

Plant Diversity Degradation in Desert and Semi Desert Zones in Sudan (Case Studies: Erkwit and El Gaab Oasis)

Ikram Madani Ahmed*

Department of Botany, Faculty of Science, University Khartoum, Sudan

*Corresponding author: Ikram Madani Ahmed, Department of Botany, Faculty of Science, University Khartoum, Sudan, Tel: 0024912355556; E-mail: Ikramahmed3@yahoo.com

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Abstract

Global climate change and continuous and rapid economic development are the main facts behind the degradation in biodiversity and hence the degradation in ecosystem functions. Degradation in diversity of plant species within an ecosystem is considered as one of the most important factors affecting its productivity and stability. This paper presents two case studies which document a sound data, from important geographic regions, about the clear and direct impact of climate change and human interference on diversity degradation in Sudan. The first case study is Erkwit plateau in the semi desert in northeastern Sudan where species density and frequency were drastically changed over the period (1956-2017). Trees, Shrubs and under shrubs of three selected sites (zones) were studied during the wet season in February 2017 and species list was prepared and compared with the floristic composition reported for the same sites in the periods 1956 and 1986. Differences in species richness and frequency were recorded and the possible cause behind these differences is suggested to be a human interference factor. The second case study is El Gaab oasis in the desert in northern Sudan. The conducted survey reported the presence of clusters of different sized vegetation mounds scattered in the studied areas. The majority of these mounds contain only dead plants and few still have living plants on the top. The plant species that forms the structure of these mounds were identified as *Tamarix aphylla*. Climate change is suggested to be the main cause of the diversity degradation in this area.

Keywords: Plants; Diversity; Degradation; Dry zones; Erkwit; Dongola; Sudan

Introduction

Habitat degradation is the process by which habitat quality for a given species is diminished. The quality of habitat would be estimated using parameters that are linked to population reproductive rate [1].

Individuals may persist for many years but will eventually die out due to lack of reproduction. It is likely that changes occur in habitat quality due to climate change. Many species will not be able to redistribute themselves fast enough to keep up with projected climate change, and considerable alterations in ecosystem structure and functions [2]. The impact of man on habitats loss or degradation is widely considered the most important cause of the loss of biodiversity [3]. In this study two areas are selected to reflect diversity change in the form of plant species composition with reference to the possible causes.

These are Erkawit in the semi desert area and El-Gaab oasis in the desert. Erkawit is a plateau located at about 45 km. to the south-west of Suakin on the Red Sea, and about 30 km. to the east of Sinkat on the railway line (18° 44 and 18° 48N, 37°05 and 37° 09E). (Contour map Figure 1) It lies at the edge of a steep escarpment dropping abruptly (600m) to the Red Sea plains.

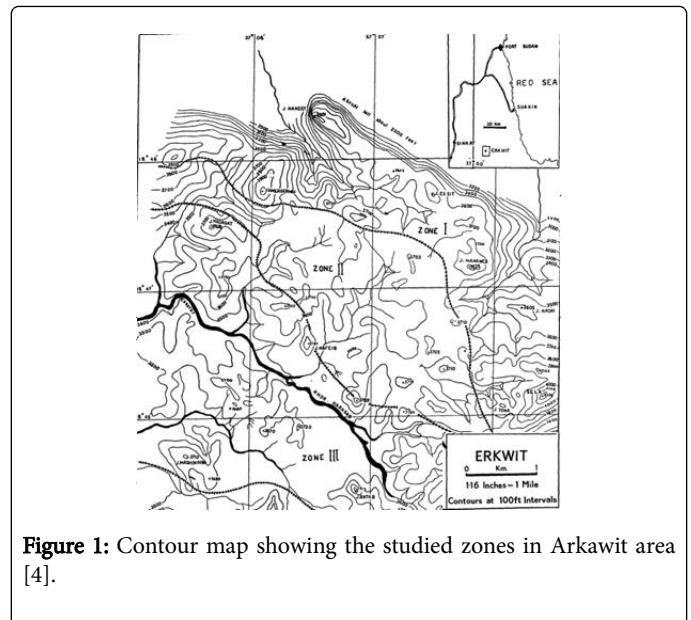


Figure 1: Contour map showing the studied zones in Arkawit area [4].

