

Original

The Flora and Fauna in Eastern Nile Locality at Khartoum State

Reem A. Hamid^{*1}, Alawia A. Elawad² and Elfatih E. Mahgoub²

¹Wildlife Research Centre, Animal Wealth Research Co-corporation, Khartoum, Sudan.

²Faculty of Science and Technology, Al-Neelain University, Khartoum, Sudan.

²College of Animal Production Science and Technology, Sudan University of Science and Technology, Khartoum, Sudan.

***Corresponding author E-mail address:** reemasah01@yahoo.com

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Abstract:

The present study is the pioneer that document the biodiversity of the Eastern Nile Locality, Khartoum State, Sudan including five range enclosures. The main objective of the present study is to document the natural vegetation status and floristic, faunal composition in five rangeland enclosures namely Abozaid (15° 46' 928", 32°88'549") Wadtbar (15° 42' 846", 33°06'552"), Elhedabab (15° 42' 893", 33°002' 36"), Salamat Wad Niel (15° 652' 680", 33°25' 928") and Seyal Elfaki Saad (15° 54' 976", 33°20' 724") in Eastern Nile Locality, Khartoum State, and to provide a recent species list. The quantitative assessment of the flora in the five enclosures was determined by measurement of density, abundance, frequency, relative density, relative abundance, relative frequency and importance value index. On each of the five enclosures 9 plots were selected and the measurements were taken for 3 consecutive years. Nineteen plants were encountered during the survey. The results revealed that the herbaceous cover is dominated by *Aristida adscensionis* in four of the five studied enclosures while in Elhedabab enclosure *Schoenefeldia gracilis* is the most dominant species.

Standard collection and identification methods were used for both plants and animals. During the study period, a total of 33 plant species, representing 27 genera from 14 families, in 11 orders were recorded. Poaceae had the highest contribution; followed by Fabaceae and Zygophyllaceae. The flora comprises a variety of life-forms; most are

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theophytes. The majority of the plant species have important ethnobotanical uses. From the collected plant 24 species are fodders grazed or browsed by wild animals and domestic livestock and 24 species are used for medicinal purposes. Almost all plant parts are economically used. The wild faunal survey results indicated the presence of 16 species two of which are reptiles, belonging to 1 order falling within 2 families. The avifauna consisted of nine species, falling in seven families within 4 orders. While the observed mammals were 5 species, falling in 5 families. Owing to the results produced by the present study, which represents the base for further ecological studies, there is an urgent need for monitoring and conserving the biodiversity in the Eastern Nile Locality.

Key words: Flora, Fauna, Biodiversity, Life forms, Economic uses.

Introduction

The U.N. Convention on Biological Diversity (CBD) (2020) defines Biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part”. According to Karmebäck *et al.*, (2015) and Wairore *et al.*, (2015) establishment of enclosures as a management tool that leads to agricultural diversification and ensure food security. Using of enclosures in the African drylands is becoming an effective management tool (Greiner, 2016 and Lovschal *et al.*, 2017).

More than 80 percent of Sudan consists of arid or semiarid areas. IPCC (2014) projected that the Horn of Africa will be among the regions to be most negatively affected by climate change. The Eastern Nile Locality lies in the semi-desert ecological zone which is characterized by low and erratic rainfall (Harrison and Jackson, 1958). Vegetation cover of this zone comprises annual and perennial grasses, forbs, shrubs and trees.

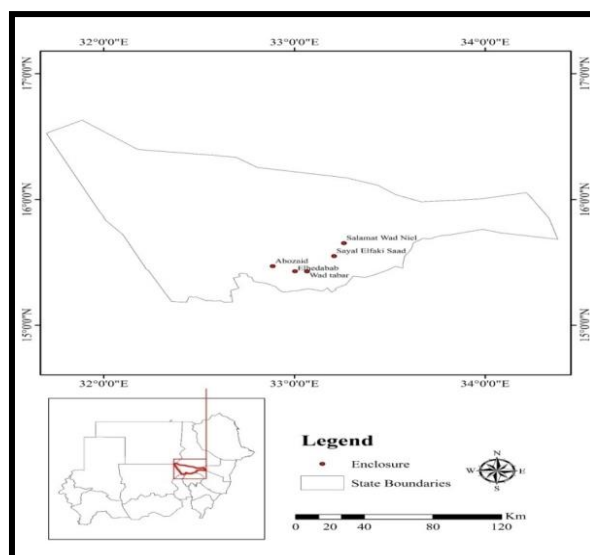
The floral composition of the Eastern Nile Locality has not been recently investigated. A general survey of the vegetation of Khartoum province had been represented by Obeid and Mahmoud (1969) and Mahmoud and Obeid (1971). Recently Abdalla and El Ghazali (2010) studied the flora of Khartoum Nile banks; Hamad *et al.* (2020) reported the Flora of Tutti Island and Mahmoud *et al.*, (2022) study the flora of Um Dom Island.

