known to have the widest natural range of distribution (Suleiman and Jackson, 1959). However, the tree is characteristic of cracking clay under rainfall of 500 mm and above. As a multi- purpose tree *Balanites aegyptiaca* (Heglig) provide food, medicines, cosmetics, fodder, fuelwood and pesticides valued for subsistence living in the arid and semi arid areas where other options are few (Bekele *et al*, 1993 and NRC 2008). Its fruit

has an edible mesocarp and a hard woody endocarp enclosing an edible oil- rich seed kernel. The leaves are eaten as a vegetable in the dry season in many countries through its range in dry-lands of Africa. The fruit of *Balanites aegyptiaca* has been the basis of an active trade for many centuries in countries where the species grows. The seed kernel oil is rich in saturated fatty acids and is used as cooking oil (Hall and Walker, 1991; NRC, 2008). It also contains steroids (saponins, sapogenins, dioseginins) used as raw materials for industrial production of contraceptive pills, corticoids, anabolisants and other sexual hormones (Abu AL Futuh, 1983). The US National Research Council (NRC) ranked *Balanites aegyptiaca* high among the 24 priority lost crops of Africa and called for a concerted effort to develop its true potential using modern capabilities (NRC, 2008). The report observed that although *B. aegyptiaca* produces the necessities of life in the world's most difficult zones of existence (Drylands), it is surprising that the species is still considered a lost crop. Apriority setting exercise to identify Indigenous Fruit Trees (IFT) with domestication potential in the drylands of five countries in eastern Africa (Ethiopia, Kenya, Sudan, Tanzania and Uganda) ranked *B.aegyptica* second after *Adansonia digitata* L. among the eight priority species(Teklehaimanot, 2008).

Despite its wide range among communities in Sudan *Balanites aegyotiaca* has received limited attention and has therefore remained largely underutilized. Any attempt towards increasing the contribution of *B ageptiaca* and other IFTs to household food security and incomes requires a clear understanding of their current use, management and conservation. Documentation of local knowledge has been noted as a necessary starting point for strengthening the capacities of local people for developing their own knowledge and methodologies that promote activities to improve and sustain their livelihoods (Oduol *et al*., 2008). Kwesiga *et al.* (2000) reported that local knowledge should form a basis for policy development and research on domestication of IFTs Shanley (2006) also noted that local knowledge can offer an irreplaceable foundation for research and development. The overall objective of this study was to collect and analyse local knowledge on use and management of B. aegyptiaca. The specific objectives were: to document and analyse local people's use and management of B. aegyptiaca and identify institutional constraints and opportunities for improved use and management of B. aegyptiaca. The study was guided by the following research questions: How do the local people in the two study areas use B*alanites aegyptiaca* tree products? How are *B. aegyptiaca* trees managed both in the wild and or farm? And what are the constraints and opportunities for improved use and management of *Balanites aegyptiaca* in the study area?

Materials and Methods

The study was carried out in South of Sinnar State (Abuhjar locality) and North of the Blue Nile State (Aldamazin locality) between latitude (13.33-11.49) N and longitude (33.37-34-42) E where the tree was observed to be dense. The climate of the two areas is characterized by short rainy season from July to September with an average annual rain fall of about 500 mm increasing southwards. The temperature is high during the dry period between February and June with an average maximum of 40^0C decreasing to 14^0C during the winter (November to January). The two areas are inhibited by settled population; their economy is dominated by traditional rain fed agriculture and seasonal wages (Elnour, 1994)

Six villages (three in each state) were chosen for data collection in the two study areas. The selection of villages was based on the existence of Balanites trees and their product use. Twenty resident households in each village were randomly selected. The total number of households interviewed was 120. The primary data were obtained through a questionnaire-based structured

interview with the selected informants. Furthermore, checklist-based semi-structured interviews were carried out with Forest National Corporation staff and forestry researchers. The main purpose was to collect information about uses and management of Balanites tree. The secondary sources were institutions' reports, records and papers. All interviews were accompanied by personal observations, which allowed the researchers to judge the reliability of the answers given. Finally, participatory rural appraisal sessions were held to clarify all the points and remove inconsistencies. The Data were processed and analyzed using the Statistical Package for Social Science (SPSS) software.