El-Ga'ab area is a depression situated on the western bank of the Nile River, south of the Third Cataract (Figure 2). It is considered to be an old basin flooded by the Nile during Early and Mid-Holocene, which is now completely dry. El-Ga'ab depression owes its importance to the fact that it is the only remote area in the Sudan Nubian desert situated away from the Nile that supports life. The most interesting features of El-Gaab depression is the vegetation mounds or hillocks

which are hilly formations of sand and organic litter that has been trapped and thus successively accumulated within growths of long-living phreatophytic shrubs. These mounds are related to irrigated agricultural schemes of rather distant past.

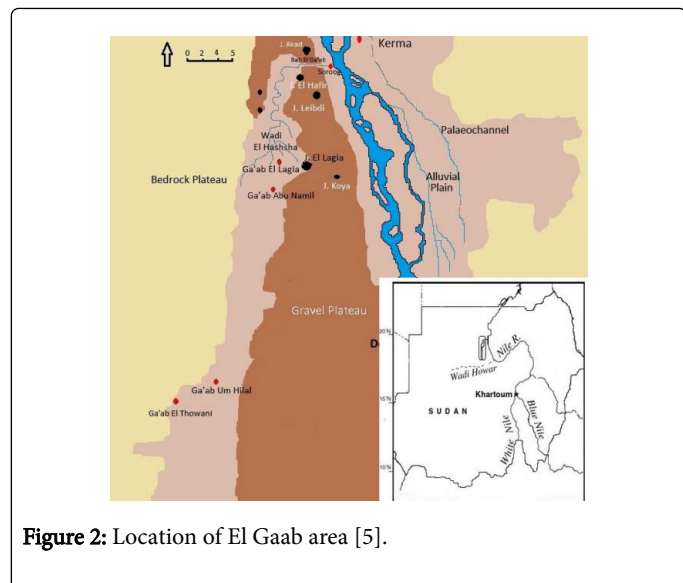


Figure 2: Location of El Gaab area [5].

Materials and Methods

Field survey in Erkwit area

Trees, Shrubs and under shrubs of three selected sites (zones) were studied during the wet season in February 2017 and species list was prepared and compared with the floristic composition reported for the same sites in the periods 1956 and 1986. Differences in species richness and frequency were recorded.

Field survey in El-Gaab area

A field survey was conducted in El-Ga'ab area in May 2013, September 2014, and November 2015. Its main task was to record the presence, location and morphometrics of the vegetation mounds which are locally known as tarbools. The plants that formed them were identified. The structures of these mounds or hillocks were also analyzed. More than 80 individual hillocks were documented. In an attempt to uncover their stratigraphy and internal contents, six eroded tarbools were excavated, five of which were in Um Hilal area and one in Al Hamra, near a Christian archaeological complex. Collected samples were dated (carbon14 dating methodology was adopted)

Results and Discussion

Diversity change in Erkwit area

In zone I (Map Figure 1), as reported [4], this site is dominated by *Maytenus senegalensis*. Associate shrubs that are characteristic of this site are: *Euclea schimperi*, *Dodonaea viscosa*, *Rhus abyssinica*, *R. flexicaulis*, *Carissa edulis*, *Phoenix sp.* and *Ximania americana*. *Olea chrysophylla* is found in 50% of the stands and rarely found in other. According to the record reported by Manal 1968 [6], this site is mainly dominated by *Diospyros mespiliformis* and associated shrubs are *Euclea schimperi*, *Dodonaea viscosa* and *Rhus abyssinica*. The present

study recorded *Diospyros mespiliformis* and *Euclea schimperi* as equally dominating this site. *Dodonaea viscosa*, *Rhus abyssinica*, *R. flexicaulis*, *Carissa edulis*, *Phoenix sp.* and *Ximania americana* are rarely encountered and *Olea asp.* is represented by only one individual concerning zone II (Map Figure 1), Kassass 1956 described this zone as *Maytenus senegalensis* and *Euphorbia abyssinica* zone. Other species include: *Rhus abyssinica*, *R. flexicaulis*, *Diospyros mespiliformis*, *Carissa edulis*, *Ximania americana* and *Acacia etbaica*. Record in 1986 reported *Acacia tortilis* as dominant species associated with *Acacia etbaica* and *Ficus sp.* The present study reported *Acacia radiana* as dominant species and *Euphorbia abyssinica* as associated species. In Zone III (Map Figure 1) and according to Kassass 1956 *Euphorbia abyssinica* is dominating this zone with few individuals of *Maytenus senegalensis*. Reports of 1986 recorded the dominant species as *Acacia etbaica* and *Balanites sp.* While the present study recorded *Acacia radiana*, *Balanites sp.* and *Ziziphus spina-cheristi* as equally distributed species [4].

