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Plant Biodiversity Assessment and its Contribution in the Livelihood of Local Communities: A Case Study of El Ain Reserved Forest, North Kordofan, Sudan

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Abstract: ***The importance of biodiversity and its linkage to livelihood aspects has been recognized at different levels. The direct and indirect services it provides are necessary to the livelihood of many people, and its loss is more severe to natural resource-dependent communities with limited livelihood options. In recent years, plant biodiversity is highly threatened by drought, desertification, deforestation, overgrazing, and poverty, which resulted in the damage of the habitats and loss of many species. Reserved forests have played a significant role in conserving plant biodiversity while providing substantial benefits to households in rural areas. In this study, plant biodiversity of El Ain reserved forest was assessed, and its contribution in the livelihood of local communities was investigated. Across the study area, a total of 73 woody plant species and 64 herbaceous plant species from 31 families were recorded. The families Fabaceae and Poaceae are well represented in the flora of EL Ain reserved forest and its buffer zone. The results also revealed that the majority of the recorded herbaceous and woody plants have had significant, impacts on people's livelihood strategies. They have avarious contribution from cash income to multiple other uses such as construction material, fuel wood, fruits, food, fodder, shelter and recreation.***

Keywords: plant biodiversity; livelihood; forest; local communities; assessment.

1. Introduction

Plant biodiversity is essential biological assets to human life and livelihood. Usually, local people depend on products, services, or even land from nearby natural areas to meet their livelihood needs. Kordofan–western Sudan, where the study was conducted, is a diverse region, and it contains numerous plant species which originate in different ecosystems (more than 183 trees and shrub species) both indigenous and exotic (El Tahir et al., 2010). However, in recent years plant biodiversity is highly threatened by drought, desertification, deforestation, overgrazing, and poverty (El Moghraby 2003 and Elsiddig et al., 2004), which resulted in the loss of many plant species from extensive areas creating forests products scarcity and land productivity decline. This situation aggravated by shocks such as climate change and climate variability that alter the behavior of the ecosystems and the beneficiaries.

Reserved forests have played a significant role in conserving plant biodiversity while providing substantial benefits to households in rural areas (Worede, 2000 and Hooper et al., 2005). There are diverse uses for forest products in Sudan the magnitude of which depend on distribution and composition within the region and/or location. In North Kordofan State, these uses can be summarized in firewood, charcoal and timber for local and commercial purposes, and non-wood forest products (HCENR 2000). NTFP provide considerable cash income and edible fruits for rural communities. So far few studies have been focused on Timber and Non-Timber Forest Products (NTFPs) economy. However, various efforts were made to explore the composition of the vegetation cover and agro-ecological zones of Sudan in the contemporary era. For example, at the national level, Andrews (1950 and 1952) and Broun and Massey (1929) studied the flora of Sudan. While, El Amin (1990) has made an appreciated attempt to update the trees and shrubs of the Sudan, and He reported more than 3156 species belonging to 170 families and 1137 genera. At the regional level, there are many floristic studies have been published. For instance, El Ghazali (1985) studied the flora of Eastern Nuba Mountains with a particular focus on medicinal plants. Bebawi and Neugebohrn (1991) provided a review of the plant of northern Sudan with a particular reference to their uses. Braun et al., (1991) published a book on the common weeds of central Sudan. Elkhalifa et al., (2003) studied the flora of the Gash Delta, Eastern Sudan and reported 163 plant species. El Tahir et al., (2010) assessed forest biodiversity in the Kordofan Region; they reported more than 183 shrub and trees species both indigenous and exotic.

This study seeks to assess plant biodiversity in El Ain reserved forest and surrounding buffer zones, and its contribution in the livelihood of local communities. This paper, based on information obtained from three field visits, the first visit, was during the dry season of 2010 and the second was during the rainy season of the same year, while the third was during the rainy season of 2011.

2. Materials and methods

2.1. Study Area

The study area is located in the North Kordofan State, Sudan, extending from 12° 52′ to 13° 04′ N and from 30° 10′ to 24° E. The forest consists of three main parts; central forest, new extension, and water reservoir as indicated in

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Fig. 1, the total area of the forest are about 44459. 52 Fed. The study area classified as tropical thorn woodland biome (low rainfall woodland savannah) and the average annual precipitation is about 318. 5mm.The mean annual temperature is 27. 3 C°. The average relative humidity is 34% decreasing to 14% during the drier months and increasing to 60% in the wet season. The soil is classified gardud which is a local term used for semi-heavy non-cracking soils.

2.2. Site Selection Rationale

A number of factors contributed to the selection of EL Ain reserved forest for this study. EL Ain reserved forest is one of the most valuable natural reserved forests in North Kordofan state. It is covering an area of about 44459. 52 Fed. It receives high amounts of rainwater as a result of its lowland and mountainous nature, which makes it an attractive place for farming and grazing. Commonly, nomads' movement during the dry season depends on the water availability as a result of water and vegetation cover disappearance of the most areas; this has led to the concentration of settlements in El Ain neighbouring areas.