Results and Discussion

Some socio-economic characteristics of the respondents:

One hundred Twenty respondents (83 men and 37 women) were interviewed. The above percentage does not imply that there are more men than women in the study area. In the rural areas of the Sudan, man is the chief earner of income and is responsible for supply of food and the most essential requirements of living for his family. Therefore, as rule men are to be interviewed since they are heads of the households and in charge of the major landuse activities. The small proportion of the female respondents is those whose husbands are absent. The age of respondents ranged from 30 to 50 years, with medium age of about 35 years, primarily rural workers (70% farmers, 30% other jobs). Of those who revealed no regular education are 24.2%. Those who have received khalwa (Quran education), primary and secondary educational levels are 55.8%, 11.7%, 8.3%, respectively. Most of the respondents (90%) are not members of any type of social committees. They were not government employees and never practiced any form of leadership (Sheik 4%, member of village committee 4%, and member of rural town council 3%.

Uses of *Balanites aegyptiaca* Products:

Balanites aegytiaca was a highly valued tree in the study site. The people along the Blue Nile in the study area regarded Balanites as their dependable dry season vegetable. But as fruits some consider other species are edible than Balanites. All household members in the study area utilized Balanites products. Balanites leaves are utilized by all while the fruits were more frequently consumed by children and women.Results presented in Table (1) revealed that one of the main uses of Balanites was snack food (fruit pulp) and leafy vegetables where Balanites product represent source of food for most of the respondents in the surveyed villages (43%), medicine (35%), fodder 20.8% and building poles 10.8%.

Table 1: Main uses of *Balanites aegyptiaca* Products

Main uses	Frequency	Percent
Food	52	43.4
Medicine	30	25
Fodder	25	20.8
Building poles	12	10.8
Total	120	100

Households used *Balanites* tree or its products in numerous ways, however, fuelwood (firewood and charcoal) were the more prominent uses. In the focus group discussion respondents stated that *Balanites* is a good firewood source and the wood is easy workable and has many other uses in furniture and agricultural tools.Several parts and products were used ranging from whole

tree for provision of shade to use of branches for fencing.

For medicinal purposes the main parts/products used were the root and stem bark, oil, fruit pulp and kernel cake table (2) Several ailments were reported to be treated using these products including, body pains, stomach upset, malaria, and deworming children.

The main source of *Balanites* was mainly the wild trees (68%) with fallow lands contributing 22.5% only. Nine percent get the products from on- farm trees.

Table 2: Current medicinal uses of *Balanites aegyptiaca* in the study area

Use	Part used
Anti-diabetic	Fruit pulp
Chest pains	Gum from stem bark
De-worming (children)	Oil and fruit pulp
Joint pains	Bark
Malaria control	Raw fruit kernel cake poured in mosquito breeding places
Malaria treatment	Root bark extract
Mosquito repellant	Smoke from nut shells
Stomach pains	Stem and root bark

Harvesting of *Balanites aegyptiaca*:

The Results of this research indicated that there are different methods for harvesting Balanites products where 32.5% of respondents collected falling products while 21.6% use a stick. Moreover16.7% of the respondents' shake tree branches to collect product. Those who throw the tree to collect falling products represent 15% of the interviewed respondents and only 14.2% of the respondents stated that they climbed the tree and cut branches and twigs. Moreover, thirty five percent of the respondents indicated that harvesting of Balanites products is practiced by all household members while 29.2% of the respondents said the job is done by children and 24.1% of them said that only women who are responsible of products collection.

From the group discussion carried with the respondents they stated that among the family members' women and children were the major collectors of Balanites products and the method of leaf and fruit collection was more or less the same for both wild and on-farm trees.

According to them Balanites leaves are collected all over the year while fruits and nuts are collected between December and May. Climbing the tree and cutting branches and twigs is done for leaves collection while fruits are generally collected after they have fallen under the tree and nuts are collected from under the parent trees and in animal resting places.

Harvesting of leaves by cutting young branches and twigs though appropriate from the harvesters' point of view is endangering the trees. The communities reported that this leaf harvesting practice increased leaf yield (Table 3). They were also aware of the negative effects of the practice on the tree as a whole as well as yield of some products. For instance, the cutting of branches and twigs was reported to decrease tree vigour and fruit and/nut yield (Table 4). This practice has negatively affected trees with some of them dying due to over-harvesting. It is also observed to affect tree growing when animal herders lope and pollard branches to feed their animal (NRC, 2008).