Diversity change in El- Gaab area

The conducted survey reported the presence of clusters of different sized vegetation mounds scattered in the studied areas giving them their characteristic feature. The majority of these mounds contain only dead plants and few still have living plants on the top (Figures 3 and 4).

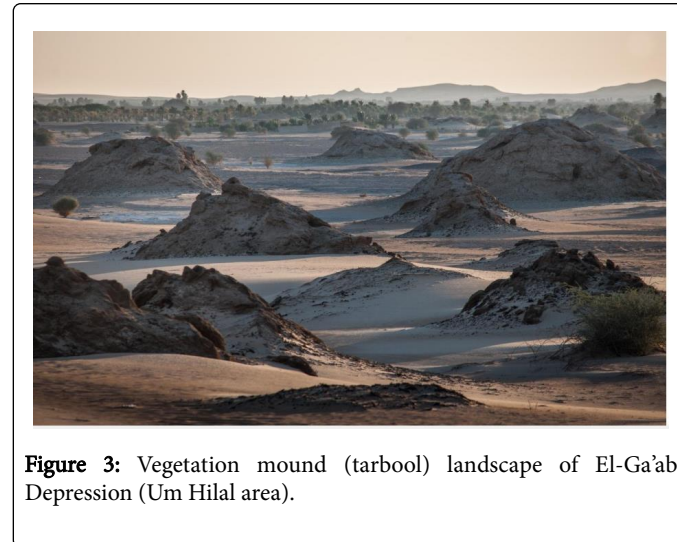


Figure 3: Vegetation mound (tarbool) landscape of El-Ga'ab Depression (Um Hilal area).

The plant species that forms the structure of these mounds were identified as *Tamarix aphylla*. Samples collected for radiocarbon dating show the age range 200-400 years ago. Inside the hillocks there are remains from old periods (Christian and Early Islamic in this particular case), indicating presence of irrigated lands in the past that supported germination of seeds and growth of plants. After the settlement and irrigation ceased, the phreatophytic shrubs were able to survive for a long time, even during and after desert encroachment, while other plants died off. As the dry climate is not suitable for the growth and establishment of seeds of such plants, it is believed that seedlings of these plants established in wet environment of irrigated agricultural land. They gradually accumulated wind-transported sand during the period of dry conditions, gradually forming the conical structure of vegetation mound (tarbool). This phenomenon was described and first thoroughly studied in Baharyia oasis in the Western desert of Egypt [7]. In Sudan, Kababeesh settlers have encountered them when they first arrived at El-Ga'ab area [8].



Figure 4: Vegetation mound (tarbool) with *Tamarix aphylla* shrub still growing on the top.

2. McNeely JA, Gadgil M, Leveque C, Padch C, Redford K (1995) Human influences on biodiversity. Global Biodiversity Assessment, UNEP-Cambridge University Press.
3. Myers N (1988) Threatened biotas: 'hot spots' in tropical forests. The Environmentalist 8: 187-207.
4. Kassas M (1956) The mist oasis of Erkwit, Sudan. J Ecol 44: 180-194.
5. Madani I, Tahir YF, Nur SM (2014) Ethnobotanical study of medicinal plants used by El Kababish tribe in Ga'ab El Lagia Oasis, West Dongla (Sudan). Nyame Akuma Bulletin, Canada. 82: 91-99.
6. Manal MA (1986) Ecology of Erkwit. Annual reports. Botany department, faculty of Science. University Khartoum. Khartoum, Sudan.
7. Pokorný P, Pokorná A (2013) "Agoul landscapes" in the oases of the Western Desert of Egypt: Ecology and palaeoecology of vegetation mounds in El-Hayz, Southern Bahriya. Recent Research into the Past of an Egyptian Oasis. Charles University in Prague, Faculty of Arts.
8. Madani I, Tahir YF, Hamdeen HM, Pokorná A, Pokorný P (2015) Vegetation ecology and taxonomy of El-Ga'ab Area, North-Western Sudan. European Academic Research 3: 2927-2943.

References

1. Primack RB (1998) Essentials of conservation biology, Massachusetts: Sinauer Associates.

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