El Ain Forest and its surrounding buffer zones are nowadays threatened because of overgrazing, over-cultivation of rain-fed crops in adjacent areas, and drought. Besides, the pattern of land tenure, conflicts between pastoralists and resident farmers, and other political, social and institutional dimensions has also severely affected resource biodiversity in the area (El Tahir et al., 2010). Some species disappeared from the area, and certain plants and animals associated with human settlements were introduced.

The characteristics of El Ain area are expected to create diversity in term of vegetation cover and wildlife habitats. Also, El Ain reserved forest was a pilot in different management projects and in which different stakeholder's options were considered. For example, Participatory Forest Management (PFM) project which was established to assist the natural forest to be more productive and sustainable, and the joint natural resources management project (Elain natural forest reserve and SOS/FNC project) which was created to encourage forest users and dependents to participate in forest protection and management. These may help El Ain forest to some extent to maintain its characteristics.

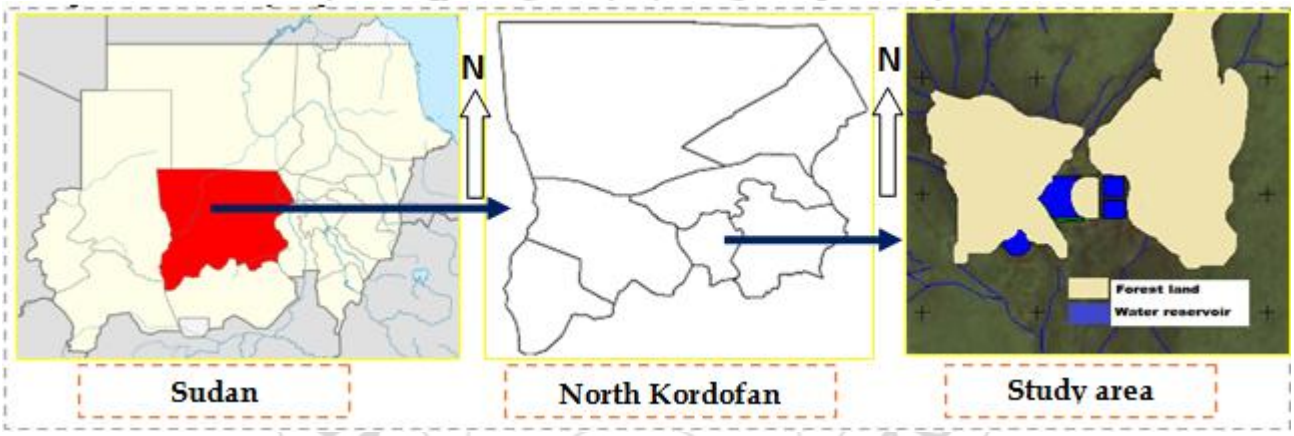

Figure 1: The location of Sudan, North Kordofan State, and El Ain Forest Reserved and its surrounding buffer zone where the study is conducted

2.3. Data collection and analysis

Systematic sampling technique was applied in this study with the aid of GPS after a sampling grid was created and transferred to GPS unit. 927 sample plots were done, and many parameters were measured in each sample plot. The numbers of individual plant species (herb, shrubs, and trees) were recorded. Fresh specimens of known or unknown plant with their all available organs (foliage, flowers or inflorescence, and fruits) were collected. The collected plant species were assigned to their scientific names, vernacular names, and families, using reference material, recent scientific publications, and floristic studies. Also, using high-quality digital camera photos were taken for (whole trees or shrubs, leaves, fruits, and flowers), for securing more details and accuracy by combining the advantages of interviews and field observations. Also, the parameters such as densities, abundance, frequency, associations of plant species were studied.

All the herbaceous and woody plant species investigated for their contribution in the livelihoodof the local community. The contribution of plant diversity was evaluated by interviews, focus group discussions, direct observations, and market survey. The households in "Wadelbagha" village, nomads, forest product traders, and forest staff were interviewed using a semi-structured questionnaire. There is no specific consideration given to gender factor, but only one respondent per family. Whoever is available at their places were interviewed during data collection.

3. Results and Discussion

3.1. Plant species diversity assessment

3.1.1. woody species

In this study, 73 woody species were identified, belonging to 49 genera, and 20 families, among them 10 planted trees (8 trees, 1 tree/shrub, and 1 shrub). The identified species were grouped according to their growth habits into 44 trees, 26 shrubs and 3 trees or shrubs. The checklist of the identified families, genera and species have been arranged alphabetically and listed after the species names were updated, as shown in Table 1 below.

A comparatively higher number of shrubs and trees were recorded on the Mayaa area (around 163 trees/h) followed

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by Khor (96 species/h) and Wadis area (75 trees/h) and then complex basement area (around 83 trees/h). However, the lowest density was found in Gardud area where water catchments present due high water run-off approx. 56 trees/h. Across the study area, the most dominant families were Fabaceae (33.8%) followed by Combretaceae (10. 8%), Malvaceae (9.5%) and Capparaceae (9.5%), respectively as shown in Fig. 2, while the other families were between the range of one and 5 species as can be seen in Fig. 2. Fig. 4 (a) indicates the abundance of woody plants. *Acacia mellifera* scored the highest density followed by *Boscia senegalensis*, *capparis deciduas*, *cordia sinensis, Acacia laeta, cadaba rotundifolia, Acacia oerfota* and *Grewia tenax,* respectively; however, the other species showed very low abundance redundant around one percent. The association of woody species was common in all studied sites except in Mayaa that is dominated only by *Acacia nilotica*.