Table 3: Perceived effect of cutting young branches and twigs on tree leaf yield

Effect on leaf yield	Frequency	Percent
Increase	53	44.1
Decrease	33	27.5
Do not Know	20	16.7
No Effect	14	11.7
Total	120	100

Table 4: Perceived effect of cutting young branches and twigs on tree vigour and fruits yield

Effect	Frequency	Percent
Decrease	73	60.8
Increase	22	18.3
No effect	15	12.5
No product	10	8.8
Total	120	100

Although most of the fruits from IFTs harvested from the wild support household food security, this could be significantly enhanced if improved varieties and production, harvesting, and storage techniques could be made available to the rural poor. Thus, a developed poor strategy involves moving away from depending on wild harvesting to domestication. Such a strategy has already been demonstrated in southern and western Africa and it involves participatory domestication genetic improvement that includes farmer-researcher collaboration, and is farmer-led and market-driven (Akinnifesi, *et al*. 2006).

Planting and management of *Balanites aegyptiaca* tree:

Balanites aegyptiaca was reported to have been planted by a few (15.1%) households, however, many (43.7%) retained and protected natural regeneration on their farms and another 41.2% regarded it as God given, thus no need to plant it.

Many (41.2%) of the households interviewed did not plant Balanites, and (43.7%) as mentioned above had retained the trees on their farms. This demonstrates the importance these communities attach to Balanites since only useful trees are retained on farms. Although some still regarded Balanites trees as `God given' with no need to plant, decreasing levels of wild trees coupled with increasing dependence on the tree products was a driving incentive for on-farm retention of the species along with other useful IFTs. Akinnifesi *et al*. (2006) also observed that although many rural households rely on IFTs as sources of cash and subsistence in the Southern Africa, there has been little effort to cultivate, improve or add value to these fruits.

The main planting materials used is seed this is reported by almost all the respondents (100%).This result is supported by Fogt (1995) who stated that the best way of establishing Balanites trees is by seeds which are collected from the wild forests. Among the respondents interviewed 46% stated that they retain Balanites trees on scattered places and Balanites trees were however, more retained on farm boundaries (37%) than near homesteads or around villages. In the group discussion respondents declared that retaining of Balanites plantation is done on marginal lands or where there is no possibility of using this land for agricultural purposes. This was true since the species in the study area is found dense in some valleys and high lands not in cultivable land.

Results of this study revealed that 38.7 % of the interviewed respondents stated that Balanites trees increase yield of associated agricultural crops although 31.1% reported decrease in yield and another 21.8%

reported Balanites trees having no effect on associated agricultural crops.

Balanites trees were reported to have no effect on yield of cereals, especially, maize, sorghum and millet but with some negative effect on yield of pulses and tubers such as groundnuts and sweat potatoes and cassava (Elfeel and Warag, 2011).

On the other hand results of the research showed that on average 5 trees were regarded suitable to be retained in one hectare this stated by 52 % of the interviewed respondents and 22.5% stated that they will not leave even a single Balanites tree in their farm because they think that trees on farm may gather birds and destroy the crop yield.

In the study area Balanites trees were among trees retains on farm. In some areas, this has created the impression that Balanites and other IFTs are dominant on farms. According to Kang and Akinnifesi (2000) the retention of a low density of valuable trees in parklands of the semi-arid areas is a common practice to improve the yield of understory crops. In southern Tanzania, Akinnifesi *et al*. (2006) reported that farmers spare fruit trees such as Uapaca kirkiana and Parinari curatellifolia because of their importance to households. This process makes IFTs the dominant trees on farms. Ramadhani *et al*. (1998) reported that IFTs constitute about 71% of the trees on farmers' fields.

As mentioned earlier the majority (41.2%) of the respondents in the surveyed villages thought that planting of Balanites was worthwhile, however, the major, reason for limited planting was the lack of knowledge and skills on its propagation (23.3%). This followed by the lack of seeds and seedlings as stated by 19.2% and 17.6 of the respondents, respectively.

