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Special Habitats within the Large Sudanese Geographical Environments

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Key words: Sudan, South Sudan, Kurdufan, Darfur, major habitats, minor habitats, Jabal Marra, Red Sea habitats, River Nile, Sudd.

Section 1 Major Sudanese Environments

An introductory photographically illustrated survey is made of the major Sudanese Environments, which include Desert, Semi Desert, Poor Savanna, Rich Savanna, and Rain Forest (Table 1 and Figure 1). These are followed by smaller habitats that fall within one or more of the major habitats and are designated as minor habitats. The minor habitats include:

- The River Nile, its tributaries and adjacent lakes whether natural, or manmade such as the reservoirs behind dams.
- Edges and Banks of the River Nile and its tributaries and Edges of Seasonal Rivers and Streams locally called Khores and Wadies.
- Swamps such as the Sud in South Sudan.
- High Mountain habitats.
- Red Sea habitat.
- Oasis.

A brief description is given of the characteristics of each habitat with special emphasis on the major features of flora and fauna. The importance of these special habitats is discussed.

Table 1 Major Geographic Environmental Zones in the Sudan Before 2005.

Geographic Zone	Percentage of area of the Sudan	Average annual rainfall in millimeters
Desert	34%	100
Semi-desert	20%	100 – 300
Poor Savanna	24%	300 – 900
Rich Savanna	18%	900 – 1400
Rainforest	4%	>1400

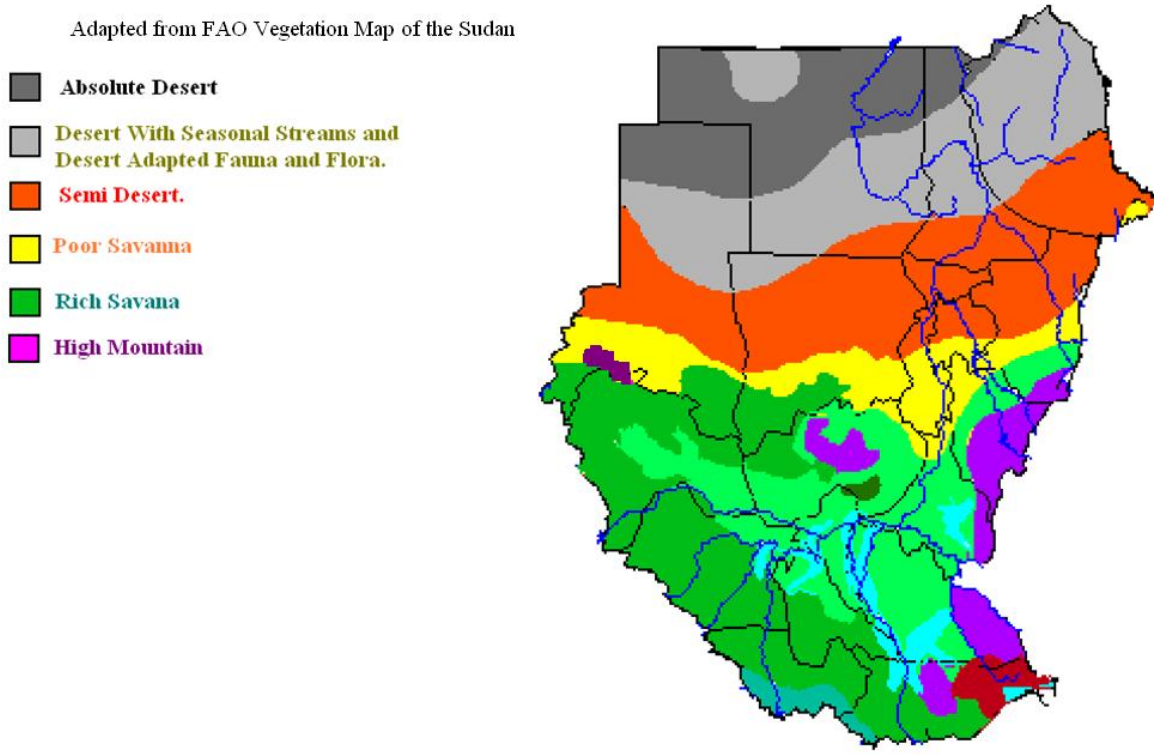

Figure 1 The Main Geographic Zones of the Sudan.