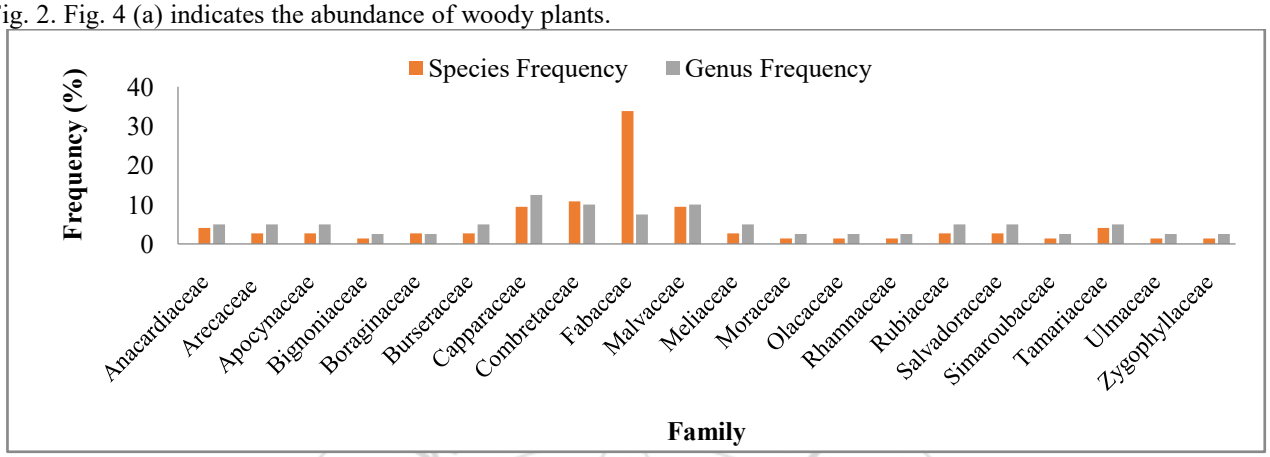


Figure 2: Frequency percent of woody plant among the families

According to the respondents, three species were considered under a high risk of extinction in the near future, namely, *Sclerocarya birrea* (Humied), *Boswellia papyrifera* (Tragtarg), *and Albizia anthelminthica* (Umtakria (Gerfedud)).

3.1.2. Herbaceous species

Across the study area, 64 herbaceous species were collected and identified, belonging to 51genera and 16 families. Based on plant habit and seasonality, the identified species were grouped into 39 annual, 20 perennials and 4 perennial or annual. The identified families, genera, and species were alphabetically arranged and recorded as can be seen in Table 2 below after the identified species are revised for their botanical names and vernacular names. The herbs diversity was higher in both the Khor and Wadis areas as compared to tree and shrub diversity due to the opening of canopy provides greater opportunity for the dominance of herbs. However, Mayaa area showed lower herbs density due to the dominance of *Acacia nilotica* and canopy closure. Total herbs density ranged between 23.9 - 44.3 ind/m^2. Figure 3 demonstrates the frequency of the herbaceous plant among the families. The family Poaceae is well represented in the flora of EL Ain reserved forest and its buffer zone. Species, namely *Tribulus terrestris* (Drissa), *Abutilon angulatum* (Amboru), and *Echinochloa colona* (Diffra) were found more dominant among the herbaceous plant species followed by *Acanthospermum hispidum* (Hurabhawsa), *Aristida hordeacea* (Danab Elkadees) and *Solanum dubium* (Gba'an).

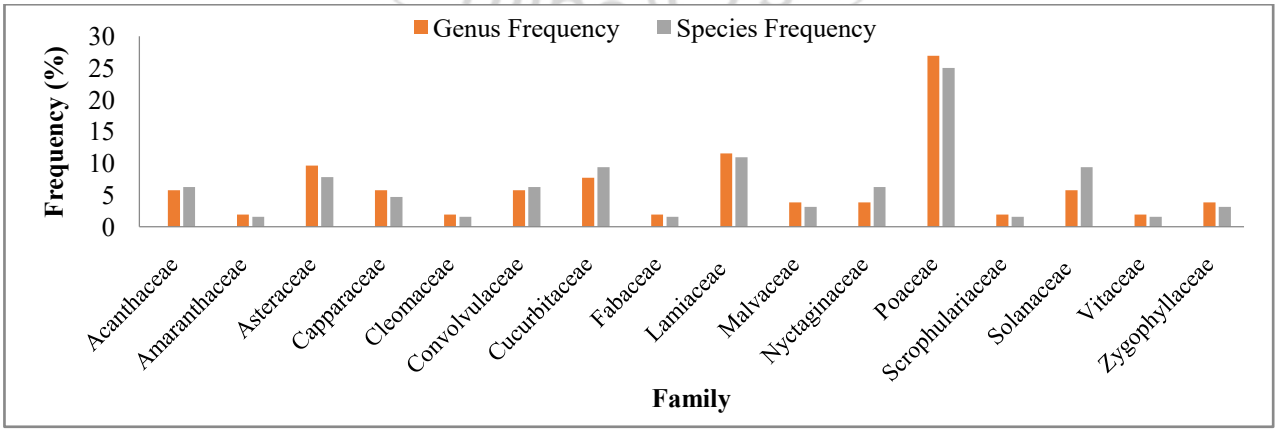


Figure 3: Frequency percent of the herbaceous plant among their families.