In order to overcome these problems 33.3% of the interviewed respondents stated that conservation of new regeneration of Balanites is the key factor in retaining the species since the tree is said to be growing naturally, not planted, while 18.3% of the respondents' think that supplying of seed will help in solving the problem and17.5% see the solution in providing enough seedlings. Moreover 16.7 % of the respondent considered the solution in regular planting by the authority and 14% mentioned raising local people awareness.

In developing countries a large amount of ecological knowledge is held by local people and has not yet been adequately integrated with formal scientific knowledge (Akinnifesi *et al* 2006). It is therefore likely, in some environments, that local people's knowledge could make a major contribution to the information needed for improved methods of forest restoration. Therefore one priority should be the recording of relevant local knowledge of forest regeneration and its integration with scientific knowledge. Constraints to growing Balanites such as lack of seedlings, and lack of knowledge and skills on its propagation need to be addressed by building the agronomic capacity of these communities.

All the interviewed respondents in this study (100%) declared that there is no management practices applied to the wild stands of *Balanites aegyptiaca*. On farms trees (81.5%) of the respondents said that the Balanites trees benefited from weeding of associated crops where as 23% of the respondents carry spot weeding for the Balanites trees on farm. Around homes 55.5% of the interviewed respondents manage the trees by making spot weeding while 36.1% are pollarding the trees. Only 8.4% do not manage it (Table 5). These trees are considered home garden for some people.

Table 5: Management practices applied to *Balanites aegyptiaca* tree

Variable	Frequency	Percent
On farm		
Benefits from weeding	97	81.5
Spot weeding	22	18.5
Total	120	100.0
Around homes		
Spot weeding	66	55.5
Pollarding	43	36.1
No management	10	8.4
Total	120	100.0

Local communities were aware of tree management to minimize negative effects on associated crops, such as shoot pruning just before sowing. These practices can be built upon in efforts to improve agroforestry in these areas.

Institutions involved in the management of *B. aegyptiaca* and other fruit trees:

Government, civil society and traditional organizations were all playing some role in the management of IFTs including Balanites. However, elders' councils and traditional leaders were the only two traditional institutions reported. Forest National Corporation was the leading government institutions (Table 6).

Table 6: Institutions involved in the management of *Balanites aegyptiaca* and other fruit trees

Institutions	Frequency	Percent
Government institutions	59	49
Traditional institutions	34	28
Civil Society	28	23
Total	120	100

From the group discussion the author recognized the feeling of communities that IFTs including Balanites were given very little attention for long time. Local people stated that FNC authority was not controlling the cutting of IFTs because the charcoal was needed in urban centers. It was also noted that still there is cut of Balanites for firewood or charcoal for income. The FNC seemed to be constrained by both human and financial resources to carry out their work. For the civil societies, forestry in general and IFTs in particular was not their core business but rather form a small component. They mainly promoted multiplication and growing of exotic fruits, such as citrus and mangoes and in a few cases timber trees. This left the communities with no technical help on management of IFTs. Communities also expressed a desire to go into small scale processing of indigenous fruits but they lacked technical support, especially in oil processing.

On the other hand, elders' councils that used to guide communities in sustainable use of trees are no longer effective since they are not respected. It was also noted that traditional leaders if empowered with relevant information on IFTs could play a great role in mobilizing communities to conserve them and add value to IFTs products.

Institutional arrangements for management of *B. aegyptiaca* and other fruit trees:

About 45% of the interviewees said that *Balanites aegyptiaca* and other IFTs were regeneration. Conserve on farm trees were mentioned by 27% of the respondents. About 11% of the interviewees mentioned pollarding of Balanites trees and another 10% pointed out use of control burning. Moreover 7 % mentioned the restrictions on cutting of IFTs whether on farms or in the wild since they benefited the whole community.

Many (58%) respondents were aware of government regulation mainly forest law. On the other hand 31% reported of no cutting of IFTs (punishment regulation) and managed in the past by retaining natural

11% talked of endangered trees and the actual existing policy on trees in general, that is, all trees on non state land belong to the people and must be used in a sustainable way to benefit the present and future generations (Table 7).

At the local (state and province) levels, some by-laws had been put in place to regulate IFTs and these included; no cutting down of trees, no grazing of young trees, Prevent cultivation on Balanites occupations and prevent using fires on fruit trees lands (Table 8).