1. The Dry Sahara Desert Zone

Extends from the Sudanese-Egyptian-Libyan borders in the north down to around latitude 16 N (Figures 2-9). It constituted approximately 34% of the total area of the Sudan before 2005. The average annual rainfall is about one hundred mm and the rainfall is not regular and two to five years may pass without any rains. The vegetation is limited to the banks of the Nile and edges of seasonal watercourses and a few oasis. The flora is mainly drought resistant plants such as *Acacia tortilis* (Samar), *Acaica radiana* (Saiyal), *Acacia ehrenbergiana* (Salam), *Acacia mellifera* (Kitir), *Zizyphus spina-christi* (Sidir), *Calatropis procera* (Usher), and shrubs such as *Casia senna* (Sennamaka), *Leptadenia pyrotechnica* (Markh), *Citrullus colocynthis* (Handal) and annual and perennial grass such as *Panicum tergidum* (Tumam or Tabas).

Figure 2 Absolute Dry Desert in Northern Sudan where plants and animals are adapted to dry and hot conditions and are usually found only in and around seasonal temporary water courses.

Figure 3 Wadi El Safra, El Masawarat, south east of Shendi during the dry Season. Plants and animals are adapted to dry and hot conditions and are found only in and around temporary water courses. Rain may not fall for a number of years, but when it comes the area flourishes with vegetation and animal life.

Figure 4 Wadi El Awataib coming from the Ethiopian Highlands may flow several times during the rainy season as happened in 2007. No rains came down in 2008 and 2009.

Figure 5 Wadi El Awataib 2007

Figure 6 El Maswarat: A Meroitic Deep Well near Wadi El Awataib (2003) still provides water for human and domestic animals although it was dug more than five thousand years ago.

Figure 7 This Broad Wadi occasionally flows from North Kordofan hills down to the White Nile south of Omdurman. This portion of the Wadi, east of Khartoum New Airport was made a Forest Reserve, known as Ghabat Jebel Douka. The dominant trees are *Acacia ehrenbergiana* (Salam) and *Acaica radiana* (Saiyal).

Figure 8 Goats and camels feed on Douka *Acacia ehrenbergiana* (Salam) and *Acaica radiana* (Saiyal), at Ghabat Doka.

Figure 9 Jebel Doka 2005. Removal of plant cover outside the forest reserve lead to soil erosion and movement of sand dunes. The first plant to grow on the moving sand is *Panicum tergidum* (Tumam or Tabas).

2-Semi-desert habitats

This zone constitutes about 20% of the area of the Sudan before separation of South Sudan. Annual rainfall ranges from 100 mm in the north to 300 mm in the southern fringe. On clay soils the vegetation is a desert scrub dominated by *Acacia seyal* and *Balanites aegyptiaca.* Other trees on clay soil include *Acacia radiana, Acacia tortilis*, *Maerua crassifolia, Caparis decidua*, *Ziziphus spina-christi*, and *Salvadora persica*. On sandy soils such as those found in Northern Kordofan and Northern Darfur. The dominant tree species are *Acacia senegal* and *Balanites aegyptiaca.* Other species include: *Acacia mellifera*, *Acacia radiana*, *Commiphora africana*, *Leptadenia pyrotechnica*, *Cassia acutofolia* and *Calotropis procera*. on the lower slopes of the southern parts of the Red Sea hills *Acacia glaucophylla* and *A. etbaica* are common.

3- Low Rainfall Savanna or Poor Savanna.

This has an annual rainfall between 300 mm and 900 mm and covered about 24% of the area of the old Sudan (Figures 10-17). It is subdivided into two zones according to soil type:

a) Clay Soils: with *Acacia seyal*, and *Balanites aegyptyiaca* as the most dominent trees. Other tree species include; *Acacia mellifera*, *Commiphora africana*,, *Boscia senegalensis*, *Acacia seyal*,, *Dalbergia melanoxylon*, *Combretum hartmannianum*, *Anogeissus leiocarpus*, *Boswellia papyrifera* and *Sterculia setigera*.

b) Sandy Soils: with *Acacia senegal* and *Balanites aegyptyiaca* as the most dominent trees. The other tree species include: *Acacia raddiana*, *Fadherbia albida*, *Adonsonia digitata*, *Acacia senegal*, *Maerua cassifolia*, *Combretum cordofanum*, *Dalbergia melanoxylon*, *Albizia* spp, *Sclerocarya birrea*, *Terminalia* species and *Tamarindus indica.*

Figure 10 Typical low rainfall Savanna with *Balanites aegyptiaca* and *Acacia seyal* on clay soils of the Dinder National Park.

Figure 11 *Combretum glutinosum* Habeel: broad leaved trees that lose their leaves during the dry season.

Figure 12 Bank of Graireesa pool rich in fauna and flora, March 2006.

Figure 13 Bush Fire at night, Wad El Haj, Dinder National Park.

Figure 14 Bush Fire, West of Dafa'alla Road Junction, on the way to Graireesa, Dinder National Park, March 2009.