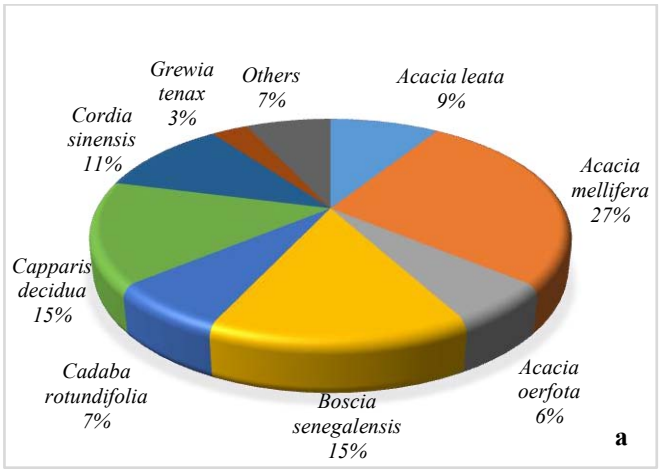


Fig. 4: (a): Abundance of the trees and shrubs

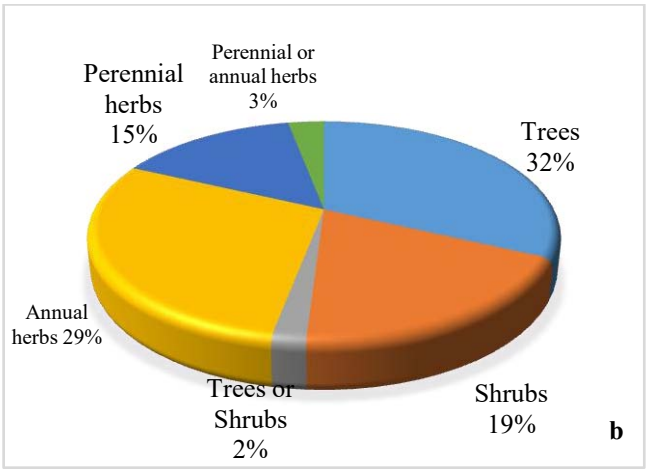
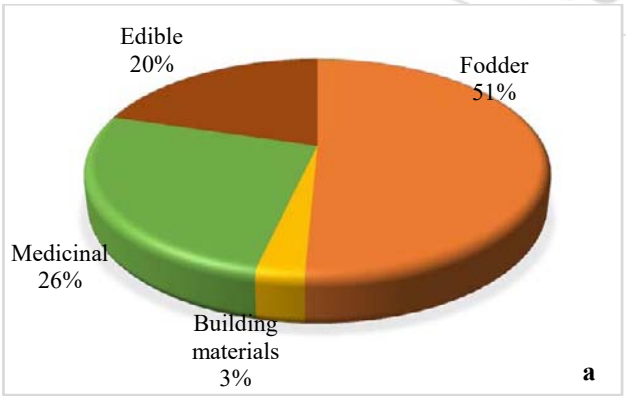


Fig. 4: (b): Distribution of plant species by habits

3.1.3. Plant Biodiversity and Livelihood Aspects

The pattern of livelihood in El Ain and its surrounding villages is pastoral production system and nonpastoral production system. In the pastoral system, there are two types of livestock management are sedentary livestock and nomadic pastorals. Settled villagers keep goats, sheep, and few cattle, while nomads are mainly camel owners who traditionally move with their livestock in a north-south axis. In nonpastoral production system or agro-based system, crop production is dominant activity. In this study, it was found that most of the plant species of El Ain reserved forest and surrounding buffer zone have had significant, impacts on people's livelihood strategies, as can be seen in Table 1 and 2. Both herbaceous and woody plants of the study area have important economic uses. The woody plant contribution was in the form of Timber and Non-Timber Products (NTFPs). The most significant contribution of timber products were firewood, charcoal, building materials, furniture, and tool handles. Whereas, Non-Timber Products provide substantial cash income, edible leaves, edible roots and edible fruits. These products also had a variety of other uses such as traditional pharmaceuticals treatments, gums products, fodder for domestic animals as more detailed in Table 1 and 2. For example, *Grewia tenax* fruit sale represents a subsistence strategy for many surveyed households. Based on these results, it can be recommended that the abundance of *Acacia oerfota* representing 6% among the other trees. This tree is not of economic value. Thus, considering replacing this tree by species of high economic values such as *Grewia tenax* would be beneficial not only from an economic point of view but also in terms of more involving of local people in the forest management. This could be adopted under Tonjia system which was successful in the plantation of some of Sudan's forests. Approaches such as Tonjia and employment of locals in the forest management will help to build confidence and increase the participation of local communities in biodiversity conservation.