No previous attempts have been carried out to document the wildlife species inhabiting this area.

MATERIAL AND METHODS:

The Study area:

The Eastern Nile Locality is in the Eastern part of Khartoum State, 45 Kilometers north eastern Khartoum. The studied area is located between 15°42' 846" - 15° 652' 680" N and 33° 25' 928" - 32°88' 549" E. Five range enclosures has been established in this locality namely: Abozaid, Wadtabar, Elhedabab, Salmat Wad Niel and Seyal Elfaki Saad (Map 1).



Map 1: Study area

Specimen collection and identification:

The collection procedure followed Bean (2016). Specimens were identified using the available literature (Andrews, 1950, 1952 and 1956; El Amin, 1990 and Braun *et al.*, 1991). Recent literature was consulted for current plant names (World Flora Online (WFO). The list of families covered in this study was arranged according to the Angiosperm System of Classification of Flowering Plants (APG IV, 2016) while subfamilies, genera, and species were arranged alphabetically within the families. The identified specimens were confirmed with authenticated herbarium specimens in the Royal Botanical Garden Herbarium Kew, the United Kingdom (<http://apps.kew.org/herbact/navigator>.

ed.) and secondary resources including books and proceedings. Vernacular names given were compiled from local people and available literature. Ethnobotanical uses given were compiled from local people or retrieved from online bibliographic databases like Web of Science and Google Scholar, Useful Tropical Plants and PROTA4U Homepage, and secondary resources including books and proceedings; 13 use citations were recorded including 6 economic use categories and 7 used part categories. Due to its compelling simplicity, the life-form classification system of Raunkiær *et al.*, (1934) was used.

The survey for wildlife was carried out by direct observations of the individuals and indirect method by signs observation, tracks and foot prints

during the day and spotlight counts survey during the night to indicate the probability of occupancy (Cromsigt *et al.*, 2009, MacKenzie, *et al.*, 2006 and Kéry, *et al.*, 2016). Capturing of small mammals and reptiles was carried out with cage traps. Spotlight CP 7150 with a power of 550,000 watts' halogen was used during the night survey and direct observation was used during the day. These were identified using Curlis *et al.* (2020), Leenders (2019) and Farallo *et al.* (2010), As for birds' direct observation method and Bisley Deluxe 10 X 50 binocular were used. Identification was carried out using Wenny *et al.* (2011) method.

Results and discussion:

The floral results are presented in Table 1 which includes a list of collected taxa and their life forms, economic uses and the parts used from each. A total of 33 plant species, belonging to 27 genera included within 14 families falling in 11 orders were recorded from the study area. The results include a varying range of species within different families. Poaceae is the largest family represented by 9 species; followed by Fabaceae 8 species. Zygophyllaceae is represented by 3 species and each of Malvaceae and Euphorbiaceae 2

species. Acanthaceae, Aizoaceae, Apocynaceae, Asteraceae, Cucurbitaceae, Cyperaceae, Orbanchaceae, Solanaceae and Rubiaceae are monophyletic (Fig.1). This result can be considered as normal in a semi-desert environment. The families Poaceae and Fabaceae are usually widely distributed in any floristic study. Occurrence of Poaceae can be attributed to their economic uses, wide variety, ecological range of tolerance and to their efficient seed dispersal capability (Collentte, 1999 and Marjan and Manohar, 2014).