Figure 15 Effect of Bush Fire in the previous night, Wad El Haj, Dinder National Park March, 2006. The *Acacia seyal* trees are fire-resistant. Lower leaves on the stems were pruned by the fire and seeds of most plants were safe in cracks in the soil.

Figure 16 Bush Fire, West of Dafa'alla Road Junction, on the way to Graireesa, Dinder National Park, March 2009.

Figure 17 Bush Fire, Gazeirat El Assad West of Galago Camp, Dinder National Park, May 2012.

4- Rich Savana Woodland.

This has an annual rainfall between 900 mm and 1400 millilitres and covers mainly most of the Blue Nile State, Southern Kordofan State and Southern Darfur State (Figures 18-20).

The main plants are ever green trees with broad leaves such as: *Khaya senegalensis*, *Combretum hartmannianum*, *Parkia africana*, *Daniellia oliveri*, *Isoberbinia doka* and *Anogeissus leiocarpus.*

Figure 18 Rich Savanna dominated with *Acacia seyal* and *Balanites aegyptiaca* El Wohda Hehlig Road, El Muglad Basin (February 2002).

Figure 19 Rich Savanna dominated with Broad leaved Ever-green Trees El Wohda Hehlig Road, El Muglad Basin (February 2002).

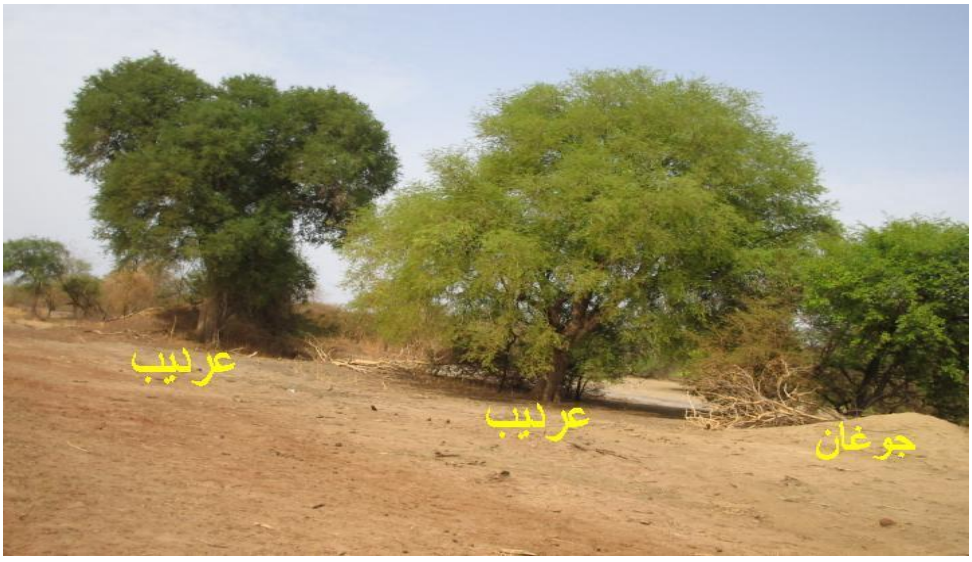

Figure 20 Variation in vegetation

5-Rain Forest

Rainforests are found on both sides of the Equator and they are characterized by a rainfall of, usually, more than 1400mm per annum. In fact rain falls almost every day

and the relative humidity rarely falls below one hundred percent.

Plants in Rain Forests are classified, according to their height, into the following strata:

1- High Level Trees which are fifty meters high, or more, whose canopies receive direct sunlight.

2- Intermediate Level Trees which are up to thirty meters high and receive sunlight from under the canopies of the higher trees.

3- Ground Level Trees and shrubs which are less than three meters in height and fall in the shade of the two other levels of trees and receive very little light and are known as shade plants.

4- Lianas or Climbers which are thin stemmed trees which extend and support themselves on stems of high level trees so that their canopies reach direct sunlight.

Each stratum has got its own faunal community of mammals, birds, reptiles, arthropods and other invertebrates. High humidity led to an abundance of algae, fungi and lichens on the stems of trees.

All the following photographs (Figures 21-34) have been taken by, the then, Zoology Department undergraduate Noon Bushra El Tahir, in 2010, at Queen Elizabeth National Park (QENP), Uganda. The QENP is adjacent to Nimuli National Park in South Sudan and is a continuation of the same rainforest. Noon took part in a field work training course organized by the Tropical Biology Association (T.B.A.) and she was asked by the author to take these photographs.