Table 7: Respondents' awareness about Government regulations/laws regarding the management and conservation of indigenous fruit trees

Regulations/laws	Frequency	Percent
Knowledge of forest law	70	58
Punishment regulation	36	31
Knowledge of endangered trees	14	11
Total	120	100

Table 8: By-laws put in place to protect Balanites and other indigenous fruit trees.

By law	Frequency	Percent
Prevent cutting of trees	48	40
Prevent grazing of young trees	26	22
Prevent cultivation on Balanites occupations	24	20
Prevent using fires on fruit trees lands	22	18
Total	120	100

Penalties for community members breaking by-laws ranged from being fined in local courts to receiving a caution. Table (9) describes the different penalties mentioned by the respondents.

Table 9: Penalties put in place for the offenders.

Penalties	Frequency	Percent
Punishment by Paying money for cutting a tree	38	31
Imprisonment	31	26
Prevent offenders from entering forests	30	25
Taking off offenders equipments	21	18
Total	120	100

The majority (51.6%) said the by-laws put in place were not effective since IFTs have continued to be cut for other uses and are still regarded as God given resources. Some (41.7%) stated that it is somehow effective and only 6.7% reported that the by-laws were effective.

From all these results still Respondents were generally unaware of government

regulations on IFTs and other trees in the capacity of the FNC to disseminate information to rural communities. Some bylaws which had been put in place, such as no cutting of fruit trees are not respected due to break down in social cohesion. Penalties set for offenders were also not deterrent enough and rarely enforced. IFTs in the wild have therefore continued to be destroyed with little regard while those on farms are protected to some extent. The future of *Balanites* and other IFTs therefore, appears to lie on their integration into traditional farming systems.

It can therefore be inferred that both traditional/local and state systems for management of *Balanites* and other IFTs are currently weak and non-existent in some communities. These posses a great challenge to these resources that have supported the livelihoods of local people for generations. With increasing impacts of climate change already being experienced in the study sites, for instance loss of IFTs could mean loss of a livelihood for many communities. Improved management and utilization of IFTs could be easily achieved through building the capacity of local institutions with some technical support being provided by FNC and local- based Civil Societies.

Constraints and opportunities for management and conservation of *Balanites aegyptiaca*:

A number of constraints and opportunities for improved management and utilisation of *Balanites* were identified (Tables 10 and 11).

Table 10: Constraints to improve management and conserving *Balanites aegyptiaca trees* in the study area

Constraint	Frequency	Percent
Illicit felling	42	35
Expansion of cultivation	38	32
Overgrazing	20	17
Forest fires	10	8
Absence of Authorities	10	8
Total	120	100

Table 11: Opportunities for sustainable management and utilization of Balanites tree

Opportunity	Frequency	Percent
Benefits provided by the tree	32	27
Contribution in Family income	30	25
Local awareness	26	22
Existence of dense stands of Balanites in the area	18	15
The diverse utilization of Balanites tree	14	11
Total	120	100

The key constraints were illicit felling and expansion of cultivation in the Balanites growing areas. In the group discussions respondents stated that the main constrains to manage and conserve Balanites trees in poverty that strike the people force them to cut trees which is the only source of income during the drought season. According to the respondents Balanites trees are found in marginal lands and outside the reserved the study area is the ignorance of the people about the important of the tree and the danger of cutting trees since the main reason for cutting trees is for obtaining land for farming, absence of the authorities, the forests which make these trees get little attention of forest authorities. However, several opportunities were also identified and they included; high local demand of Balanites products including their

tradability, high density of Balanites trees found in the study areas, availability of local awareness and knowledge on some processing, and presence of some local institutions willing to play a role in improving the management of Balanites and other IFTs.