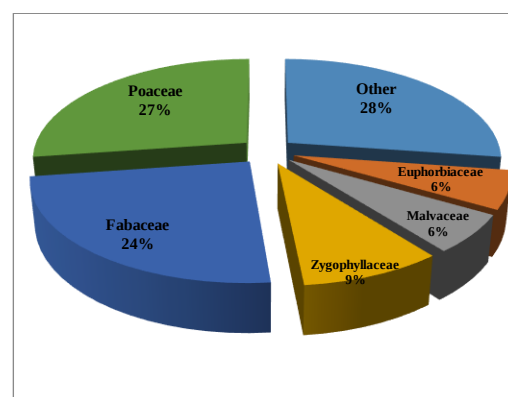


Fig (1): % of plant species within families

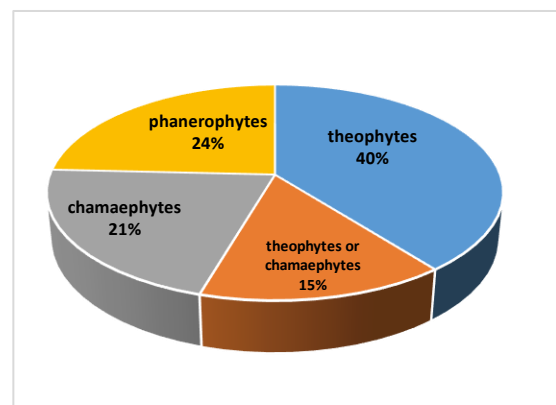
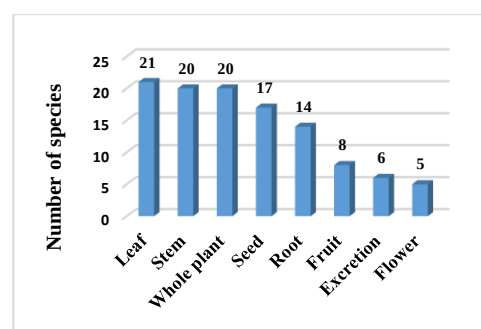
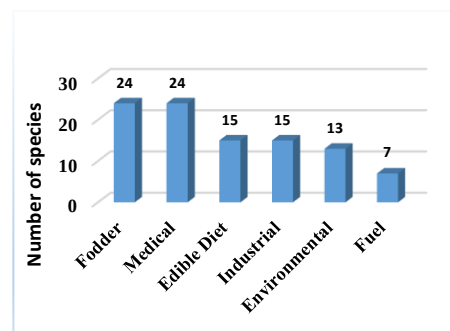


Fig (2): % of life forms within plant species.

The most common annual grasses are *Aristida adscensionis* and *Schoenefeldia gracilis*. The common forbs are *Corchorus depressus* and *Fagonia indica*, while the common shrubs and trees were *Acacia tortilis* subsp. *spirocarpa*, *A. ehrenbergiana* and *A. mellifera*; these findings agree with (Harrison and Jackson 1958).

The flora comprises different life-forms (Fig. 2); most are theophytes (40%). All plant species have important economic uses (Fig. 3a). The study area is considered as a natural range for the livestock. Twenty-four species are fodder plants, most are grazed and some are browsed by animals during the dry season. Seeds of *Blepharis ciliaris* (Fig. 4) a widely distributed fodder plant in most North African countries are brought to the locality during the broadcast program of the executive Range and Pasture Administration, Khartoum. Large trees, shrubs and grasses are utilized for building materials. Some plants are used for medicinal purposes; others are edible as human food, while *Striga hermonthica* parasitized the cultivated areas. All plant parts are being used; the use of

leaves was predominant followed by stem, whole plant, seeds, root, fruits, excretions and flowers (Fig. 3b).



**Fig (3): (a) Economic uses
(b) used parts of collected taxa**

The faunal survey resulted in identification of 16 species (Table 2). The results revealed the presence of two species of reptiles belonging to 2 families within 1 order. The finding of this study was in agreement with (Corkill, 1935) who reported that *Rhagerhis moilensis* have been secured from Western, Northern and Khartoum States. Jawad (2021) stated the warm and dry climate is a suitable habitat for reptiles and he reported that *Stenodactylus sthenodactylus* inhabits semi desert regions.

The avian fauna results revealed the presence of nine species of birds' species falling into 7 families within 4 orders, seven of which are recorded in Sudan (Nikolaus, 1987). *Turdoides fulva* is resident and common with breeding records in Sudan. *Corvus rhipidurus* is residential and a local migrant; it inhabits local rocky hills and mountains. *Corvus albus* is a resident and a local migrant. *Streptopelia roseogrisea* is resident and common, reported to breed in Sudan. *Oena capensis* it is very common, local and African migrant species. *Cursorius cursor* is a rare palaearctic migrant. *Ptilopsis leucotis* (Fig. 5) breeds in Sudan and prefers dry acacia savanna and open woodland. *Eremopterix verticalis* and *Lanius meridionalis* were not reported by Nikolaus (1987). Also, the result is compatible with Del Hoyo *et al.* (2007) who mentioned that Passeriformes inhabits a wide diversity

of habitats. *Corvus albus* was recorded in Jabel El Dayer National Park, North Kordofan State (Ibrahim *et al.*, 2021).