In the same way, herbaceous plant showed great contribution in the livelihood of the local community. 28% of herbaceous species demonstrated medicinal applications, whilst 22 % are edible plants. Some of them were used as building materials. For instance, *Cymbopogon nervatus* and *Sorghum halepense* are used as a straw building material for roofing and fencing. On the other hand, El Ain reserved forest is considered as an important source of fodder for animal grazing in the dry seasons, the villagers and nomads have no alternative for animal feeding. It was found that 65 out of 73 (89%) of woody plants and 35 out of 64 (54%) of herbaceous species provide fodder.



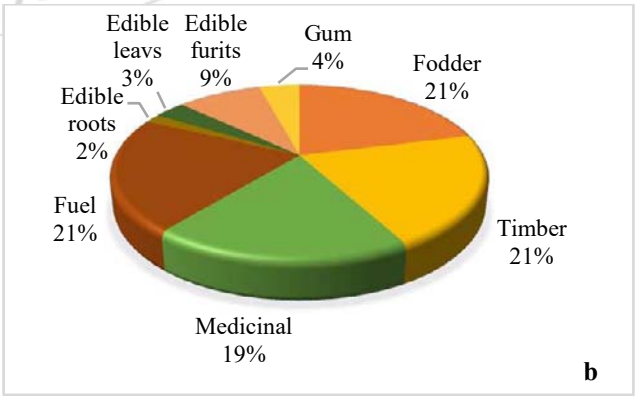


Figure 5: Economic uses of (**a**) herbaceous plant species (**b**) woody plant species.

Figure 6: The vegetation cover of El Ain reserved forest in the rainy season

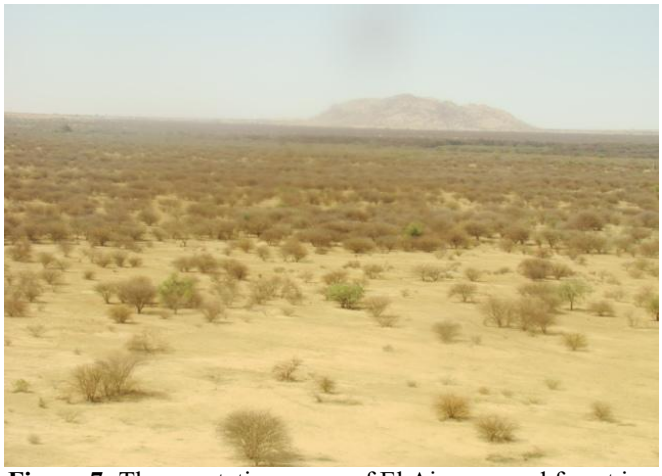


Figure 7: The vegetation cover of El Ain reserved forest in the dry season

Table 1: List of woody plant species in El Ain reserved forest and their contribution in the livelihood aspects

