CHAPTER ONE
INTRODUCTION

Forestry sector is one of the most important components of the national economy of many countries specially those depending mainly on agriculture. Sudanese people depend on forests to obtain important products such as firewood, charcoal, Gum Arabic, building materials and sawn timber for railwayleapers and sustainable provision of non-wood forest products, Seid Ahmed. (1996).

Eighty percent of the total population depend on agriculture, and 98% depend on Firewood for energy purposes. The use of Firewood consumption roughly estimated at nearly $2m^3$ per capita per year. Source if possible wood burning makes use only of 5 percent of the energy released in open fire while charcoal is manufactured in primitive earth kilns which have recovery rate under 10 percent of dry weight of the wood. The charcoal stove efficiency in Sudan is 15-18 percent, lIED. (1990).

Next to Firewood collection, the most important forest activity in Sudan is Gum Arabic production, which also has a significant value for the national economy. In the Gum Arabic belt agriculture is traditional consisting of shifting cultivation that combines agriculture with forestry, lIED. (1990).

Acacia senegal. L. wild (Hashab tree) is found in a belt of 300 km wide across the southern frontier and Saharan desert from Mauritania in the west to Sudan Ethiopia and Somalia in the east, NAS. (1979). The rehabilitation of the Gum belt gardens promised to provide both cash income for population and reduce ecological damage, El feel. (1996).

Acacia Senegal is an important multipurpose leguminous tree species for afforestation of arid and semi arid areas in the tropical regions. This tree can provide Firewood, Fodder-Gum. It plays also a considerable environmental protection and minimizing soil erosion and have the ability to fix atmospheric nitrogen in symbiosis with rihzobium in root nodules. Population of organisms is generally much greater in number and diverse in forest soils than in agriculture soils, William. (1979).

Gum Arabic produced by the hashab tree is of high quality. Gum Arabic is also an important cash crop to people living in the rural areas. Gum Arabic is collected after harvesting other crops from November to March, Elfeel. (1996).

Gum Arabic is the natural gummy exudate obtained by tapping the branches of the hashab tree and its closely related species. Commercial production of Gum Arabic occurs principally in (Gum belt) on the southern periphery of the Saharan desert mainly between North latitudes 14^0. More than 80 per cent of world Gum Arabic supplies have perennially come from the Sudan, where it has been soured and exclusively marketed for more than twenty years by the Gum Arabic company LTD. Sudan is the origin of Hashab tree which produce the exudate known in Sudan as Gum Arabic prized for outstanding and highly uniform characteristics, such as excellent solubility, pale color, and superb emulsifying and film forming properties. It relatively of high species uniformity of the predominantly *Acacia senegal* tree stock in the Sudan makes possible this on going high Gum quality. Gum Arabic Company. (2000).

Problem statement:

In-spite of the fact that investment in forestry is not attractive, the Gandail company becomes pioneer in this sector. Gandail Company

planted hashab (*Acacia Senegal)* in Blue Nile State as a product of high value. The company is now collecting gum Arabic from planted areas as well as from rainfed plantation. This investment has an economical effects on rural people living at the vicinity of those areas. This study will cover the socioeconomic effects on those people from both employment side and Gum collection No previous studies had been conducted in this field before.

Objectives:

- To assess the socio-economic values provided by this investment to local people in the study area.
- To identify and highlight the services and benefits provided by investment in Hashab to rural people.

Data collection:

Two types of data were used in the research, primary and secondary data. Primary data was collected through the field surveys and interview secondary data was done through review of literature related to the research topic

Analysis:

Data is analyzed by frequency and percentage.

CHAPTER TWO
LITERATURE REVIEW

2.1. Background:

The Gandail company activities started in three province namely, Eddamazien in Khor Donya with an area of 52.000 feddans Rosairis Province in Altakamul with an area of 8.000 fed, and Bao Province with an area of2.200fed, Etaib. (2005).

The first agricultural investment was in 1991 in Abogamy with an area of 25000 feddans-planted with cash crops mainly sesame, millet, cotton, and sunflower. In season (1992) 4000 feddans were planted in both Abogomy and Altakamul. In 1993 season the planted area increased to 9000 feddans, in Abogomy and 7000 feddans in Altakamul. In 1994 the company tended to invest in hashab rather than in the cash crops and the reason behind this can be summarized in the following points as stated by Etaib (2005):

- Decline in agricultural crops-yield.
- Decline in cash crops prices locally and in the international markets.
- High cost of agricultural operations.
- Low cost of production of gum compared with cash crops.
- Good prices accur by gum Arabic.
- Gum Arabic could be stored when prices are not satisfactory.
- High demand for gum Arabic.
- Concentration of Gum Arabic in special Zone.