To overcome most of the constraints cited above, it is important for the research and development community to work with local communities, especially women groups to add value to Balanites products. In this regard, oil processing should be encouraged because it seems to offer greater promise given the high unsupplied market and its high market value. This could raise the status of Balanites leading to its protection. This would later lead to increased demand for planting and thus kick-start a participatory domestication process as it has been done with other IFTs such as *Scelocarya birrea* in southern Africa (Hall *et al*., 2002; Shackleton, 2004; Akinnefesi *et al*., 2006) and *Adansonia. digitata* in western Africa (ICRAF, 2003). Participatory domestication would then solve the problem of long juvenile phase through vegetative propagation and also improve fruit characteristics (Akinnefesi *et al*., 2006). In the short run, the method of leaf harvesting and control of bush fires in all the study sites need to be addressed to sustain the resource base. Furthermore, community sensitization is needed for raising awareness about the potential role of Balanites and other IFTs in the study area for livelihood improvement. According to Teklehaimanot (2004), some socio-economic conditions need to be addressed for the potential of IFTs to be realized. Some of these include; a change in land use and forest policies to give farmers ownership of parkland trees and production incentives related to markets and technology.

Conclusions and recommendations

The findings of the study indicated that the tree is useful and all its parts are used for different purposes (food, medicine and fodder) and is used by all household members. There are regulation on management and conservation of *Balanites aegyptiaca* and other IFTs in the study area; however such regulations lack effective implementation. There is a break down in traditional tree management institutions yet local government institution lack the capacity to manage Balanites and other IFTrs. Cutting of Balanites trees during land clearing are therefore leading to increase loss of tree. The study recommended that methods of leave harvesting need to be addressed to sustain the resource base. Raising community awareness about the potential role of the tree is more essential for improving rural livelihood. The study also recommended that incorporating local knowledge on tree management when planning management activities.

Refrences

Ethiopia, RELMA Technical handbook no. 5, RELMA, Nairobi, 474pp.

Elfeel, A.A and Warrag, E.I. (2011). Uses and conservation status of *Balanites aegyptiaca* (L.) Del. (Hegleig Tree) in Sudan: Local people perspective. *Asian Journal of Agricultural Sciences* **4**: 286-290.

Elnour, M.A. (1994). Natural regeneration of Heglig "*Balanites aegyptiaca* (L)

Abu-Al-Futuh, I.M. (1983). *Balanites aegyptiaca*: an unutilized raw material potential ready for agroindustrial exploitation. UNIDO Document no. 12419 project TF/INT/77/021.UNIDO of the United Nations.

Akinnifesi, F. K.; Kwesiga, F.; Mhango, J.; Chilanga, T.; Mkonda, A.; Kadu C. A. C.; Kadzere, I.; Mithofer, D.; Saka, J. D. K.; Sileshi, G.; Ramadhani, T.; and Dhliwayo, P. (2006). Towards the development of miombo fruit trees as commercial tree crops in Southern Africa. *Forests, Trees and Livelihoods*, **16**: 103-121.

Bekele T. A.; Birnie, A. and Tengnas B. A. (1993). Useful Trees and Shrubs for

Dell" on clay soil of central Sudan. University of Khartoum Journal of agricultural sciences 2(2):147-155.

Fogt, K. (1995). Field guide to identify trees and shrubs in the dry land of the Sudan. Antony Rowe Ltd. Chippenham, U.K.

Hall, J.B. and Walker, D.H. (1991). *Balanites aegyptiaca:* a monograph. School of Agricultural and Forest Sciences. Publication No. 3. University of Wales,Bangor.

Hall, J. B. O'Brien, E. M. and Sinclair, F. L. (2002). Sclerocarya birrea: a monograph. School of Agricultural and Forest Sciences, publication number 19, University of Wales, Bangor. 157 pp

ICRAF (2003). When a tree becomes a garden vegetable - baobab gardens in Mali, ICRAF, Nairobi [Online] URL: http: //www. worldagroforestry. org/ar2003/downloads/AIA_Baobab. Pdf.

Kang, B. T. and Akinnifesi, F. K. (2000). Agroforestry as alternative land-use production systems for the tropics.*Nat. Res. Forum*, **24**: 137-151.

Kwesiga, F.; Akinnifesi, F.; Ramadhani, T.; Kadzere, I. and Saka, J. (2000). Domestication of indigenous fruit trees of the miombo in southern Africa. In: Shumba, E. M.; Lusepani, E. and Hangula, H . (ed.) The domestication and commercialization of indigenous fruit trees in the SADC Region. SADC Tree Seed Centre Network, pp 8-24.