Figure 21 Plants in Rain Forests are classified, according to their height, into three groups: Very high trees, which are fifty meters or more, whose canopies receive direct sunlight; Intermediate level trees which are up to thirty meters high and receive sunlight from under the canopies of the higher trees; Ground level trees which are less than three meters in height and fall in the shade of the two other levels of trees and receive very little light and are known as shade plants.

Figure 22 The two higher Strata of the Rain Forest.

Figure 23The Median Level Tree Canopy of the Rain Forest

Figure 24 High humidity and daily rainfall characterize rainforests.

Figure 25 The Median Level Tree Canopy of the Rain Forest

Figure 26 Shade Plants in the Rainforest which grow in the dark receive very little sun light.

Figure 27 Shade Plants in the Rainforest

Figure 28 The giant trees in Rainforest need strong struts at the base to support the heavy weight of the tree just like a high rise building.

Figure 29 Student Noon Bushra at the base of a giant Rain forest tree.

Figure 30 Climbers, on the Stem of a Giant Tree, extend their stems for tens of meters to reach sunlight.

Figure 31 Climbers, on the Stem of a Giant Tree, extend their stems for tens of meters to reach sunlight.

Figure 32 Lichens on the Stem of a Giant Tree in Rainforest

Figure 33 Shelf Fungi on the Stem of a giant Tree.

Figure 34 Black and White Colobus *Colobus guereza* (Sultan El Grood). Photographed by Sarah Abdulla Khider in Q.E.N.P. in 2003.

Section 2 Special Sudanese Habitats

1. The River Nile System

The main River Nile and its tributaries in the Sudan are not connected to any natural lakes (Figure 35). However, there are small lakes directly connected to the White Nile in South Sudan. In the Sudan there are manmade lakes which are reservoirs behind dams and include those of Rosaries, Sennar, Khashm El Girba, Jebel Awlia, Marawee, and Lake Nubia. All these lakes, together with the Nile and its tributaries are important breeding sites for algae, protozoans, various types of worms, crustaceans, insects, molluscs and other invertebrates.

The vertebrate fauna of the Nile System consists of more than ninety species of fish, several species of amphibians, many species of reptiles such as turtles, lizards, snakes, monitors and crocodiles.

The Sudan bird fauna is very rich and includes 963 species all of which go to the Nile to drink and, many, to feed or breed. Many ducks and geese feed on algae and some breed in floating vegetation.

Species of herons, ibises, plovers and storks feed on various invertebrates, amphibians, reptiles and fishes. In addition some species of the herbivorous mammals such as the Nile Lechwe *Kobus megaceros* and the hippopotamus *Hippopotamus amphibius* spend most of their time in the water but come out to feed on plants at the banks during the night. The Clawless Otter *Aonyx capensis* lives permanently in water and feeds on fish but has to come out to the surface to breathe.