2.2. *Acacia sengegal:*

classification:

family:	leguminosae, sub family mimosoideae.
genus:	Acacia.
species:	*Acacia senegal var. senegal*.
Arabic name:	Hashab.

2.3. Botanical description:

It is a shrub or small tree 2-12m. high. Bark yellow to light brown or grey, rough, fissuring or flaking, young branch-lets with horizontal slit-like lenticeles. Stipules non spines-cent. Prickles at nodes in threes 2 lateral pointing up ward or forward and one central pointing down ward or back ward falcate 40mm long dark brown with grey base. Leaves 1-5cm long. Pinnae 2-6 pairs 0.5-3cm long. Leaflets 8-18 pairs. Linear to elliptic oblong. 1-6 x 0.5-2cm inflorescence spicat. 2-10cm long on peduncles 0.7-2cm long. Flowers white or cream, sessile-sepales 2x0.7mm. pubescent: petals 2-5x0.3mm. glabrous: stamens 4-7mm. long. Glandular. Fruit flat straight oblong membranous dehiscent pods 3-24x1-3.3cm. pale brown to straw coloured: seeds vertical in pod. Orbicular. composed 8-12mm a cross, yellow or pale brown: areoles crescent shaped. central. 1-5-6x2-5-5 mm funicles 7.5 mm long. Flowers Nov-Feb. fruit Jan-April, Elamin. (1990).

2.4. Ecology:

A. senegal (L) wild is native of hot subtropical to tropical regions with annual rainfall as low as 200 mm with 8-11 dry months in the year. Best development is in the range of 300-450 mm rainfall per year but it is found up of 800 mm, Ballal, (1991). It is intolerant to water logging condition-Altitude ranges from 100-800 meters above sea level. It tolerantes high daily temperature (mean maximum temperature of up to 45°c. (or more) IIED, (1991). In Sudan it grows on sites with annual

rainfall of 280 mm in sandy soils but mostly concentrated in the area between 280-450 mm rainfall. In the clay soils it grows in sites with annual rainfall of 500 mm and above - it is also found in sites with 900mm rainfall such as stony ground near Juba Badi *et al*. (1989).

The tree occurs almost in pure stands on sand between 280-450mm rainfall. But in higher rainfall it is confined to small batches and strips. In dark cracking clay of the central and eastern Sudan, the tree is never found in pure stands, but mixed with *(Acacia mellifera)* or *(A. seyal)*.

All the parties involved in Sudan Gum Arabic industry recognize the need to continually invest, maintain, and improve this most valuable resource, Badi *et al*. (1989).

2.5. Geographical distribution:

A. senegal (L) wild is found on the drier part of southern sahara and is found throughout the Saharan zone from Senegal to Somalia. The variety Senegal occurs in Africa and Asia. In Africa it is recorded in Senegal-Gambia, Mali, Ghana, Nigeria, Niger, Sudan, Ethiopia, Somalia, Central African, Republic of Cameron, Zaire, Rwanda, Uganda, Kenya and Tanzania. In Asia it is recorded in Pakistan, and India, Ballal (1991).

In Sudan it is distributed in a continuous belt from east to west, but more successful on the western sand plains of Kordofan and Darfur Elamin (1976). this belt is called the Gum belt which lies between latitude 10°-14° North. Within the Gum belt two main areas of distribution can be distinguished-the first is on stabilized sand dunes under rainfall of 280mm and above-but mostly concentrated between 280-450 mm. The second is dark cracking clays under rainfall of 500mm**.**

2.6. Regeneration:

A. senegal regenerates naturally and artificially. It regenerates freely on cultivated lands, when apiece of land is left fallow after cultivation where gum gardens are formed Harrison / Jackson, (1985).

A. senegal has remarkable coppicing power and thus coppicing is the most important way of natural regeneration Badi *et al.* (1989). Natural regeneration by seeds usually faces many hazards like fire, heavy grazing and over cultivation, which may lead to unsuccessful growing of the seedlings. The seedlings may also be damaged by pests like insects, millipedes squirrels and rabbits. Seif Eldin (1970).

Animals help in dissemination of hashab seeds by eating the pods and scattering the seeds with their dung. The seeds are then subjected to the effect of acids in the animals digestive system and will probably germinate as soon as it is dropped if the conditions are slightly moist. Badi et al, (1989).

