

Sudan University of Science and Technology
College of Graduate Studies

**Assessment of Refugees Effect on Um Gargur Plantation Forest,
ALFashaga Locality, Gadaref State- Sudan**

تقويم أثر اللاجئين على غابة أم قرقور المزروعة بمحلية الفشقة ولاية القضارف - السودان

A Dissertation of Master Degree (M.Sc) in Environmental Forestry

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DE DICATION

This research is dedicated to all those wonderful peoples:

To my parents, brothers, sisters and relatives.

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It gives me great pleasure to express my deep thanks to my supervisor Prof. Dr. Ismail Mohamed Fangama Abdalla, to his encouragement, guidance, patience and close supervision.

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الاية

بسم الله الرحمن الرحيم

قال تعالى:

((أَمَّنْ خَلَقَ السَّمَاوَاتِ وَالْأَرْضَ وَأَنْزَلَ لَكُمْ مِنَ السَّمَاءِ مَاءً فَأَنْبَتْنَا بِهِ حَدَائِقَ ذَاتَ بَهْجَةٍ
مَا كَانَ لَكُمْ أَنْ تُنْبِتُوا شَجَرَهَا أَئِلَّهٌ مَعَ اللَّهِ بَلْ هُمْ قَوْمٌ يَعْدِلُونَ)) (60)

سورة النمل، الاية (60)

Abstract

The study was carried out in Um Gargur plantation forest, in ELfashaga Locality, Gedaref State. The refugees perform different activities such as farming, grazing, fire wood collection and building materials. These activities led to substantial natural resources deterioration. The objective of the study is to assess the impact of refugees on Um Gargur plantation forest during the period from 2004 to 2017. To achieve this objective, the tenth percent (10 %) method was applied to determine the trees density. as well as the living and dead trees in the plantation forest. Moreover, randomly, about fifty (50) questionnaires were distributed in the camp. The collected data was, analyzed by Statistical package for Social Science (SPSS) software; version (16). The result showed the tree density was zero in feddan. Based on the above findings, the study forwards the following recommendations: establishment of large plantations in refugee's areas to provide them with the necessary fuelwood and building materials and use other alternative source of energy.

الخلاصة

أُجريت الدراسة فى غابة أم قرقور المزروعة فى محلية الفشقة ولاية القصارف. يقوم اللاجئون بنشاطات مختلفة تشمل الزراعة ، الرعى وجمع حطب الوقود ومواد البناء ، هذه النشاطات أدت الى تدهور الموارد الطبيعية وبالأخص الغابة المزروعة . تهدف هذه الدراسة الى تقويم أثر اللاجئين على الغابة أم قرقور المزروعة فى الفترة من 2004-2017م . لتحقيق هذا الهدف، استخدمت طريقة العشرة فى المائة (10%) لتحديد كثافة الأشجار الحية والميتة فى الغابة المزروعة، وبطريقة عشوائية صُممت (50) استبانة وتم توزيعها للمستهدفين فى المعسكر. وتم تحليل البيانات باستخدام التحليل الإحصائى نسخة (16) ، بينت النتيجة ان كثافة الأشجار هى صفر فى الفدان، أوصت الدراسة باستزراع مساحات واسعة من الغابات حول مناطق اللاجئين لتزويدهم بالاحتياجات الاساسية من حطب الوقود ومواد البناء وبدائل الطاقة.

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CHAPTER ONE

INTRODUCTION

1.1 Back ground

Gedaref State is an important area for Ethiopian and Eritrean refugees, due to availability of ample security and huge natural resources. The influx of refugees was high during the previous forty years due to continuous war between Ethiopia and Eritrea. Where the number of refugees in Gedaref State only reached about 36,000 persons.

Definition of refugee: a refugee is defined as a person who owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of particular social group, or political opinion, is outside the country of his nationality, and is unable to or, owing to such fear. He is unwilling to avail himself of the protection of that country. (Jeff crip, 2011).

1.2 Significance of the study

Refugee at Um Gargur camp, performs in discriminated tree cutting to meet their demand shelter, fuelwood, building material. This activity has negative impact on the available resources of environment. Therefore it become necessary to take immediate remedial action to restore and conserve the natural resources and environmental settings.

1.3 Research problem

The refugees in Gedaref area like other people in rural areas in Sudan. For livelihood, they practice different activities; including; cultivation, grazing, charcoal production, fire wood and building materials collection. All these activities have direct or indirect impact on natural resources base and environmental settings, particularly on forest, and land resources.

However the well established forest plantation at Um Gargur experienced a serious damage due to high influx of refugees to this area. Nevertheless, the Um

Gargur camp still receiving more refugees. Therefore, the existing forest plantation began deterioration, where; acute shortage of fire wood, building materials as well as shortage of grazing vegetation became problematic area. Initially, the construction of the refugee camps decreased the total forest area which becomes available to climate change which will have negative effect on socio economic and environment in the area.

1.4 Objectives

a. General objectives

- To assess the present situation of Um Gargur forest plantation during the period 2004-2017.
- Understanding the magnitude of the forest deterioration.

b. The specific objectives

- To determine which activity causes greater deterioration to forest resource in the study area.
- Determinate the trees status by counting the living and death trees.

1.5 Research questions

- 1- What is the status of trees in the plantation?
- 2- What are the factors cause the degradation in the plantation?
- 3- What are the reasons behind the degradation of the trees in the plantation?

1.6 Location and extent of the study area

a) Location: Gedaref State is located between latitudes 14° and 16° N, and longitudes 33° - 36° E, and altitude of 600 meters above sea level, with an area of 71000 km²(Harron, 1999).

The Gedaref town is about 490 km. from Khartoum and 770 km. from Port Sudan (Harron, 1999).

The study area, at the Um Gargur camp belongs to El Fashaga locality in the North-Eastern corner of Gedaref town. It lies within the latitudes of

14° 30′, longitudes 35° 38′, and elevation of 592 m above sea level. It is about 96.7 Km from El Gedaref, and 31 km from West El Showak (Fangama, 2006).

b) Physical attributes

- **Geology:** Gedaref area is a flat plain, particularly the central clay plain. Gedaref and the surrounding areas located on a high plateau, forming water dividing line between Atbara to the East and River Rahad to the West (Atta El Moula, 1985). He added that the Gedaref State consists of the following geological formation:
 - **Basement complex:** The Precambrian basement complex is the most extensive geological formation in Gedaref State. It consists mainly of igneous and metamorphic rock, outcrops of the rock formation are found in Gala El Nhal series. Fau Jebels and Gadambaliya.
 - **Nubian series:** Geologically termed as Gedaref formation, which includes all those sandstones, sandy mudstones and mudstones that crop out in the area around Gedaref and along Ethiopian frontiers of Setite valley and Adigrat sand stones. Jebel Sumsam and Um Belil are outcrops of the Gedaref formation.
 - **Volcanic Rocks:** This is dominated by tertiary basalt which surrounded by Mesozoic sandstone and mudstone of Gedaref formation. Decomposed basalt acquired different colors ranging from light to dark grey and from brown to red. However, the outcrops of this formation are found on Gedaref and Gallabat Ridges.
 - **The superficial Deposits:** This is a thick layer of Quaternary elastic materials mostly covers the rocks of all formation. It is a result decomposition and disintegration of the Volcanic rocks. It mostly heavy

clays found in the central and southern parts of the State, where the mechanized rain-fed farming is practiced.

Also there is a medium coarse textured materials found in North and Eastern parts, while the river sediments are found along Atbara and Rahad rivers.