Family	Scientific name	Vernacular name	Habit	Uses							
				E. G.[a]	E. F.[b]	E. L.[C]	E. R.[d]	Fod.[e]	Fuel[f]	Tim.[g]	Med.[h]
Anacardiaceae	*Lannea fruticosa* (Hochst. ex A. Rich.) Engl.	Leuon	Tree	√	–	–	–	√	√	√	√
	Lannea humilis (Oliv.) Engl.	Leuon	Tree	√	–	–	–	√	√	√	√
	Sclerocarya birrea (A. Rich.) Hochst.	Humied	Tree	–	√	–	–	√	√	√	√
Arecaceae (Palmae)											
Subf. Coryphoideae	*Borassus aethiopum* (Ron Palm) Mart.	Daliab	Tree	–	√	–	–	–	–	√	√
	Hyphaene thebaica (L.) Mart.	Dome	Tree	–	√	–	–	–	√	√	√
Apocynaceae											
Subf. Apocynoideae	*Adenium obesum* (Forssk.) Roem & Schult.	Shagar Elsim	Shrub	√	√	–	–	–	–	√	√
Subf. Asclepiadoideae	*Calotropis procera* (Aiton.) Aiton.	Oshar	Shrub	√	–	–	–	√	√	√	√
Bignoniaceae	*Stereospermum kunthianum* Cham.	Khashkhash Abid	Tree	–	–	–	–	√	√	√	√
Boraginaceae	*Cordia africana* Lam.	Gembeel	Tree	√	√	√	√	√	√	√	√
	Cordia sinensis Lam.	Andrab	Tree/ shrub	–	√	√	√	√	√	√	√
Burseraceae	*Boswellia papyrifera* (Del.) Hochst.	Tragtarg	Tree	–	–	–	–	√	–	√	√
	Commiphora africana (A. Rich.) Engl.	Gafal	Tree	–	–	–	√	√	√	–	√
Capparaceae	*Boscia angustifolia* A. Rich.	Sarih	Shrub	–	√	√	–	√	√	√	–
	Boscia senegalensis (Pers.) Lam. ex Poir.	Mokhaiet	Shrub	–	√	–	–	√	√	√	√
	Cadaba rotundifolia Forssk.	Kormot	Shrub	–	–	–	–	√	–	–	√
	Capparis decidua (Forssk.) Edgew.	Tundub	Shrub	–	√	–	–	√	√		√
	Capparis tomentosa Lam.	Marwa	Shrub	–	√	√	–		√	√	√
	Crateva adansonii DC.	Dabkar	Shrub	–	√	√	–	√	√	√	√
	Maerua angolensis DC.	Shagar Eldoud	Tree	–	–	–	–	–	√	√	√
Combretaceae	*Anogeissus leiocarpus* (DC.) Guill. & Perr.	Sahab	Tree	–	–	–	–	√	√	√	–
	Combretum aculeatum Vent, Choix.	Shehait	Shrub	–	√	–	–	√	√	√	√
	Combretum hartmannianum Schweinf.	Habeel Eljabal	Tree	–	–	–	–	√	√	√	√
	Combretum glutinosum Perr. Ex DC.	Habeel	Shrub	–	–	–	–	√	√	√	√
	Combretum molle R. Br. ex G. Don.	Habeel	Tree	–	–	–	–	√	√	√	√
	Guiera senegalensis J. F.Gmel.	Gubeish	Shrub	–	–	–	–	√	√	√	√
	Terminalia brownii Fresen.	Subag/Shaf	Tree	–	–	–	–	√	√	√	√
	Terminalia laxiflora Engl. & Diels.	Subag/Droot	Tree	–	–	–	–	√	√	√	√
Fabaceae											
Subf. Caesalpinoideae	*Bauhinia rufescens* Lam.	Kulkull	Shrub	–	–	–	–	√	√	√	√
	Bauhinia reticulata DC.	Kharub	Tree	–	–	–	–	√	√	√	√
	Cassia siamea L.	Siamea	Tree	–	√	–	–	–	–	√	–
	Parkinsonia aculeata L.	Sesaban	Tree	–	–	–	–	√	√	–	√
	Piliostigma reticulatum (DC.) Hochst.	Kharoub	Shrub	–	–	–	–	√	√	–	–

	Tamarindus indica L.	Ardieb	Tree	–	√	√	–	–	–	√	√
Subf. Mimosoideae	*Acacia laeta* (Vahl.) Benth.	Shubahi	Tree/ shrub	–	–	–	–	√	√	√	√
	Acacia mellifera (Vahl.) Benth.	Kitir	Tree/ shrub	–	–	–	–	√	√	√	–