Hashab tree is regenerated by seeds, seedling or coppices. Hashab seedlings are given to peasants in villages to be planted on private land to provide direct benefits and promote socio economic condition that prevailing in Blue Nile State. Development focuses on the necessity to improve the condition of the investment for the poorest strata of the rural people. Gum Arabic Company, (2000).

2.7. Biological importance:

A. senegal is a drought-resistant tree and withstand savanna harsh conditions, hence it can be used in reforestation projects. The tree is important through-out the Saharan zone especially for environmental economic reasons, e.g. stabilization of sand dunes-enrichment of soil by nitrogen fixation leaf litter and mineral, it also produces firewood, charcoal, and building materials, fodder for grazing animals. Moreover, the tree has the advantage of producing natural gummy exudate (Gum

Arabic) that is used widely in pharmaceutical confectioneries, ink, and other industries Elfeel, (1996).

2.8. The start of Hashab plantations in the study area:

Plantations start of Hashab in 1994 by Gandail as an alternative to cash crops production. The area planted was 4000 feddans in Abogomay and the same area was planted at Altakamul and Khor Donya. Seed were obtained from Tree Seed Center at Soba-Khartoum. In 1995 the area was increased by 600 feddans at Abogomay by 2000 feddans at Altakamul. In 1996 the area planted reached 9600 feddans in Abogomay and 4175 feddans at Altakamul. Planting in Khor Donya started in 1997 with an area of 8500 feddans, and increased to 10000 feddans in 1998 the total planted area was 12000 feddans. After that, the company stopped plantations an started to evaluate the gum production and marketing (Etaib, 2005).

2.9. Tending operations:

Tending operations were done manually only once in the first season of plantation and found to be costy. Now the tending operations are carried mechanically. Fire lines opening are carried annually to protect the plantation from fire hazards. Animals are also kept away during the sapling stages. Over grazing during sapling stage affected seedlings growth, so tensile protection was commenced during the first stage.

2.10. Protection of trees:

Animal are allowed to graze under trees with special care. Natural grazing is beneficial to hashab tree because it reduces fire hazards.

2.11. Tapping:

Tapping started as a test in 1998. The production was moderate. After that in 1999 another tapping was carried out as an other test at Abogomay and Altakamul in 1999 and the production was very good in

Abogomay and Altakamul. Tapping started in Khor Donya in 2002 because of insecurity and the production was under optimum but the general production is good. After that the projects started the commercial production and increased the area until it reached 13.600 feddans. The production in 2005 was 150,000 tones which is the peak point of production in the project. The tapping normally starts in October and ends in April. It was done through contractors and casual labors. Reasons for the decline of production in Khor Donya were low rainfall, and fire hazard, Etaib, (2005).

2.12. Gum Arabic collection:

After tapping, the gum is collected in number of pickings depending on the time of tapping. Up to seven pickings could be reached if the tapping is done early, the first picking is made 4-6 weeks after first tapping, subsequent pickings are made every 10-15 days IIED, (1991).

2.13. Gum Arabic production:

Apart of small amounts, that originated outside Africa, the continent is world's sole source of gum that enters world trade. Table (1) shows production level for gum in twenty four African countries. The table illustrates the wide variation in scale of production. Sudan has always been the principal producer and exporter of Gum Arabic, Nigeria is the second biggest producer and exporter, has the benefits of some resources as Sudan but has poor reputation for quality of its gum Arabic. Chad, the next most important after Sudan and Nigeria has recently increased production and quality of exported gum Arabic, Abdelazim (2002).

The vast majority of gum Arabic, which inters international trade, originates in so-called gum belt of sub-Saharan African. The belt extends from Mauritania, senegal and Mali in west Africa across the saled extends to Sudan, Ethiopia and Somalia in the horn of Africa. The belt lies

between latitudes 10^0-14^0 north and amounts to about 5200 square Kilometer (approximately one fifth of the total area of Sudan) the potential supply of Sudan gum Arabic from Hashab tree alone is at least several times the level of present production. Commercial production of good quality gum Arabic within this belt is, however restricted to areas where there is high degree of uniformity of the species (Abdelazim, 2002).

Table (1): Average annual inputted exports of Gum Arabic from 24 African countries for the period 1990 - 1998 (tones).