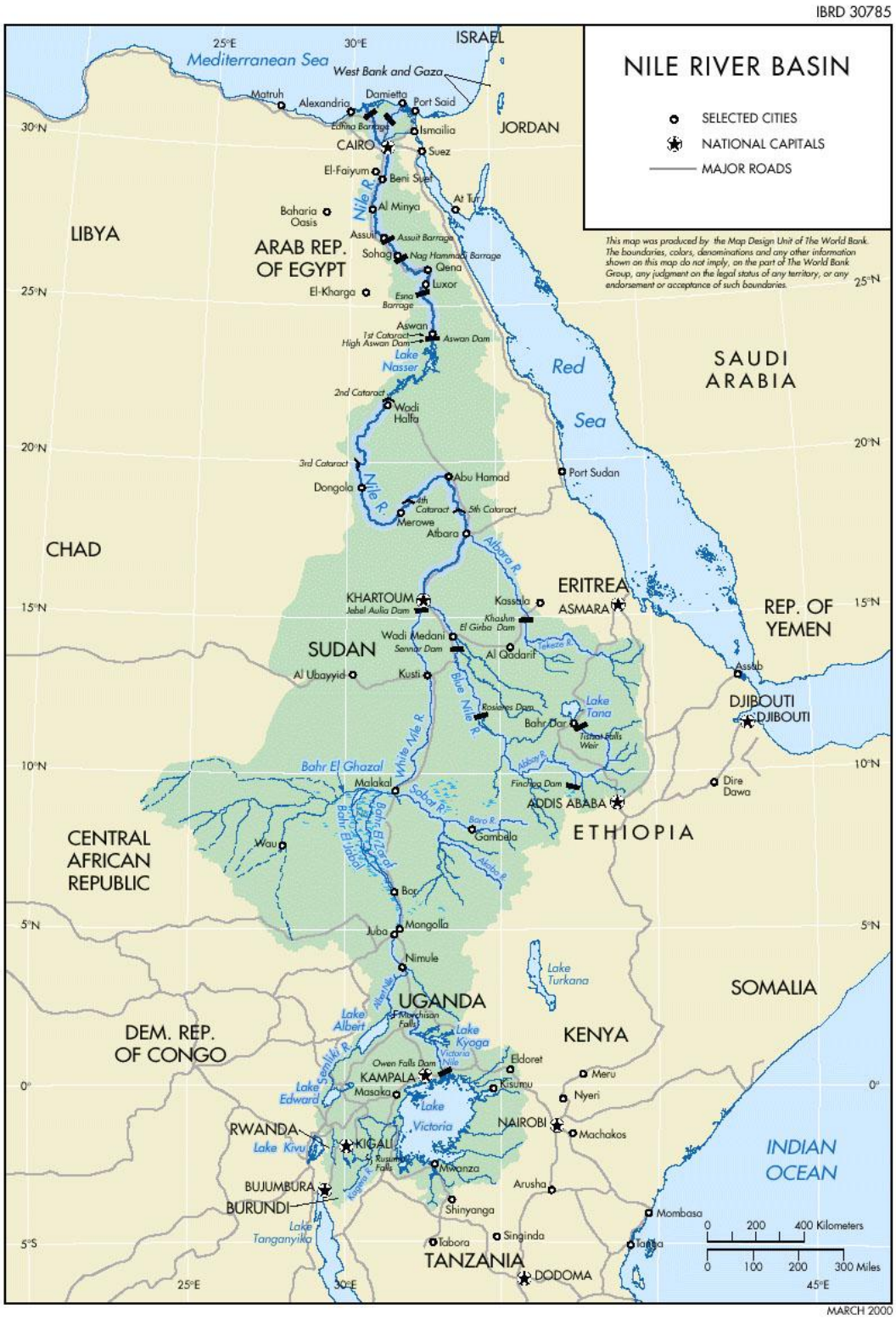

Figure 35 Nile River basin

2. River banks, edges and banks and banks edges of adjacent freshwater lakes habitat

The banks of the Main Nile and its major tributaries (the White Nile and Blue Nile) are always richer in vegetation than the surrounding geographical environment and as result richer in animal diversity because animals use the plants as food or as shelter to live in. This applies also to the banks of seasonal streams, such as Wadies, Khores and seasonal rivers such as Atbra, Rahad and Dinder.

The river bank habitats are especially noticeable in semi desert and desert areas where the Nile appears from a distance as a green line in the arid grey surroundings (Figure 36-42).

One of the important aspects of the River Bank habitats is the flora and the fauna when depleted by human action are renewed by seeds and small animals brought by floods from upstream.

Figure 36 Poor Savanna: a thick cover of shrubs and grasses on the bank of the River Dinder in the dry season.

Figure 37 *Ficus sycamorus* (Jomaize) and *Acacia seibriana* (Kook) trees on the bank of the River Dinder, 2010.

Figure 38 This is possibly the biggest Dome *Hyphaena thebaica* forest on the bank of the River Dinder, Dinder National Park 12/3/2003. It is located three kilometers to the South of Galago Camp.

Figure 39 *Acacia nilotica* (Sunnut) at Mayiat Abd El Gani DNP, January 2001.

Figure 40 *Acacia seibriana* trees and Water Buck at the bank of Lake Ras Amer, D.N.P., 2010.

Figure 41 *Acacia nilotica* and *Acacia seibriana* in Mayiat Musa D.N.P, in April, 2007.

Figure 42 *Acacia nilotica* and *Acacia seibriana* in Mayiat Musa D.N.P, in April, 2007.

3. Sud Swamps Habitat

When the White Nile enters the South Sudan at Nimuli it is known as Baher El Jebel and at this stage it has strong current and high banks which may reach six meters during the low season (Figure 43). Just after the town of Bor the river enters a flat plane and becomes shallow and divided into a main channel and many smaller channels filled with floating aquatic plants such as *Cyperus*, and

Phragmites (Figure 44, 45). This swamp covers a very large area between Bor and Malakal. It is very important biologically as a breeding place for fish, reptiles such as crocodiles and snakes, and birds such as the shoebill stork, crowned crane and mammals such as otters, hippopotami and various semi aquatic antelopes.

It was decided by Egypt and the Sudan in the late 1970s to build a canal to take Bahr El Jebel Water directly from Bor to Malakal. This was to avoid water loss by evaporation and was to add four billion cubic meters to be shared by the two countries. The project was stopped by war in 1983 and was never resumed (Figure 46).

Figure 43 Bahr El Jebel, rich savanna zone two kilometers north of Bor just before the river enters the Sud Swamp. Notice the six meters high bank.