- **Soil:** The soil of Gedaref State is described as dark colored, heavy clay soil (Atta Moula, 1985).
- Identified area of chocolate-colored cracking clay, around Gedaref and North of Doka. Also restricted islands of red soils occur in some area, such as seen at Azaza North Gedaref and elsewhere.

In 1966 a reconnaissance soil survey was carried out in the southern Gedaref state (Sumsam, and Um mseinat) (Atta El Moula, 1985).

Described the soils of the study area as low inherent fertility status and the availability of nutrients in the surface soils classified as low to very low. While the soil of Um Gargur area was described as dark cracking clay.

- **Climate:**

The climate of Gedaref is hot and rainy in the summer. The rainy season extends for four months, with an average of annual rainfall of 700 to 900 mm (Meterological station, Khartoum 2016).

In the Autumn during the rainy seasons, or (Kharief) as it is locally called, large pools of water and green meadows with trees of various kinds of Acacia cover the area. The early advent of the flamingo flock, or the Simber as it is locally called, gives the sign of the beginning of the Kharif.

- **Rainfall:** Rainfall is considered as one of the important factors in determining the type of vegetation cover. In Gedaref area, it has a seasonal character, where the length of rainy season concentrates around four months from June to October (Churchill, 2007). It reaches its peak in August.

In Gedaref, the rainfall varies from North to South. The annual rainfall ranges from 175 mm in the north to 570 mm in the center and 650 mm at Doka and Basunda in the South.

A study of the area by (El Tayeb, et al., 1983) showed that the annual distribution of rains remained fairly constant during the past thirty years. They consider July, August and September as rainy season during which 75% of the rainfalls. This rain will be effective in agriculture and plant cover. The average annual rainfall in Um Gargur is 450 mm.

- **Precipitation**

The averages annual precipitation is 603.7.

- **Temperature**

The average annual temperature is 28.7 degrees Celsius (83.7 degrees Fahrenheit) and average monthly temperatures varies by 6.8C this indicates that the continentally type is hyperoceanic, subtype truly hyperoceanic.

- **Relative humidity**

The average annual relative humidity is 42.8%.

- **Sun shine**

The percentage annual sun shine is 76%

Topography, flora and fauna

The geographical feature of the Um Gargur city is marked by a group of hills surrounding it and small khors (tiny dry valley creeks). The largest is called Khor Maqadim, which runs from the Southeast part of the city between Deim El Nur and Deim Suakin districts to the Northwestern part of the city in Deim Bakr District. Its course overflows during the fall season, when

heavy rain falls in the highland areas along the Ethiopian border. (Encyclopædia Britannica, 2011. Web. 20 Aug. 2011).

1.7 Natural Resources base

- **Vegetation:** Generally, the vegetation of the area is largely dependent on rainfall and soil types. According to (Harrison and Jackson, 1958) the Gedaref area lies in the low rainfall woodlands savannah belt on clay. This was sub divided into the followings:

- a. *Acacia mellifera* in **(thorn land)**

- On dark cracking clays alternating with grass area (400 – 570 mm of rainfall).
- On soil associated with *Commiphora africana* and *Bosica senegalensis* (200- 500mm of rainfall), *A. seyal* and other.

- b. *Acacia seyal*. *Balanites* in **(savannah):**

- Alternating with grass area (570 – 800 mm rainfall)

- c. *Anogeissus*. *Combretum hartmannianum* in **(savannah woodland):**

- (Above 800 mm of rainfall). To the South of the *A. mellifera* belt transit to the rainfall belt changes in the dominant trees, *A. seyal* – *Balanites* savannah in the area of Hawata, Mafaza, Beila, Qala Nahl, Summsam, Um seinat, Doka, Fazra etc.

The vegetation cover of the area consisted mainly of *Commiphora africana*, *Bosica senegalensis*, *Acacia seyal* (Harrison and Jackson, 1958).

- **Land resources**

- Forest

In Gedaref State forest about 11 reserved the *Acacia* trees prevail and produce gum arabic, along with 31 other reserved

forest also dominated by Acacia trees. And this forest tracts ranging from 100 to 800 acres.

- Animal resources

Livestock estimated in Gedaref State about 5 million heads of cattle various factions and builds up to 7 million heads in the rainy season when seasonal pasture available to the mandate and pilgrimage destination shepherds their animals from the neighboring States in pursuit of pasture and water.

Livestock owners in the State reported an acute shortage of water and pastures in El Butana in the beginning of October. The conditions forced the pastoralists to move with their livestock to other areas, causing friction with the farmers.(www.angelfir.com, 2016).

1.8 Land use in the study area

The State is characterized by vast land suitable for agriculture, which is considering the largest projects for rain-fed Mechanized agriculture in Sudan. a mechanism that agriculture machine used in various stages of production such as tractors and combine harvesters rely on rainfall. It also has the largest market for private crop sesame crops, and sorghum. The State is considered important for food security in Sudan's strategic center, so agriculture is the economic activity and often rely on rain for irrigation, as well as associated with agriculture and trade, including the border with Ethiopia and Eritrea trade in services. With the introduction of the machine in agriculture in 1945 expanded the agricultural area until it reached 71,621,33 kilometers, while armed amounted to 2376563 forest five kilometers and contribute to the production of

gum arabic from Sudan. The distribution of agricultural areas on the following areas: Belt dry Agriculture: is approximately 162792 million acres and is located in the North of line with rates ranging between 500 and 600 mm rain zone. Featuring Ptrepettha mud and lack of valleys and creeks and practiced mechanized farming in the form of large sprawling fields. Belt rainfed agriculture: the area of about 2,962,620 acres and range from a rainfall of 550 to 600 mm, the type of clay soil and permeate the home coves flat plains, where rain-fed agriculture in the form of large fields and other small forests Reserve. Water basins area: The area of about 1.58034 million acres, and permeate its soil Gedaref Hills series (tippers, gouge bees and Mount QNA) where water descends towards the clay soil land and water available. Belt and mixed farming area of about 13924 million acres. Protected areas: The total land area of about 176 630 acres watershed protected waters, and an area of about 878 180 acres.

The most important agricultural projects in the State are:

Agriculture Projects mechanisim relies on rain-fed irrigation and rainfall, and those projects: Um Segttat and sesame and Rahad irrigated Agricultural Project and industrial uses of Nehr alarhad. The most important crops: sesame, maize, millet, gum arabic, sun flower and horticultural crops such as lemon, watermelon and vegetables such as tomatoes and okra, squash and others.s

El Gedaref — Large areas cultivated with maize and sesame in El Gedaref State have gone out of the production circle because of the bad weather conditions for agriculture, according to a former member of the Sudanese Union of Farmers. More than three million acres in North and Northwest El Gedaref are affected. Traders have sold their cattle because of the lack of water and pasture, and the decreasing prices for livestock. Farmers of the Fadasi project complained that their lands have been subjected to extremely dry weather for nearly a week.

1.9 Environment and climatic variation

El Tayeb and Lewandowski (1983); studied and analyzed climatic data regarding temperature and rainfall in the Gedaref area over the past forty years to know if there is any significant change occurred.

1.10 Research organization

Chapter one deals with introduction, the study area, research problem, objectives and the importance of the study. While chapter two deals with literature review. And Chapter three deals with materials and methods, followed by chapter four which deals with results and discussion. Chapter five devoted for conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Deforestation in the world

The Food and Agriculture Organization of the United Nations reported that world deforestation, mainly the conversion of tropical forests to agricultural land, had decreased over the past ten years and it still continues at a high rate in many countries (FAO,2010).