	Acacia nilotica (L.) Delile subsp. *Tomentosa* (Benth.) Brenan.	Sunt	Tree	–	–	–	–	√	√	√	√
	Acacia nilotica subsp. *nilotica* (Brenan.) A. F. Hill.	Sunt	Tree	–	–	–	–	√	√	√	√
	Acacia oerfota (Forssk) Schweinf	Laot	Shrub	√	–	–	–	√	√	√	–
	Acacia polyacantha Willd.	Kakamot	Tree	√	–	–	–	√	√	√	√
	Acacia senegal (L.) Willd.	Hashab	Tree	√	–	–	–	√	√	√	√
	Acacia seyal var. *fistulal.* Schwinf. Oliv.	Safar Abid	Tree	–	–	–	–	√	√	√	√
	Acacia seyal var. *seyal* Del.	Talh Ahmar	Tree	√	–	–	–	√	√	√	√
	Acacia tortilis subsp. *raddiana* (Savi) Brenan.	Sayal	Tree	–	–	–	–	√	√	√	√
	Albizia amara (Roxb.) Boiv.	Arad	Tree	√	–	–	–	√	√	√	√
	Albizia aylmeri Hutch	Sireira	Tree	–	–	–	–	√	√	√	
	Albizia anthelminthica Brong.	Umtakria (Gerfedud)	Tree	–	–	–	√	√	√	√	√
	Dichrostachys cinerea (L.) White & Arn.	Kadada	Shrub	–	–	√	–	√	√	√	–
	*Faidherbia albida (*Delile) A. Chev.	Haraz	Tree	–	–	–	–	√	√	√	–
	Prosopis chilensis (Molina) Stuntz.	Mesquite	Shrub	–	√	–	–	√	√	√	–
Subf. Faboidae	*Dalbergia melanoxylon* Guill. & Perr.	Abanoos	Tree	–	–	–	–	√	√	√	√
	Pterocarpus lucens GuilL. & Perr.	Traia	Tree	–	–	–	–	√	√	√	–
	Erythrina abyssinica DC.	Hab Elaroos	Tree	–	–	–	–	√	√	√	–
Malvaceae											
Subf. Bombacoideae	*Adansonia digitata* Linn.	Tabaldi	Tree	–	√	√	√	√	–	–	√
Subf. Grewiodeae	*Grewia flavescens* Juss.	Grgadan	Shrub	–	√	–	–	√	√	√	√
	Grewia tenax (Forsk.) Fiori.	Godiem	Shrub	–	√	–	–	√	√	√	√
	Grewia villosa Willd.	Hiliw	Shrub	–	√	–	–	√	√	√	√
	Grewia mollis Juss.	Basham	Shrub	–	√	–	–	√	√	√	√
Subf. Malvoideae	*Azanza garckeana* (F. Hoff.) Exell & Hillcoat.	Nakhgar	Tree	–	√	–	–	√	√	√	√
Subf. Sterculiodeae	*Sterculia setigera* Del.	Tartar	Tree	√	–	–	–	√	√	√	√
Meliaceae	*Azadirachta indica* A. Juss.	Neem	Tree	–	√	–	–	√	√	√	√
	Khaya senegalensis (Desr.) A. Juss.	Mohogani	Tree	–	–	–	–	√	√	√	√
Moraceae	*Ficus salicifolia* Vahl.	Um sisi	Tree	–	–	–	–	√	√	√	–
Olacaceae	*Ximenia americana* L.	Saat/ Sea Lemon	Shrub	–	√	–	–	√	√	√	–
Rhamnaceae	*Ziziphus spina-christi* (L.) Desf.	Sidir	Tree	–	√	–	–	√	√	√	√
Rubiaceae	*Gardenia lutea* J. Ellis.	Gardennia	Shrub	–	–	–	–	√	√	√	√
	Xeromphis nilotica Stapf.	Marfaeen tree	Shrub	–	–	–	–	–	√	–	√
Salvadoraceae	*Dobera glabra* (Forsk.) Poir.	Maykah	Shrub	–	√	–	–	√	–	–	√
	Salvadora persica L.	Arak	Shrub	–	–	–	–	√	√	–	√
Simaroubaceae	*Ailanthus excelsa* Roxb.	Neem hindy	Tree	–	–	–	–	√	√	√	√
Tamariaceae	*Tamarix aphylla* (L.) Karst.	Tarfa	Tree	–	–	–	–	√	√	√	–
	Tamarix nilotica (Ehrenb.) Bunge	Tarfa nileia	Shrub	–	–	–	–	√	√	√	–
Ulmaceae	*Celtis integrifolia* Lam.	Mohajreia/ Labnja	Tree	–	√	√	–	√	√	√	√
Zygophyllaceae											
Subf. Tribuloideae	*Balanites aegyptiaca* (L.), Del.	Heglig	Tree	√	√	–	–	√	√	√	√