Figure 44 Sud swamp habitat from an air plane, 1980.

Figure 45 Sud habitat from a boat with *Eichornia* in the front of the photograph 1980.

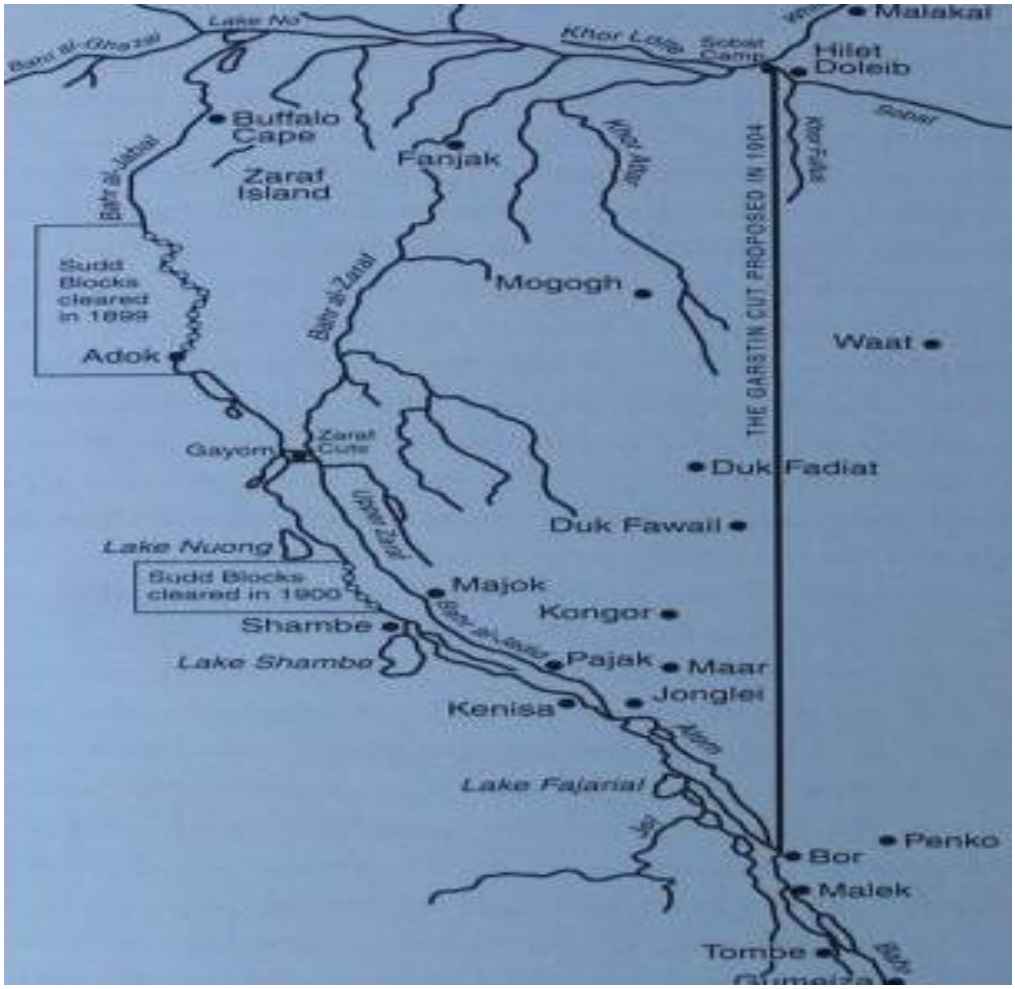

Figure 46 proposed canal on Bahr El Jebel

4. High Mountain Habitats

Mountain habitats can be found in western and eastern Sudan (Figure 47-56).