Globally, around 13 million hectares of forests were converted to other uses or lost through natural causes each year between 2000 and 2010 as compared to around 16 million hectares per year during the 1990s. Brazil and Indonesia, which had the highest loss of forests in the 1990s, have significantly reduced their deforestation rates. In addition, ambitious tree planting programmes in countries such as China, India, the United States and Vietnam - combined with natural expansion of forests in some regions - have added more than seven million hectares of new forests annually (FAO,2010).

As a result, the net loss of forest area was reduced to 5.2 million hectares per year between 2000 and 2010, down from 8.3 million hectares annually in the 1990s (FAO, 2010).

2.2 Impact of Refugees on Neighboring Countries

Developing countries that host refugees for protracted periods experience long-term economic, social, political, and environmental impacts. From the moment of arrival, refugees may compete with local citizens for scarce resources such as water, food, housing, and medical services. Their presence increases the demands for education, health services, infrastructure such as water supply, sanitation, and transportation, and also in some cases, for natural resources such as grazing and firewood. The presence of the refugees has both positive and negative impacts (UNHCR, 2010). The dynamic between positive

and negative factors is complex and varies depending on several factors, including the political economy of hosting countries, urban-rural interactions, and the nature of host-refugee relations (UNHCR, 2010). Furthermore, even when a refugee situation creates economic opportunities for both the displaced and their hosts, there can be winners and losers in each group (UNHCR, 2010).

2.2.1 Economic Impacts

Large-scale and protracted refugee influxes can have macro-economic impacts on the host country economy (G.o.M, et al., 1990). Some of these impacts are associated with increased but uncompensated public expenditures related to the care and maintenance of the refugee population.

A report concerning the impact of refugees on the national public expenditure in Malawi during the 1990s concluded that significant direct and indirect expenditure related to refugees affected the scale of the government capital investment in the social and infrastructure sectors. Direct and indirect costs of refugee influxes on public expenditure were estimated at US\$ 9.4 million for 1988 and US\$ 8.4 million for 1989 (G.o.M, et al., 1990).

As a result, a UNHCR emergency assistance program was developed to ensure that development projects served the needs of both the displaced and nationals in the refugee hosting areas (Zetter, 1995).

This program included a substantial expansion of hospitals, clinics, road networks, and water supply, as well as reforestation plans to alleviate the environmental degradation of fuel wood reserves.

Another example of the economic impact of refugees on a host country is the case of Kosovar refugees in Albania and Macedonia. A report on Kosovar refugees prepared by the International Monetary Fund and the World Bank asserts that a large influx of refugees strains the social and economic infrastructure of neighboring countries, and therefore emergency financial

assistance was needed. Preliminary estimate indicated that for the six countries most affected by the Kosovo refugee crisis in 1999, the direct host country budgetary cost of humanitarian assistance ranged between US\$52 - 188 million (World Bank, 1999) In the case of Albania, an emergency budget support operation was recommended. For Macedonia, it was suggested that existing operations be revamped to make them more responsive to the needs arising from the refugee presence and that official debt relief for the country be considered. The report concluded that based on the Albanian and Macedonian experience, additional funds through quick-disbursements are essential to effectively address the economic impacts of refugee crises in hosting countries, particularly for poor countries (World Bank report, 1999).

In recent decades, several studies have focused on the impact of refugees on the local economies of hosting countries (Alix, 2007). In Tanzania, an assessment was undertaken of the impact of Rwandan refugees on local agricultural prices between 1993 and 1998 (Alix, 2007). The study found a significant increase in the prices of some agricultural goods (e.g., cooking bananas, beans and milk) and a decrease in the price of aid-delivered goods (e.g., maize). As a result, many Tanzanian farmers who produced a surplus benefited from an increased demand for their agricultural products in local markets.

Evidence suggested that on average, farmers doubled the size of their cultivated land and their production of bananas and beans during 1993-1996 (Whitaker, 2002). The increase in the size of the local markets also boosted business and trade activities conducted by both hosts and refugees. At the same time, welfare indicators such as electricity, televisions, and refrigerators increased in host population households near refugee camps (Whitaker, 2002).

2.2.2 Social impacts

The presence of refugees in hosting countries has potential social impacts on the ethnic balance of hosting areas, social conflict, and delivery of social services. The socio-cultural impact of refugees on the host community may occur simply because of their presence. Thus, if traditional animosities exist between cultural or ethnic groups, it may cause problems when one group becomes exposed to another that has been forced to become refugees. For example, in the late 1990s the mere presence of Kosovo-Albanian refugees in Macedonia generated tensions between ethnic Albanians and Serbs in Macedonia (Pini, 2008).

However, UNHCR has also found that when refugees are from the same cultural and linguistic group as the local population, there are greater opportunities for peaceful co-existence and interaction among them (UNHCR, 2010). For instance, approximately 25,000 refugees from the Central African Republic were in the Democratic Republic of Congo during the 1990s. Like their Congolese hosts, the refugees belonged to the Yakoma ethnic group, so their integration into the host society was smooth and peaceful.

Similarly, 3 million Afghan refugees in Pakistan, mostly ethnic Pashtun resided for more than a decade among fellow Pashtun communities in the North-West Frontier Province (NWFP). During the entire period, relations between refugees and the host population were largely peaceful. The same has been the case with the massive influx of Somali refugees into the Dadaab area in Kenya, which is inhabited by people sharing the same culture and language, and which are often related by clan or tribal ties to the refugee population (Pini, 2008).

In refugee-affected and hosting areas, there may be inequalities between refugees and non-refugees that give rise to social tension (Betts, 2009). Refugees are frequently viewed as benefitting from privileged access to resources unavailable to the local host population. In this regard, refugee status

offers an opportunity for education, literacy, vocational training, health, sanitation, and basic livelihood.

However, when social services provided through international funding also target host communities, the likelihood that the local population will have a positive view of refugees increases significantly. Thus, the special Program for Refugee Affected Areas (SPRRA) in Tanzania (1997-2003) benefited host communities by promoting farming activities, road construction, and income-generating activities in surrounding areas.

2.3 Impact of Refugees on Environment

For rural populations in developing countries, the natural environment is intimately linked to economic welfare. Populations are dependent on their surroundings for water, food, shelter and medicine. Refugee influxes intensify normal 'green' environmental problems those associated with over-exploitation of rural natural resources due to poverty, rising populations, weak property rights and inappropriate management (Gill, 1995).

2.4 Refugees in Asia case of Afghanistan

By the early 1990s, the civil war in Afghanistan had forced more than three million Afghan refugees to resettle in neighboring Pakistan. Although previous studies have noted that refugees have had a negative impact on natural resources in the vicinity of resettlement camps, there has been little work done to quantify these impacts. The research presented here examines the clearing of forests in the Siran Valley, Pakistan, where 111,000 refugees were settled in ten camps between 1978 and 1993 (Ambio, 1996).

Multi-temporal satellite images were georeferenced using 1:50,000 scale topographic maps of the study area. A digital elevation model (DEM) was created to stratify by altitude the unsupervised classification of the two images

used in the change detection analysis. The elevation data were included in the classification process to reduce the spectral confusion between agricultural and forest land cover classes. The comparison of the satellite images for the two dates show a dramatic decline of forested land. Procedures similar to those presented here can be used to assess the environmental impact of refugee movements in many environments (Ambio, 1996).

2.4.1 Refugees in Nepal

This article analyzes the relationship between forest resources, refugees, and the host population. The host population are heavily dependent on the local forest for their daily needs such as fuelwood, timber, grazing area, fodder for domestic animals, foods, and medicine in addition to cultural and esthetic needs. The forest has also been relied upon for agricultural needs such as manufacture of agricultural tools, maintenance of irrigation water systems, erosion control, and fertilizer needs.