From the 224 species and sub-species of mammals other than bats reported by Setzer (1965) in the Sudan the survey revealed the presence of five species within 5 families in 3 orders. ***Vulpes pallida*** (Fig. 6) ***encountered in this survey*** inhabits sandy and stony deserts and semi-desert areas, Saharan-Sahel in northern Africa; it may also occur near human habitation and cultivated fields where food is more available than natural habitat Sillero-Zubiri *et al.*, (2016). *Jaculus jaculus* is endemic to North Africa, northeastern Africa, the Arabian Peninsula, and southwestern Asia it inhabits arid environments desert and semi desert areas (Ben-Faleh *et al.*, 2010 and Boratyński *et al.*, 2014).

Fig (4): *Blepharis ciliaris*
*pallida*Fig (5): *Ptilopsis leucotis*Fig (6): *Vulpes***Table (1): Floral Composition of the Eastern Nile Locality, Sudan.**

Taxa	Life form	Uses						Used part							
		F d	E	M	F u	I	E n	W	R	S t	L	F l	F	S e	E x
I. Monocots															
1/ Poales															
i Cyperaceae															
1. <i>Cyperus rotundus</i> L.	Ch	+	+	+		+		+	+	+	+				
ii Poaceae															
subf.: Aristidoideae															
2. <i>Aristida adscensionis</i> L.	Th/ Ch	+					+	+	+	+	+				
subf.: Chloridoideae															
3. <i>Dactyloctenium aegyptium</i> (L.) Willd.	Th	+	+	+				+		+	+			+	
4. <i>Eragrostis cilianensis</i> (All.) Janch.	Th	+	+	+		+	+	+	+	+	+			+	
5. <i>E. tremula</i> Hochst. Ex Steud.	Th/ Ch	+	+			+		+		+				+	
6. <i>Schoenefeldia gracilis</i> Kunth.	Th	+				+		+		+					
subf.: Panicoideae															
7. <i>Brachiaria deflexa</i> (Schumach.) C. E. Hubb. ex Robyns	Th	+	+					+		+	+			+	
8. <i>Cenchrus biflorus</i> Roxb.	Th	+	+	+			+	+	+	+	+			+	
9. <i>C. ciliaris</i> L.	Th/ Ch	+	+	+			+	+		+	+			+	
10. <i>Panicum turgidum</i> Forssk.	Ch	+	+		+	+	+	+		+	+				
II. Eudicots/Superrosids/Rosids/Fabids															
2/ Zygophyllales Link															
iii Zygophyllaceae R.Br.Subf.															
Tribuloideae															
11. <i>Balanites aegyptiaca</i> (L.) Delile	Ph	+	+	+	+	+	+	+	+	+	+		+	+	+
12. <i>Tribulus terrestris</i> L.	Th		+	+				+					+	+	
subf.: Zygophylloideae															
13. <i>Fagonia indica</i> Burm. f.	Th/C h	+		+				+		+	+				

3/ Order: Fabales iv Fabaceae subf.: Caesalpinoideae 14. <i>Senna alexandrina</i> Mill. 15. <i>S. occidentalis</i> (L.) Link	Ph Ch			+		+	+				+		+		+	
subf.: Mimosoideae 16. <i>Acacia ehrenbergiana</i> Hayne 17. <i>Senegalia mellifera</i> (M.Vahl) Benth. 18. <i>Vachella tortilis</i> subsp. <i>spirocarpa</i> (Hochst ex A. Rich.) Brenan	Ph Ph Ph	+		+	+		+					+				
subf.: Papilionoideae 19. <i>Crotalaria senegalensis</i> (Pers.) Bacle ex DC. 20. <i>Indigofera hochstetteri</i> Baker 21. <i>Sesbania sesban</i> (L.) Merr.	Th Th Ph	+														
4/ Order: Cucurbitales v Cucurbitaceae subf.: Cucurbitoideae 22. <i>Citrullus colocynthis</i> (L.) Schrad	Th/C h			+					+	+	+	+		+	+	+
5/ Order: Malpighiales vi Euphorbiaceae subf.: Acalyphoideae 23. <i>Chrozophora plicata</i> (Vahl) A. Juss. ex Spreng.	Ph	+		+		+	+		+	+	+	+	+	+	+	
subf.: Euphorbioideae 24. <i>Euphorbia prostrata</i> Aiton	Th	+		+					+	+	+	+				
Eudicots/Superrosids/Rosids/ Malvids 6/ Order: Malvales vii Malvaceae subf.: Grewioideae 25. <i>Corchorus depressus</i> (L.) Stocks 26. <i>C. tridens</i> L.	Ch Th	+	+	+		+			+	+		+		+	+	
Clade: Eudicots/Core eudicots 7/ Order: Caryophyllales viii Aizoaceae subf.: Sesuvioideae 27. <i>Trianthema triquetra</i> Rottler&Willd.	Th			+					+							
Eudicots/Superastrids/Asterids/Lamii ds 8/ Order: Gentianales ix Rubiaceae subf.: Rubioideae 28. <i>Oldenlandia corymbosa</i> var. <i>caespitosa</i> (Benth.) Verdc.	Th	+	+	+					+							
x Apocynaceae subf.: Asclepiadoideae 29. <i>Calotropis procera</i> (Aiton) W.T.Aiton	Ph	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