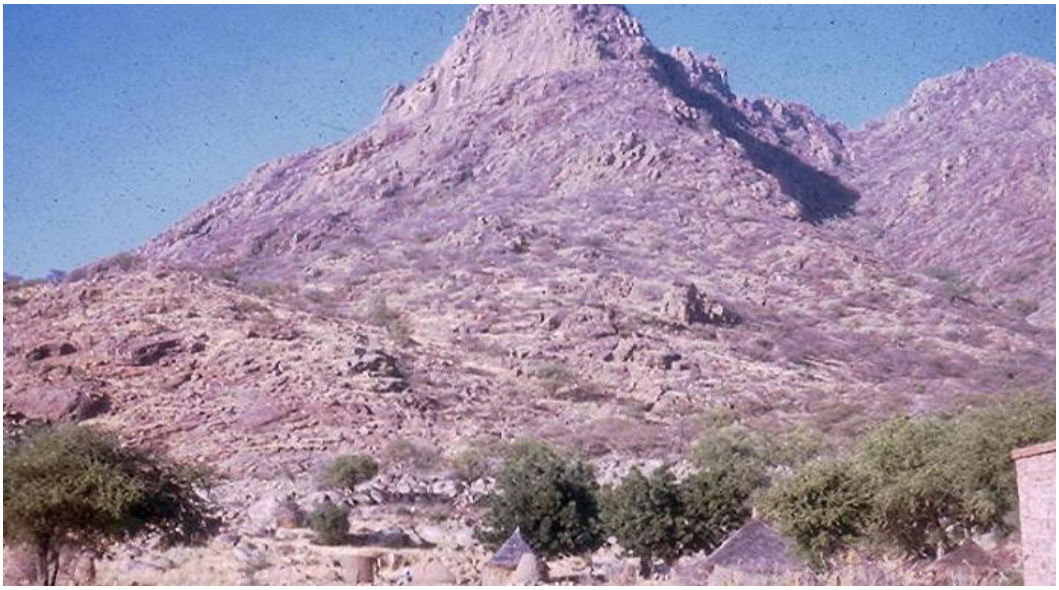

Figure 47 Dry Savanna at the foot of Jebel Marra with *Balanites aegyptiaca* and *Acacia* trees at the northern suburbs of the town of Kas, December 1964.

Figure 48 A village half Way to the Summit of Jebel Marra with ever-green broad-leaved trees, December 1964.

Figure 49 Galol, Jebel Marra with Ever-green Broad-leaved Trees, April, 1976.

Figure 50 Martajaloo Water Fall, Jebel Marra.

Figure 51 Pine trees imported from Europe and planted near the Summit of Jebel Marra, December 1964.

Figure 52 One of the two crater lakes at the Summit of Jebel Marra, December 1964. Some of the trees seen in the picture were wild olive trees which are Mediterranean plants.

Figure 53 Desert at the foot of of the Red Sea Hills.

Figure 54 Erkweet on the Red Sea Hills with a rich biodiversity, low clouds and two rainy seasons in the winter and in the summer.

Figure 55 Jebel El Sit, Erkweet the highest mountain in the Sudanese Red Sea Hills with a rich flora and fauna.

Figure 56 Low clouds or Shaboora at Arkweet on the Red Sea Hills.

5. Sudanese Red Sea

The Red Sea is the Northern Part of the Great African Rift Valley and extends for a distance of 1932 kilometers between Bab El Mandab in the South and Gulf of Agaba in the North with a maximum width of 355 kilometers. The Red Sea

covers an area of 438000 square kilometers with a maximum depth of 2359 meters.

The Red Sea is characterized by clear water that can be penetrated by sunlight to a depth of about forty meters. This is possibly because no river flows into it and therefore very little silt makes the water turbid. This clear water allows growth of algae and a high diversity of corals molluscs, and various animals which feed on or are symbiotic algae.

There is a very limited tide movement which, measures between 0.6 to 1.8 meters. The salinity of the Red Sea is higher than that of the Indian Ocean possibly because of the high evaporation rate coupled with the scanty rainfall. The fauna of the Red Sea consists of more than one thousand species of invertebrates about four hundred species of fish two species of turtles and several species of mammals such as whales, dolphins and a single species of dugong (Figure 57-64).

Figure 57 The Red Sea Coast at Sawakin, 2002.

Figure 58 The Red Sea Coast at Sawakin, 2002. Today this site has been developed into a gas exporting port.

Figure 59 The Red Sea Coast at Sawakin with xerophytic plants, 2002.

Figure 60 A forest of Mangrove or (Shoora) Trees on the Red Sea Coast forms an important habitat for roosting birds and for the breeding of, fishes, crabs, molluscs and various other organisms.

Figure 61 Mangrove trees destroyed by grazing camels.

Figure 62 What used to be Haidoub Mangrove Forest, ten kilometers south of Sawakin, completely destroyed by grazing and use of wood for buildings and fuel.

Figure 63 Date Palm Trees at Sawakin, 2008

Figure 64 Sanganaib National Park in the Red Sea twenty kilometers to the north east of Port Sudan, 2002.