The forest was under a sustained demand as any other Terai forest of Nepal. After the arrival of refugees in 1992, the demand for forest resources increased substantially. Initially, the construction of the refugee camps decreased the total forest area and also required some felling of trees. More significantly, the refugees themselves became active users of the forest resource, which generated extra pressure on the forest and created scarcity of forest resources. Before the arrival of the refugees, forest management and monitoring of illegal use of the forest resources were carried out by the government through its local forester office. The local residents were active users of the forest resources, but were passive in managing and maintaining the forest resource. However, competition from the refugees instilled a desire in the local population to safeguard and protect the dwindling resource against the external threat by creating the Humse Dumse Community Forest (Birendra, 2006).

2.5 Refugees in Africa

Africa like any other parts of the world, the degradation of forests is caused by a combination of natural and anthropogenic factors. The aim of which has been the conversion of forest lands to agricultural land. Accordingly on intensive land use began, between 1950 and 1983 the area of Africa's wood land and forests declined by 23% from 910 to 890 million hectares (FAO, 1982).

Obudho (1998) mentioned that, migration in Africa is associated with series of social, cultural, political and economic factor.

Considering the continuous influx of Mozambican refugees to Malawi as an external shock to the forest ecosystem. A dynamic model of optimizing the use of forest tree resources is developed in research. Land clearing for refugee camp sites, construction material, fuel wood and agricultural crop production constitute a major threat to forest resources in the refugee populated areas (International Food Policy Research Institute, 2000).

The optimal conditions for choosing the levels of land clearing for various uses of refugee population are derived. The model parameters are used to identify the optimal timing and rate of a forestation that will attain a dynamic equilibrium of forest tree resources. Several policy implications are derived from the model results for reducing the environmental degradation of forest resources due to the presence of refugees. It is argued that the general environmental regulation policies based on user-pay principles may not be appropriate under the refugee situation and that additional intervention is needed by the host government and international relief agencies for reversing the trends in deforestation (International Food Policy Research Institute, 2000).

2.5.1 Environmental impacts of the Rwandan refugees on Zaire

A previous study examines the environmental impact of Rwandan refugees on Zaire's forests, soils, sanitation, wildlife, and water supplies. The mass movement of 1.5-2.0 million Rwandan refugees to the economically declining country of Zaire occurred after July 13, 1994. The refugees settled in Kivu, which has around 6 million inhabitants. The average national population density is only 13 people per sq. km. Zaire is the location for about 50% of Africa's remaining tropical rainforest. Zaire's forests are the second largest after Brazil's. The location of camps was made under unplanned crisis conditions that were not suitable to forest protection. Deforestation around camps occurred in the city of Goma and neighboring areas in North Kivu, in the city of Bukavu and neighboring areas, and in the Ruzizi plain in South Kivu (Ambio, 1996).

An estimated 3758 hectares of forest land were lost within 3 weeks of the arrival of refugees. Refugees even burned furniture in buildings for fuelwood. The most serious deforestation occurred in Goma and the Virunga National Park in North Kivu, where large camps of refugees settled within the buffer zone. South Kivu's camps had more favorable sites. Mont Goma had not a single tree left 3 days after the refugees' arrival. The Kibumba (135,000 refugees), Mugunga (125,000 refugees), Katale (110,000 refugees), and Nyabirehe refugee camps were responsible for damage to the Rugo-Kibati sector, the Mugunga sector, and the Kubare-Kalengera-Katale sector of the park. About 7000-10,000 cu. m of wood per day were taken from the forests (Ambio, 1996).

2.5.2 The impact of war on forest areas in the Democratic Republic of Congo

The effects of the civil war on forest areas in the Democratic Republic of Congo. Only a few of these effects were beneficial, the most important being

the collapse of the wood industry. However, the war has increased the number of people that rely on wood for fuel and bush meat for protein. The presence of soldiers and refugees aggravates this pressure. When people hide they do not necessarily refrain from hunting, because goods, including ivory, can be stocked to be traded when the situation improves. War seems beneficial to the environment only if it keeps people out of large areas. It could be useful to extend the concept of peace parks to war zones. The idea of an international 'green force' to protect biodiversity hotspots should be given serious consideration. Awareness is growing that political instability should not preclude conservation efforts from being continued (Dirk Draulans and Ellen Van Krunkelsven, 2002).

2.6 Impact of refugees on forests in Sudan

The Sudan is a vast country with nine neighboring countries around its borders. Since more than three decades Sudan hosted refugees from African neighboring countries especially Eritrea and Ethiopia. Formal conventions made by United Nations (UNHCR) gives the refugees the right of settlements and support and the Sudan Government gave them the lands for both settlement and agriculture. Severe environmental degradation took place to the natural resource (Forests resources). Moreover, loss of wildlife habitat, range lands, soil productivity, which leads to environmental degradation due to over exploitation and misuse by refugees' population on the areas settled by refugees in addition to the study area which is located at North East Gedarif State at ElFashaga locality.

The socio-economic council of the United Nation mentioned that the amount of forest removed from Eastern region by refugee's consumption of firewood and charcoal was very great. It was estimated as equal to the amount of forests cut by the local people by three holds of the total consumption from charcoal and firewood (COR, 1985).

(COR, 1988) reported that about 92593.3 hectare of forest land had been cleared from forest – tree cover in the Eastern region for the settlement of refugees and agriculture.

2.6.1 Um Gargur refugees camp

The area of Um Gargur was densely covered by trees before refugee's settlement, but after that the trees were removed by refugees through different activities such as production of charcoal, firewood and cleaning for cultivation and housing (Fangama, 2006).

He added that, no trees were observed on the landscape of this area except those plantations that have been established by International Organizations. He added that, most of the refugees in this camp were semi-nomads, and therefore, they had little experiences about agriculture, since most, of them were farmers and the rest were herdsmen and traders. The total livestock owned by the refugees' was 1403 heads comprising of 228 cows, 291 sheep, 687goats, 195 donkeys, and two camels.

(The Refugees Settlement Administration, 1989) reported that the camp was established in 1976 with 17484 refugees in receptions one and two. The total number of households was 3496. The ethnic groups include Beni Amer, Baria and Bilen. The total area allotted for agriculture was 7500 ha and the area for farm per family was 4.2 ha. The area allotted for housing was 500 ha and the numbers of huts built were 3497. In 2017 the camp has 13000 refugees. The total number of household was 2600 (Fangama,2006).

(Swedish University of Agricultural Science in 1990 and South Kassala Agricultural Project (SKAP) in 1992 at Gedaref State) showed that there were huge impacts on the vegetation cover due to refugee's activities and their dependence on natural forests around their camp.

2.6.2 Um Gargur plantation forest

At Um Gargur site a plantation of *Acacia seyal* and *Acacia senegal* with an area of 125 hectares (300 fed) was established by direct sowing in 1985. The spaces between trees were 3×4 m and within straight lines as stated by (Fangama, 2006). He added that the total area planted by 104166 trees and the density was 360 trees/ feddan. Mortality in the plantation was remarkable, because the refugees used to cut trees by one way or another means at night in the absence of forest guards.

2.6.3 The Purpose of plantation forest

The Care- Sudan organization planted trees for compensating the natural forest removed by refugees. The plantation can provide ecosystem services such as maintaining nutrient captured, protecting watersheds, soil structure, and storing carbon. Forests provide a diversity of ecosystem services including converting carbon dioxide into oxygen and biomass, acting as a carbon sink, aiding in regulating climate, purifying water, mitigating natural hazards such as floods, and serving as a genetic reserve. Forests also serve as a source of lumber and as recreational areas (Care- Sudan, 1985).