NRC (2008). Lost crops of Africa: Volume III: Fruits. Development, security and cooperation policy and global affairs. The National Academies Press. Washington, 351 pp.

Oduol, P. A.; Ajayi, O. C.; Matakala, P. and Akinnifesi F. K. (2008). The role of institutional arrangements and policy on the conservation, utilization and commercialization of indigenous fruits in Southern Africa.In: Akinnifesi, F. K.; Leakey, R. R. B.; Ajayi. O. C.; Sileshi, G.; Tchoundjeu, Z.; Matakala, P. and Kwesiga, F. R. (eds). *Indigenous fruit trees in the Tropics: Domestication, Utilisation and Commercialisation*. ICRAF/CABI, Nairobi. PP 310-321.

Ramadhani, T., Chile, B. and Swai, R. (1998). Indigenous miombo fruits selected for domestication by farmers in Tanzania. In: Maghembe, J. A., Simons, A. J., Kwesiga, F. and Rarieya, M. (eds). *Proceedings of a Conference on `Selecting Indigenous trees for Domestication in Southern Africa: Priority Setting with Farmers in Malawi, Tanzania, Zambia and Zimbabwe*'. ICRAF, Nairobi.

Shackleton S. (2004). Livelihood benefits from the local-scale commercialization of savanna resources: a case study of the new and expanding trade in marula (*Sclerocarya birrea*) beer in Bushbuckridge, South Africa. *S. Afr. J. Sci.* **100**,651–657.

Shanley, P. (2006). Science for the poor: how one woman challenged researchers, ranchers and loggers in Amazonia. *Ecology and society*, **11** (2): 28.

Suleiman, A.M. and Jackson, J.K. (1959). The heglig tree. *Sudan Silva*, **9** (1): 1-4

Teklehaimanot, Z. (2008). The role of indigenous fruit trees in sustainable dryland agriculture in eastern Africa, In: Akinnifesi, F. K.; Leakey, R. R. B.; Ajayi, O. C.; Sileshe, G.; Tchoundjeu, Z.; Matakala, P. and Kwesiga, F. R. (eds) *Indigenous fruit trees in the tropics: Domestication, utilization and commercialization*, CABI and ICRAF, Nairobi, pp 204-223.

استخداما ت وادارة شجرة الهجليج في السودان : منظور السكان المحليين

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المستخلص :

يهدف البحث الى دراسة المعرفة المحلية للسكان حول إدارة وإستخدامات شجرة الهجليج. أجريت هذه الدراسة في ولايتي سنار والنيل الأزرق. تم تصميم إستبيان لجمع المعلومات وأجري المسح الإجتماعي على عدد 120 شخص في منطقتي الدراسة. وتم عقد عدد من المقابلات مع مسئولي الغابات والباحثين فيما يختص بإدارة وإستغلال هذه الشجرة. وكذلك تم عقد جلسات التقييم بالمشاركة مع بعض المواطنين لتوضيح بعض النقاط وإزالة اللبس. أوضحت نتائج الدراسة أن شجرة الهجليج ذات أهمية و يتم الاستفادة من جميع أجزاءها لأغراض مختلفة مثل الغذاء والعلف والدواء. وأظهرت نتائج الدراسة أن الشجرة تنمو طبيعيا ولا يتم زراعتها و من أهم معوقات زراعة الشجرة هو عدم توفر البذور والشتول والرعي الجائر والحفاظ على التجدد الطبيعي هو الحل لهذه المشكلة. وأوضحت الدراسة أنه يتم تسلق الشجرة وقطع الفروع والأغصان لجمع الأوراق في حين يتم جمع الثمارعموما بعد سقطوطها تحت الشجرة. أوضحت الدراسة انه لم يتم تطبيق أي ممارسات لإدارة أشجار الهجليج التي تنمو في الأراضي البرية بينما التي تنمو في المزارع تستفيد من ازالة الأعشاب الضارة من المحاصيل المرتبطة بها. أوصت الدراسة بأخذ طرق استغلال الأوراق في الإعتبار لضمان إستدامة الشجرة ورفع الوعي للسكان بأهمية الشجرة في تحسين سبل العيش. وأوصت الدراسة بإدماج المعارف المحلية عند التخطيط لأنشطة الإدارة