[a] E. G. = Edible Gum, [b] E. F. = Edible Fruits, [C] E. L. = Edible Leaves, [d] E. R. = Edible Roots, [e] Fod. = Fodder, [f] Fuel = Fuelwood, [g]Tim. = Timber, [h] Med. = Medicinal, [i]– = indicates not stated uses.

Table 2: List of herbaceous plant species in El Ain reserved forest and their contribution in the livelihood aspects.

Family	Scientific name	Vernacular name	Habit	Uses
Acanthaceae				
Subf. Acanthoideae	*Blepharis linariifolia* Pers.	Beghal	Perennial	Medicinal and Fodder
	Justicia schimperi (Hochst.) Dandy.	Na'ana	Annual or perennial	Medicinal
	Justicia flava (Forssk.) Vahl.	Elfkha	Perennial	Edible and Medicinal
	Peristrophe paniculata (Forssk.) Bru.	Abu Rokab	Perennial	Fodder
Amaranthaceae	*Aerva javanica* (Burm. f.) Juss.	Ras Elshaib	Perennial	Edible and Fodder
Asteraceae				
Subf. Asteroideae	*Acanthospermum hispidum* DC.	Hurabhawsa	Annual	Medicinal
	Eclipta alba (L.) Hassk.	Tamr Elghnam	Annual	Medicinal
	Xanthium brasilicum Vell.	Rantook	Annual	Medicinal
	Sonchus comutu Hochstetter.	Molita	Annual	Fodder and Medicinal
	Vernonia pauciflora (Willd.) Less.	Tagtag	Annual	Medicinal
Capparaceae	*Cadaba rotundifolia* Forssk.	Kurmut	Perennial	Fodder
	Maerua angustifolia A. Rich.	Arig Elsriah	Perennial	Fodder
	Maerua oblongifolia (Forssk.) A.Rich.	Arig Elmahba	Perennial	Medicinal
Cleomaceae	*Cleome gynandra* L.	Tamaleka	Annual	Edible
Convolvulaceae	*Ipomoea eriocarpa* R.Br.	Liwees	Annual	Fodder
Cucurbitaceae	*Cucumis metuliferus* E. Mey. ex Naudin	Tibish Elkilab	Annual	Edible
	Cucumis prophetarum L	Fagoos Elkhala	Annual	Fodder
	Momordica balsamina L.	Era ira	Annual	Edible fruits
	Luffa aegyptiaca P. Miller.	Lief	Annual	Bath sponges
Fabaceae				
Subf. Papilionoideae	*Indigofera oblongifolia* Forssk.	Eldahaseir	Perennial	Fodder
	Zornia glochidiata Reichb. ex DC.	Shiliny	Annual	Fodder
Subf. Caesalpinoideae	*Senna italica Mill*	Sin Elkalib	Perennial	Medicinal
	Senna obtusifolia (L.) Irwin & Barneb	Kawal	Perennial	Edible
	Senna occidentalis (L.) Link.	Soreeb	Perennial	Medicinal
subf.Faboidae	*Crotalaria senegalensis* (Pers.) Bacle	Sifeira	Annual	Fodder
Lamiaceae				
subf. Nepetoideae	*Ocimum basiclicum* L.	Rihan Elkhala	Annual or perennial	Edible
Malvaceae				
Subf. Malvoideae	*Abutilon angulatum* (Guill. & Perr.) *Mast*	Amboru	perennial	Fodder
	Abelmoschus esculentus (L.) Moench	Weika	Annual	Edible and fodder
	Corchorus olitorius L.var. Olitorius	Malokhiet Elkhala	Annual	Edible and fodder
	Hibiscus esculentus Linn	Bamia	Annual	Edible
	Sida alba Linn.	Um Shdida	perennial	Medicinal
Subf. Grewiodeae	*Corchorus tridens* L.	Khodra	Annual	Edible
	Triumfetta pentandra J.M. Garg	Abu liseig	perennial	
Nyctaginaceae	*Commicarpus verticillatus* (Poir.) Standl.	Raba'a	Annual	Medicinal
	Boerhavia erecta L	Lisan Elter	Annual	Fodder
	Boerhavia diffusa L.	Um Shiraya	Annual	Medicinal
	Boerhavia africana Lour.	Abu Libin	perennial	Fodder and Medicinal
Poaceae	*Aristida hordeacea* Kunth.	DanabElkadees	Annual	Fodder
	Aristida plumose L.	Gabash	Annual	Fodder
	Brachiaria eruciformis (Sm.) Griseb.	Um kwiaat	Annual	Fodder
	Cenchrus biflorus Roxb.	Haskaniet	Annual or perennial	Fodder
	Cenchrus ciliaris L.	Haskaniet Naem	Annual or perennial	Fodder
	Chloris virgata Swartz.	Um Faru	Annual	Fodder
	Cymbopogon nervatus (Hochst.) Chiov.	Gash Elnal	Annual	Fodder and building material

	Dactyloctenium aegyptium (L.) Wild.	Abu Asabi	Annual	Fodder
	Dinebra retroflexa (Vahl) Panz.	Um Gnigra	Annual	Fodder
	Echinochloa colona (L.) Link.	Diffra	Annual	Fodder
	Eragrostis tremula Steud.	Binno	Annual	Fodder
	Tetrapogon cenchriformis (A. Rich.) W. D. Clyton.	Difra	Annual	Fodder
	Phragmites australis (Cav.) Trin.ex Steud.	Elbos	Perennial	Fodder
	Pennisetum purpureum Schumach.	Danab Elkalib	Annual	Fodder
	Setaria verticillata (L.) P.Beauv.	Shailny Maak	Annual	Fodder
	Sorghum halepense (L.) Pers.	Adar	Perennial	Fodder and building material
Scrophulariaceae	*Striga hermonthica* (Del.) Benth.	Boda	Annual	Fodder, dye and mordant
Solanaceae				
Subf. Solanoideae	*Datura innoxia* Mill.	Sikeran	Annual	Medicinal
	Capsicum Frutescens L.	Shata	Perennial	Edible
	Solanum dubium Fresen.	Gba'an	Annual	Fodder
	Solanum coagulans Forssk.	Gba'an	Perennial	Milk coagulation
	Solanum nigrum L.	Um Gibingibin	Annual	Medicinal
	Solanum lycopersicum L.	Tomato	Annual	Edible
Vitaceae	*Cissus quadrangulis* L.	Slala	Perennial (Climber)	Medicinal and Edible
Zygophyllaceae	*Fagonia cretica* L.	Marist Elter	Annual	
	Tribulus terrestris var. *terrestris* L.	Drissa	Annual	Fodder

4. Conclusion and Recommendations

The results of this study have shown that El Ain reserved forest possess a wealth of plant biodiversity regardingspecies composition and richness. Also, ithas a significant contribution in the livelihood of the local people, despite the pressures resulting from the illicit felling and over-grazing, and most of the community stakeholders have the perception that the forest is critical for their lives and livelihood.

- Based on this study, it can be recommended that for ensuring natural resource sustainable use, stakeholders should involve in conservation programmes because any gap between the forest authorities and the villagers present major challenges and could prevent El Ain forest from achieving its goals of sustainable management and livelihood improvement.
- Extension campaigns in schools and pro-active community conservation awareness for the local community adjacent to EL Ain forest are needed to sensitize them about the importance of this forest and conservation values it offers in the region.
- More research is needed to investigate the possibility of replacement of economic species by poor ones and the reasons behind the disappearance of some plant species. If this happened definitely will greatly support the livelihood of the local population.

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