CHAPTER THREE

MATERIALS & METHODS

3.1 Location of the study area

The study area, at the Um Gargur camp belongs to El Fashaga locality in the North-Eastern corner of Gedaref town. It lies within the latitudes of $14^{\circ} 30' N$, longitudes $35^{\circ} 38' E$, and elevation of 592 m above sea level. It is about 96.7 Km from El Gedaref, and 31 km from West El Showak (Fangama, 2006).

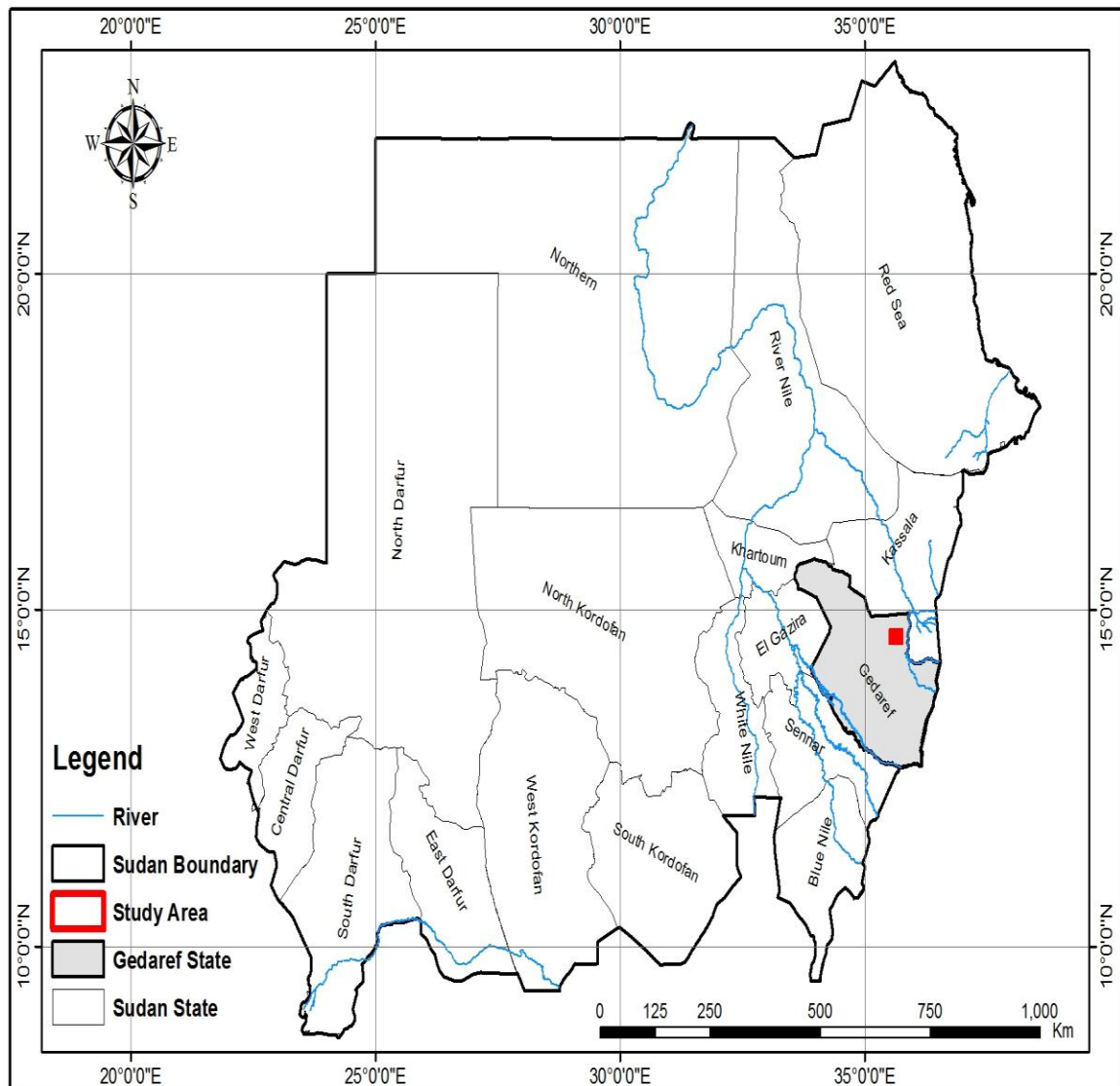


Fig. (1): Location Map of the Study Area

Source: Google earth (2017)

3.2 Materials and Methods

3.2.1 Materials: In this study, the following materials were used: Global Position System (GPS), meter, robe, pencil, note book, and paper bags,

3.2.2 Methods

One trip was paid for data collection during the period between May and July 2017.

1) Methods of data collection

a. Secondary data: Secondary data was collection from different resources like Ministries, departments, Organizations, library of the Collage of Forestry and Range Science, Forest National Corporation, beside the text books, scientific papers, reports, internet, etc...

b. Primary data: This includes the data collected during the field work including trees measurement, questionnaires and direct interviews with elites and government officials.

-Determination of trees density: The numbers of live and dead trees in the forest plantation were counted, using the method of vegetation survey (Tenth percent) (Tom, 2004). The sampling begins by counting each tenth line as a sample, from the begging to the end of the forest plantation. The total living and dead trees from *Acacia senegal* and *Acacia seyal* were counted. Then the density of trees per feddan was calculated by dividing the total trees living/ dead by the total area of forest plantation.

- Questionnaire: A questionnaire was designed in direct question for the refugees as target group. Fifty refugees were chosen from the 5000 refugees as total refugees in Um gargur camp. The questions concerned with the degradation of the plantation through their activities during their settlement, the reason of degradation of forest, the role of organization in rehabilitation and protection the forest, the role of refugees in protection the forest.

-Interviews: The interviews were done with the official staff of Refugee's Administration and Forest National Corporation (FNC) staff in Gedaref State to know the reason of degradation and how to solve the problem of cutting down trees, total number of refugees, sources of energy, and number of guards in the plantation forest and purpose of forest plantation.

-Observation: Deterioration of vegetation cover. Active soil erosion and recent formation of several valleys.

3.3 Data analysis

The collected data were analyzed by Statistical Package for Social Science (SPSS).



Plate (1): Trees cutting, at Um Gargur plantation forest (2017)