6. Oasis (Figures 65-72)

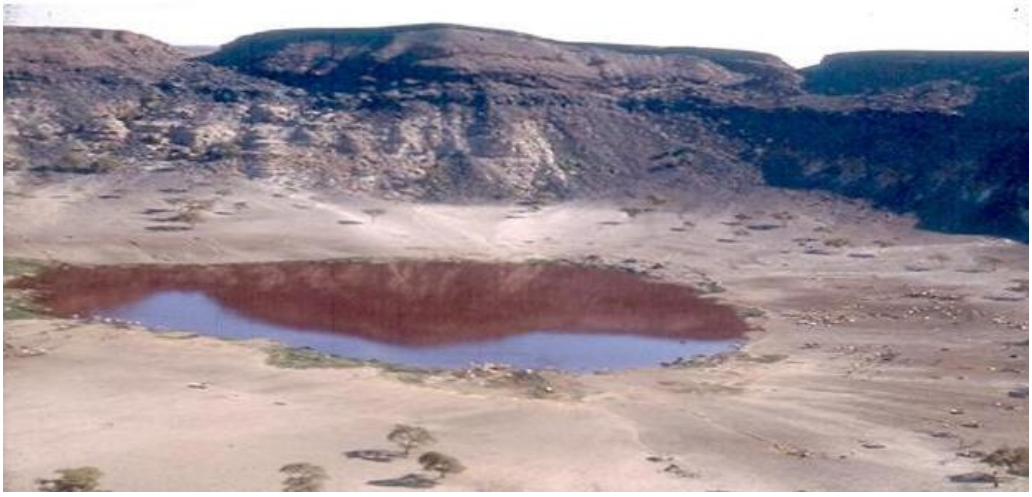

Figure 65 El Malha Oasis in the Sahara Desert Northern Darfur

Figure 66 El Nukhaila Oasis in the Sahara Desert, Northern Darfur. The water is too salty for humans and even for camels to drink. However, it is drunk by migratory birds travelling across the Sahara.

Figure 67 El Atroun Oasis in the Sahara Desert Northern Darfur. There is a well but its water unfit for human and domestic animal use and drinking water is brought by tankers for natrun miners.

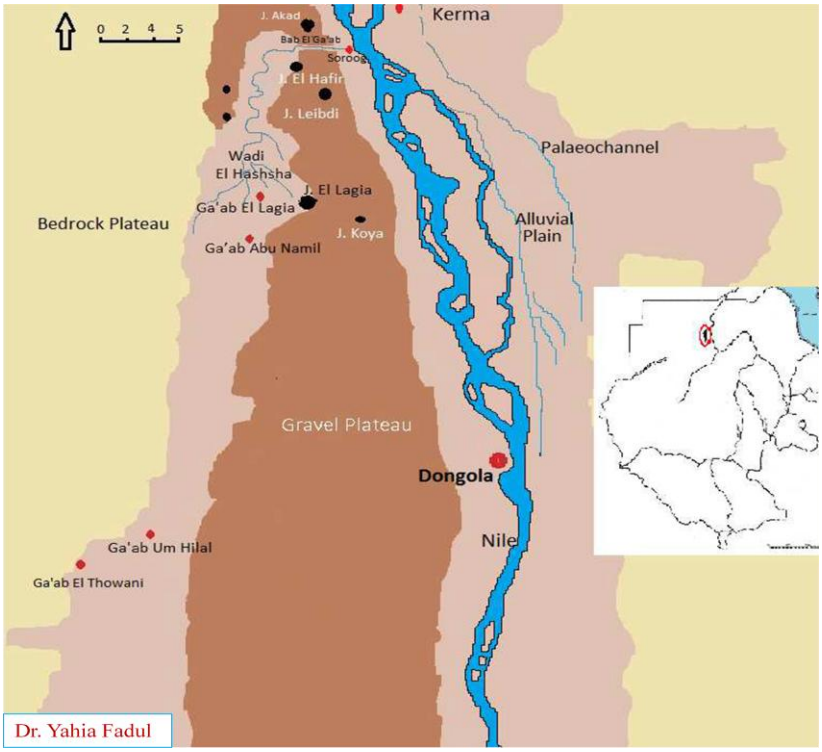

Figure 68 El Ga'ab is an underground depression full of fresh water at a depth of two to four meters below the surface. The water is used for human needs and for export camels coming from Darfur in their way to Egypt. There is a start of farming at Gaab El Lagia. It is thought the Ga'ab is filled by water at its northern end during the flood season of the Nile.

Figure 69 Fresh Water for human use and agriculture at Ga'ab El Lagia, 14/1/2009.

Figure 70 Vegetation of Ga'ab 8/1/2009 *Acacia ehrenbergiana* (Salam), *Acaica radiana* (Saiyal), *Acacia tortelis* (Samar), *Hyphaena thebaica* Dome *Phoenix dactylifera* Date Palm and *Panicum tergidum* (Tumam). Photographed by Dr. Yahia Fadul.

Figure 71 Ga'ab 8/1/2009. Photographed by Dr. Yahia Fadul.

Figure 72 Ga'ab 8/1/2009. Photographed by Dr. Yahia Fadul.

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