9/ Order: Solanales xi Solanaceae subf.: Solanoideae 30. <i>Solanum dubium</i> Dunal.	Ch			+		+								+	+	
10/ Order: Lamiales xii Orbanaceae 31. <i>Striga hermonthica</i> (Delile) Benth.	Th					+		+								
xiii Acanthaceae 32. <i>Blepharis ciliaris</i> (L.) B. L. Burtt	Ch	+		+				+								
Clade: Eudicots/Asterids/campanulids (euasterids II) 11/ Order: Asterales ivx Asteraceae 33. <i>Pulicaria undulata</i> (L.) C.A. Mey.	Ch			+				+								

Life forms: Ph = Phanerophyte, Th= Theophytes, Ch= Chamaephyte. **Economic**

Uses: Fd = Fodder, E=Edible, M= Medicinal, Fu = Fuel, I= Industrial, En=

Environmental. **Part Used:** W= Whole plant, St = Stem, L= Leaves, F= Fruits, Se=

Seeds, Ex = Excretions

Table (2): Fauna of Eastern Nile Locality

Animal	Order	Family	Scientific Name	Common Name
Reptiles	Squamata	Colubridae	<i>Rhagerhis moilensis</i> Reuss	False cobra
		Gekkoniidae	<i>Stenodactylus</i> <i>Sthenodactylus</i> Lichtenstein.	Elegant gecko
Birds	Charadriiformes	Glareolidae	<i>Cursorius cursor</i> Latham.	Cream-coloured courser
	Columbiformes	Columbidae	<i>Streptopelia roseogrisea</i> Sundevall.	African collared (Rose-Grey) Dove
			<i>Oena capensis</i> Linnaeus	Namaqua Dove
	Passeriformes	Alaudidae	<i>Eremopterix verticalis</i> Smith.	Grey backed sparrow lark
		Corvidae	<i>Corvus albus</i> Statius Muller	Pied Crow
			<i>C. rhipidurus</i> Hartert	Fan- Tailed Raven
		Laniidae	<i>Lanius meridionalis</i> Temminck	Southern grey shrike
		Timaliidae	<i>Turdoides fulva</i> Desfontaines	Fulvous babbler
	Strigiformes	Strigidae	<i>Ptilopsis leucotis</i> Temminck	Northern white-faced scops- owl
Mammals	Carnivora	Canidae	<i>Vulpes pallida Cretzschmar</i>	Sand fox
		Felidae	<i>Felis</i> sp.	Wild cat
	Lagomorpha	Leporidae	<i>Lepus</i> sp.	Hare
	Rodentia	Dipodidae	<i>Jaculus Jaculus</i> Linnaeus	Desert Jerboas
		Gerbillinae	<i>Gerbillus</i> sp.	Jerbel

Conclusion:

Most of the plant species of the study area have important economic uses. The area is considered as an important source for animal wellbeing, 22 species are fodder plants; most herbaceous are grazed and woody plants are browsed by animals during the dry season. Large trees and shrubs are utilized for timber.

Some plants are used for medicinal purposes; others are edible as human food; while *Striga hermonthica* parasitized the cultivated areas.

The herbaceous cover is dominated by *Aristida adscensionis* which spread in all enclosures except in Elhedabab which is dominated by *Schoenefeldia gracilis* followed by *Aristida*
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adscensionis. *Acacia tortilis* subsp. *spirocarpa* is the only woody plant present in all enclosures except Wad Tbar.

Thirty-three plant species were recorded from the study area. Poaceae was the largest family; followed by Fabaceae and Zygophyllaceae. Most of the plant species of the study area have important economic uses. Twenty-two species are fodder plants. The faunal survey of the area resulted in the identification of 16 species; two of which are reptiles, 9 birds and 5 Mammals.

Recommendations:

1. Establishment of more range enclosures. Broadcasting of palatable species like *Belphearis ciliaris* and *Panicum turgidum* should be continued to improve range condition.
2. Establishment of fire lines should be continued to control wild fires.
3. Comprehensive survey of wildlife resources in rangeland should be conducted seasonally.

Authors' contribution statement:

Reem collected the plant and animal data; Reem and Alawia identified and classified the collected plant species

and wrote the text; Reem and Elfatih collected the data identified and classified the encountered animal species.

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