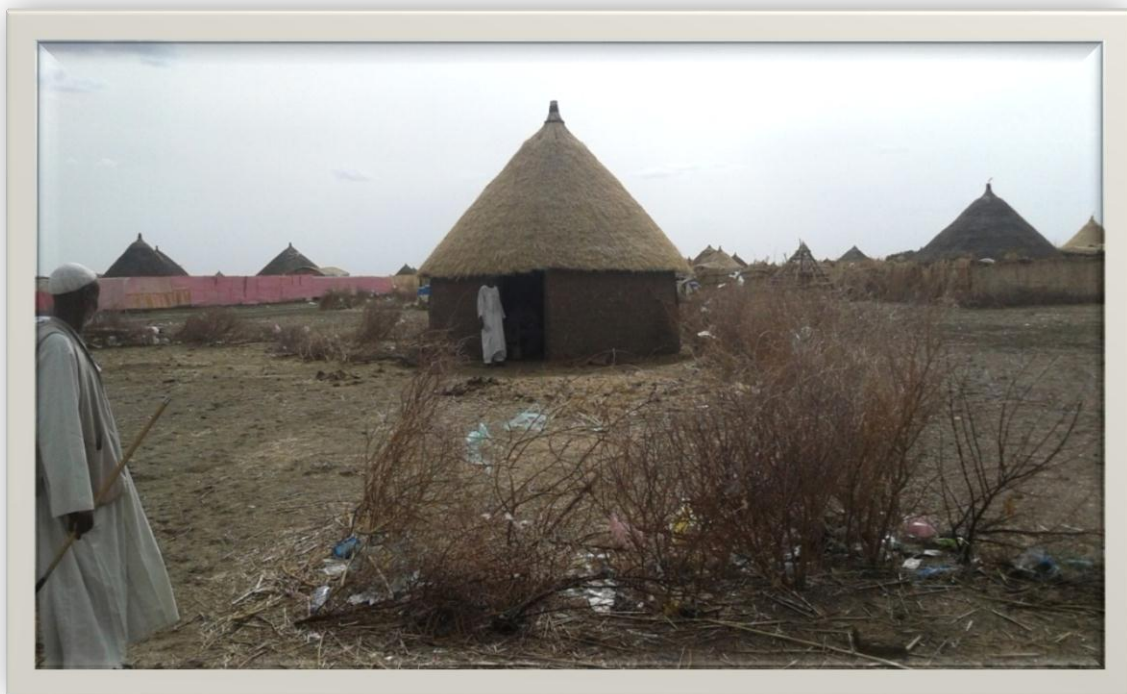


Plate (2): Trees used for fencing at Um Gargur camp (2017)



Plate (3): Trees cutting in Um Gargur plantation forest (2017)

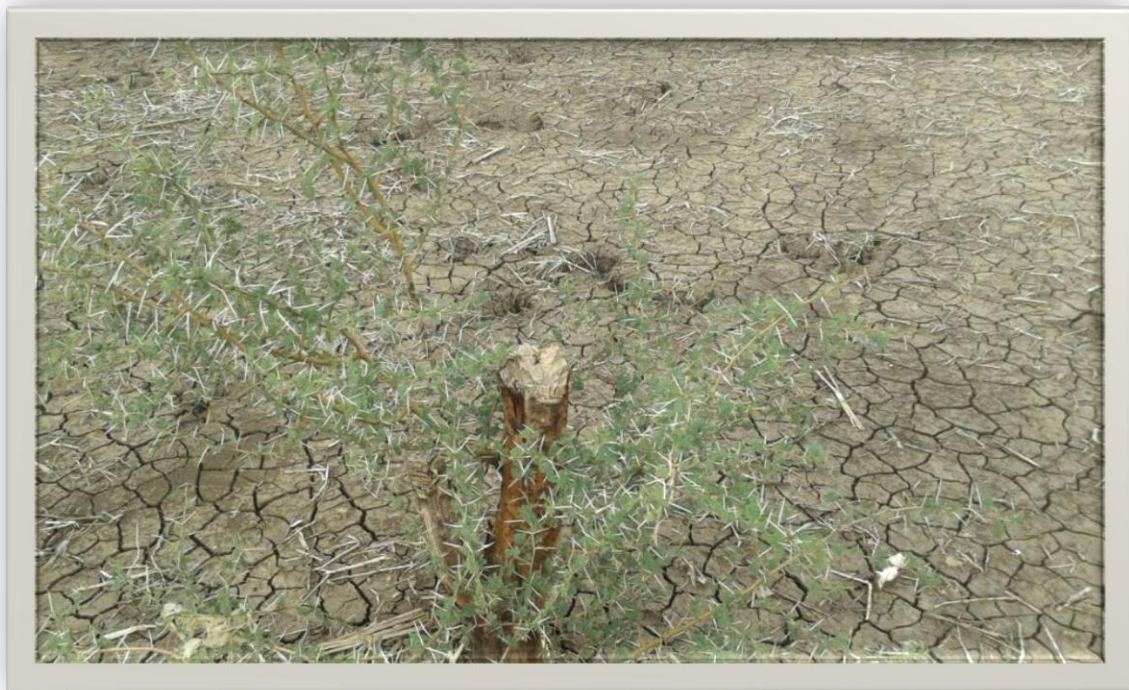


Plate (4): Illegal tree cutting inside Um Gargur plantation forest (2017)



Plate (5): Formation of new valleys at Um Gargur area (2017).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results of field survey

Table (1): Sex of respondents at Um Gargur camp (2017)

Sex	Frequency	Percentage
Male	34	68.5
Female	16	31.5
Total	50	100

Table (1): Showed that the majority of the respondents were males (68.5%), and the other were females (31.5%).

Table (2): Education levels of the refugees at Um Gargur camp (2017)

Education level	Frequency	Percentage
Illiterate	10	20
Khalwa	10	20
Primary school	17	34
Intermediate	3	6
Secondary	9	18
University	1	2
Total	50	100

In table (2) most of respondents completed primary school represents 34% that Um Gargur camp has two primary school and one secondary school, the community of camp need awareness in important of education.

Table (3): Age frequency distribution of the refugees respondents at Um Gargur camp (2017)

Age/ years	Frequency	Percentage
15 – 25	14	28
26 – 35	9	18
36 – 45	10	20
46 – 55	4	8
Over 56	13	26
Total	50	100

From table(3), Age class 15 to 25 years showed the highest percentage (28%), followed by age class over 56 years (26%) and age class 36-45 years (20%), Where the age class 46-55 years came at the bottom of the list.

Table (4): Refugees’ sources of income at Um Gargur camp (2017)

Sources of income	Frequency	Percentage
Agriculture	17	34
Herder	5	10
Other	17	34
Idle	11	22
Total	50	100

From table (4), the refugees in Um Gargur camp are farmers (34%), and herders (10%), while the idles are about 22%.

Table (5): The number of years stay in settlement camp at Um Gargur Camp (2017)

Rang years	Frequency	Percentage
0 – 10	7	14
10 – 20	24	48
20 – 30	10	20
30 – over 30	9	18
Total	50	100

In table (5) most of respondent stay from 10 to 20 years, that mean um Gargur camp until now resaving refugees, and it is important to plant trees to meet their supplies.

Table (6): Dominant trees species at Um Gargur forest plantation (2017)

Species	<i>Acacia seyal</i>		<i>Acacia Senegal</i>		<i>Acacia mellifera</i>		<i>Balanites aegeptiaca</i>	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Yes	36	72	16	32	13	26	4	8
No	14	28	34	68	37	74	46	92
Total	50	100	50	100	50	100	50	100

From table (6) the dominant trees are *Acacia seyal*, secondly *Acacia senegal* after that *Acacia mellifera*, last one is *Balanites aegeptiaca*, but there is no trees observed except that planted by care- sudan organization. This table shows high significant.

Table (7): Sources of energy at Um Gargur camp (2017)

Type	Charcoal		Fire wood		Kerosene		Gas	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Yes	18	36	24	48	-	-	10	20
No	32	64	26	52	50	100	40	80
Total	50	100	50	100	500	100	50	100

In the table (7) firewood and charcoal in view of it is critical significances for the supply of wood and wood products and it is high potential to contribute to environmental and social benefits and landscape diversity. This table show high significant.

Table (8): Method of energy used for cooking food at Um Gargur camp (2017)

Method	Traditional stove		Tri- stone stove		Improved stove	
	Frequency	%	Frequency	%	Frequency	%
Always	35	70	24	48	19	38
Some time	11	22	8	16	10	20
Rarely	3	6	5	10	12	24
Not used	1	2	13	26	9	18
Total	50	100	50	100	50	100

From table (8) it clear that about 70% of respondents always used traditional stove method for production charcoal and 48% used tri-stone stove, last about 38% used improved stove, that mean most of them used those methods for production charcoal. This table show high significant.

Table (9): Source of collection fuel wood at Um Gargur camp (2017)

Type of source	Forest nearby to camp		From the market		Forest far from camp		Plants residual	
	Frequency	%	Frequency	%	Frequency.	%	Frequency	%
Yes	20	40	17	34	15	30	1	2
No	30	60	33	66	35	70	49	98
Total	50	100	50	100	50	100	50	100

Table (9) indicated 40% of respondents were obtain fuel wood from forest nearby the camp, 34% were obtain fuel wood from the market, and 30% were obtain from forest far to the camp, while 2% using plants residual.

Table (10): Methods of trees cutting at Um Gargur plantation forest (2017)

Method	Cutting the upper branch		Cutting stem at the roots		lobbing		pollarding	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Yes	30	60	2	4	9	18	9	18
No	20	40	48	96	41	82	41	82
Total	50	100	50	100	50	100	50	100

From table (10) above the refugees in Um Gargur camp have awareness in method of cutting down trees, because the 60% of respondents have knowledge of cutting the upper branch that let forest regeneration.

Table (11): Degree of participation in reforestation programs, (2017)

Cases	In most cases		In some cases		Rarely		Not at all	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Yes	7	14	12	24	2	4	29	58
No	43	86	38	76	48	96	21	42
Total	50	100	50	100	50	100	50	100

In table (11) clear that most of respondents don't participated in reforestation program that done by some organization, this is represent 58% and in some cases participated 24%, while in most cases participated 14%. That mean there is no reforestation program was done by FNC except that practiced by Care-Sudan Organization.

Table (12): Impact of participation in reforestation

Type of participation	Important of forest in life		Setup small forest		Planted tree in my house		Cutting down trees	
	Frequency	%	Frequency.	%	Frequency	%	Frequency	%
Yes	12	24	3	6	13	26	13	26
No	38	76	47	94	37	74	37	74
Total	50	100	50	100	50	100	50	100

In table (12) the benefit of respondents from participated in rehabilitation programs are stopped cutting down trees represent 26%, they known important of forest in life represent 24%, planted tree in our house 26%, and setup small forest 6%.

Table (13): The values of forest plantation at Um Gargur camp (2017)

Benefit	Weather		Grazing		Shelter		Protection		Recreation	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency.	%
Yes	12	24	20	40	17	34	6	12	5	10
No	38	76	30	60	33	66	44	88	45	90
Total	50	100	50	100	50	100	50	100	50	100

In table (13) above about 40% of respondents they estimated that the benefit of plantation forest in grazing of animals, 24% of them say the benefit is improved weather, 34% were benefit in shelter, 12% the benefit of forest in protection of agricultural land, and 10% say recreation value, that mean the refugees known the benefit of plantation.

Table (14): Importance of Um Gargur plantation forest (2017)

Importance	Frequency	Percentage
Yes	44	88
No	6	12
Total	50	100

From table (14) most of respondents mentioned the important of plantation forest represent 88%, that mean they have awareness about important of forest, and practically the plantation forest protected them.

Table (15): Animals grazing at Um Gargur forest plantation (2017)

Place of grazing	In the forest plantation		In agricultural land		Non of 1 or 2	
	Frequency	%	Frequency	%	Frequency	%
Yes	30	60	16	32	3	6
No	20	40	34	68	47	94
Total	50	100	50	100	50	100

In table (15) 60% of respondents mentioned that our cattle's grazing in side plantation forest that accepts there is over grazing in plantation forest. After that they depended upon agricultural land, and rarely on natural forest far from camp.

4.2 Measurement of trees in plantation

a) Number of trees

Table (16): Trees Status at Um Gargur plantation forest, (2017)

Status of trees	<i>Acacia sengal</i>	<i>Acacia seyal</i>	Total
Living	15	30	45
Dead	59	126	185
Total	74	156	230

Table (16) reflects the total number of living and dead trees in the forest plantation in the study area was 45, and 185 trees respectively. There is a decrease in living trees compared to dead trees. This is bad indicator. Similar result was found by Fangama (2004).

b) Tree Density

Table (17): Trees density in Um Gargur plantation forest during the period 1985 to 2017

Particular	Year		
	1985	2004	2017
Number of trees/fed.	833	60	zero

Table (17) reflects the tree density/fed for various periods. In 1985, the tree density was high, but the forest rapidly deteriorated due to continuous tree cutting. Therefore, the trees in the plantation showed a trend of decline, where the number of trees per fed. was 833 in 1985, 60 in 2004 and became zero in 2017. Therefore; the Gum Arabic production sharply dropped due to the disappearance of *Acacia senegal* in the plantation.

Similar result was found in Zaire, where about 3758 ha. of forest plantation was lost within three weeks after arrival of refugees in Ruziz camp (Ambio, 1996).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The effect of the refugees on forest activity at Um Gargur camp put more pressure on the natural resources. This activity ultimately leads to deforestation and land degradation. Moreover, due to tree clearance, the land was left bare, therefore rainfall water runoff increased. As consequence, soil lost fertility and crop yield dropped. Moreover the human activities contributed to climate change which is expressing increase of temperature, range deteriorated, removal of trees and rainfall fluctuation and irregularly.

5.2 Recommendations

- Establishment of large plantations in refugee's areas to provide them with the necessary fuelwood and building materials.
- Implementation of laws and regulations that control cutting of trees in refugees areas.
- Refugees should be used other alternatives source of energy.

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Illiterate	Khalwa	Primary School	Intermediate	Secondary	University

Section II: Information of refugee's activities on trees in settlement areas

1. How many years stay in this settlement camp? years

2. Put the following trees according to their availability when you reached the settlement area?

- a- *A seyal* b-*A. senegal* c-*A. mellifera*
d- *Balanites aegyptiaca*

3. Arrange the sources of energy used for cooking according to its importance?

- a- Charcoal b-Firewood c- Kerosene d-Gas

4. The use of fire wood and its bi – product (i.e. charcoal, by the following methods :

a) The traditional stove (mangad)

- a- Always b- Sometimes c- Rarely d- not used

b) Tri – stone stove method (Ladaia)

- d-Not used a- Always b- Sometimes c- Rarely

c) The Improved stove (Kanon Alseror)

- d-not use used a- Always b- Sometimes c- Rarely

5. From where do you obtain fuel wood, if you have been used them?

- a- From the forest nearby the camp. b-From the market
c- From forest far from the camp d-From plants residual

6. If you cut the trees to make use of them, what method do you use for cutting down trees?

- a- Cutting the upper branches
- b. Cutting the stem at the root
- c- Cutting the stem half way (in the middle or lobbing)
- d- Cutting the stem at the bottom (pollarding)

7. Some organizations have setup reforestation programmed (their perception). Have you ever participated in any of them?

- a- in most cases
- b- in some cases
- c- rarely
- d- not at all

8. If you have ever participated in rehabilitation programs, what make you benefited from?

- a- I have known the importance of forest in life
- b- I have setup a small forest.
- c- I have planted tree in my house.
- d- I have stopped cutting down trees.

9. Can you benefit from the plantation forest?

- Yes
- No

10. If your answer yes, explain the benefits of the plantation forest

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.....
.....
.....

11. Can our animals grazing inside forest?

- Yes
- No

12. If your answer no, where our animal grazing?

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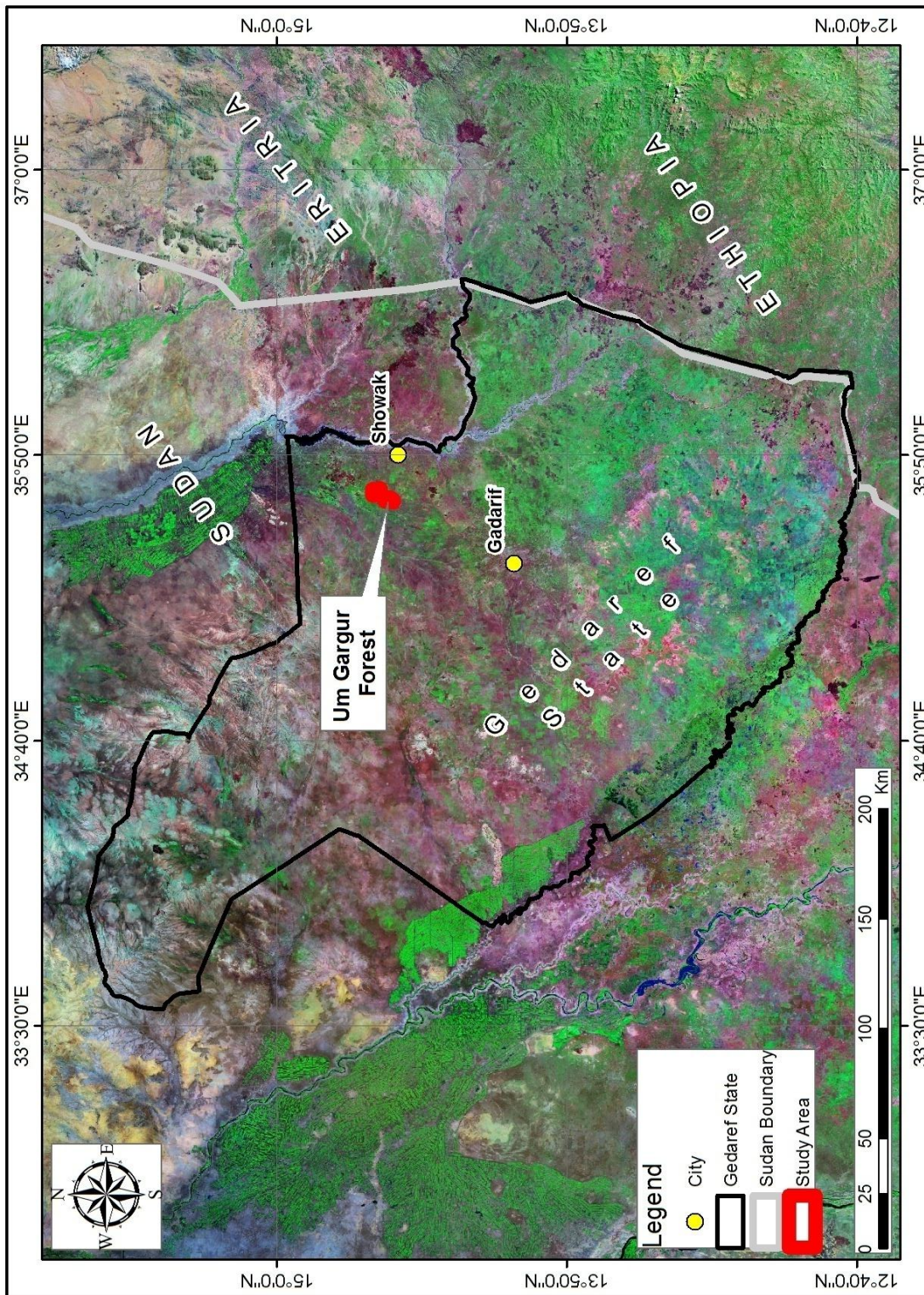


Fig. (2): Location of Um Gargur Forest in Gedaref State

Source : Google earth (2017)

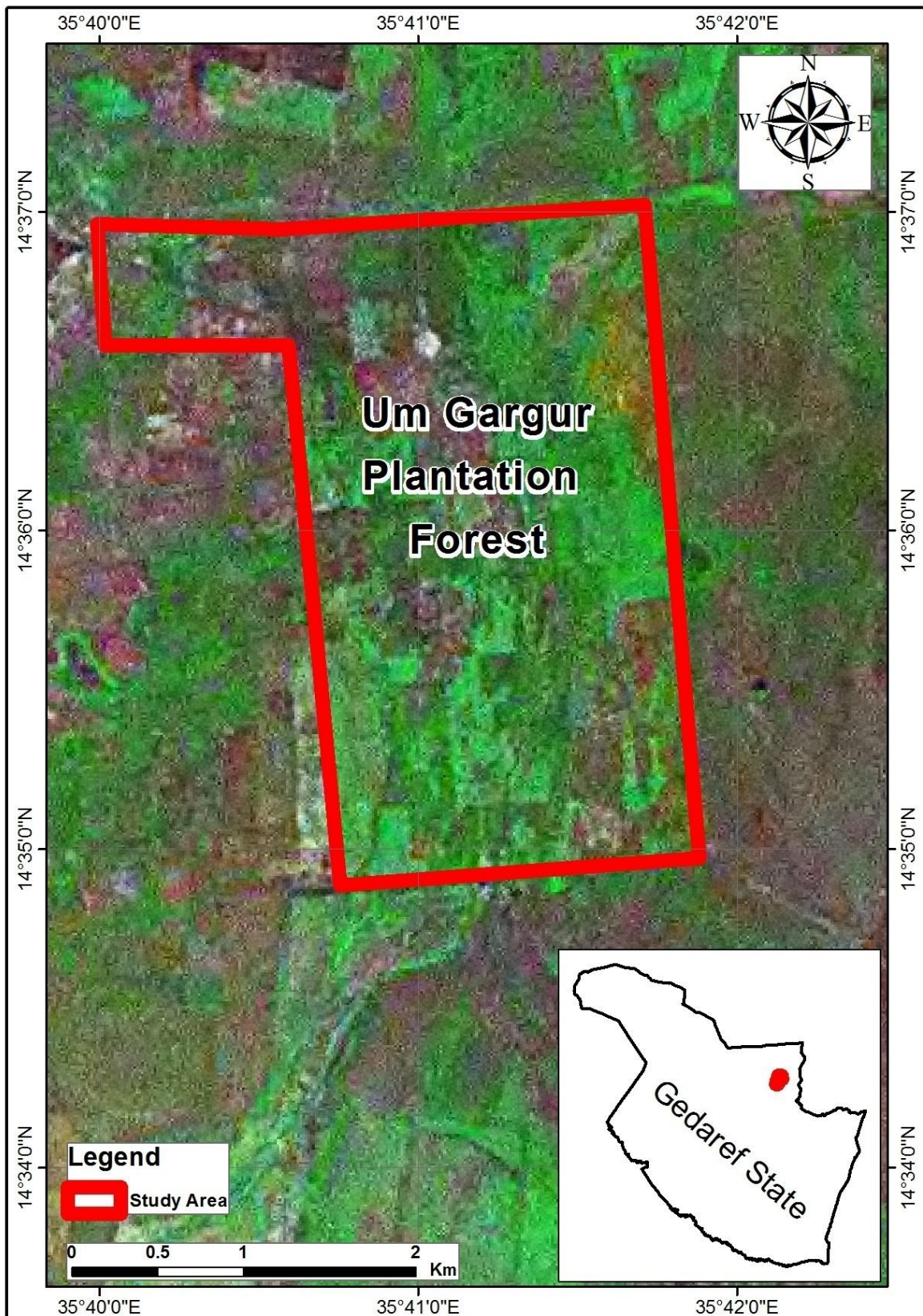


Fig. (3): Um Gargur Plantation Forest

Source: Google earth (2017)