Country	Average annual export (per tones)
Sudan	19520
Nigeria	9263
Chad	5467
Tanzania	503
Cameron	471
Senegal	364
Central Africa	245
Mali	211
Zimbabwe	202
Eritrea	202
Ethiopia	141
Niger	138
Kenya	128
Burkina Faso	106
Egypt	100
Somalia	47
South Africa	25
Mauritania	18
Ivory cost	18
Togo	3
Gerria Bissau	2
Morocco	2
West Sahara	2
Djibouti	1

Abdelazim (2000)

Table (2) The Gum Arabic Purchases:

Season	Hashab	Talha	Total purchases
1990/91	11466	595	12061
1991/92	7152	177	7329
1992/93	9955	1455	11410
1993/94	22409	11049	33458
1994/95	39303	9455	48758
1995/96	30291	1434	31725
1996/97	17746	13	17759
1997/98	12479	4639	17118
1998/99	21165	6679	27844
1999/2000	3576	4393	7969
2000/2001	12009	3696	]5705
2001/2002	12855	3074	15929
2002/2003	13973	1865	15838
2003/2004	7953	7911	15864

Source: Gum Arabic. Co (2000)

2.14. Gum Arabic Marketing:

The first Gum Arabic market in Sudan was established in Elobeid 1900). Gum Arabic passed from hands of collectors to small merchants to big merchants and finally to the Gum Arabic Company, (GAC) Gum Arabic is brought by producers and local merchants to the auction market and sold by auction to buyers. In the auction market both producers and local merchants come together under one roof. Prices can go above the minimum floor price that are guaranteed by the central government but not below unless for defected gum Arabic. The auction system does not exit in all producing areas, and all producers cannot reach the auction market. Selling in this system is not obligatory; producers are thus free to sell directly to buyers out side the auction market, Nimer (1995).

2.15. Socio-economic impact:

The services provided by the company were markable. The company established a clinic, 25 hand pump stations, one Hafier (reservoir) and rehabilitated other 8 Hafier in Elrosairis with total cost, of $18000. Training people for tapping. It established (reservoir) in

Eddamazien and maintains 75 hand pump stations. One clinic in Griessar, one high secondary school and one basic schools were constructed.

2.16. Labour supply:

In some system of Gum Arabic production, labor supply is a prerequisite for tapping and collection of gum Arabic. The bulk of the labor. supply required for the silvo-agricultural operations in the central and eastern parts of the Sudan is drawn from the western states of Kordofan and Darfur. The supply of labor for Gum Arabic tapping and collection depends on the success or failure of rainfall and subsequently on the cultivation season in the homeland of immigrant labors. A successful cultivation season in those areas would markedly reduce the labor for tapping Hashab tree and collection of Gum Arabic. The demand for labor by agricultural activities can also affect the supply of labor for gum Arabic production. The major activities demanding seasonal labor supply in the Sudan include the irrigated cotton and Sugar schemes, mechanized commercial farming and charcoal burning. Unfortunately the competition between these activities and Hashab trees tapping and collection is high. Most of them are undertaken at the same time of year. Blue Nile is inhabited by smaller population which means large areas of naturally growing Hashab is available and the areas are attractive to migrant producers from the two western provinces of Kordofan and Darfur-International Institute, (1990).

2.17. Socio-economic importance:

A. senegal plays an important role in agricultural practice balance and also in socio-economic set up in Blue Nile State. The farmers and villagers have realized the multiple benefits from the Hashab tree as this tree provide them with additional income from gum production. The tree enriches the soil fertility as its roots fix nitrogen in the soil. The tree canopy intercepts the rain drops and prevents run-off and soil erosion. The tree also provides protection to the agriculture fields from moving sand particles, Ballal (1991).

2.18. Tapping tools and time:

Small axe is the traditional tool used in tapping the tree, with alight stork at the side of the branches. The axe blade is driven under the bark of the tree without penetrating the wood. These ends are pulled in turn creating a strip of bark about three quarters of an inch to one end and half inches wide and two to four feet long. The suitable time for tapping immerses when the bark is dark in colour and the leaves fall down Ballal, (1991).

2.19. Economic complementarity:

There is an obvious Economic complementary between gum Arabic production and other forms of production. This is reflected in the inputs required and income generated by the producer. In most parts of the belt gum Arabic as an activity and as source of income was rated second to crop farming and livestock rated last, specially after the last drought. In many areas in the sandy part of the belt producers said that the capital they used to buy livestock prior to the 1984-1985 drought was accumulated from cash surpluses generated from gum Arabic production. International Institute (1990).

CHAPTER THREE

STUDY AREA

BLUE NILE STATE

3.1. General Location:

Blue Nile is located at the South, East of the Sudan between latitudes 9° 30' and 12° 30' N and longitudes 33° 00' and 35° 00' E. It is bounded by Sinnar state from the north, Ethiopia from the east and Upper Nile state from the South-West.

The Blue Nile state has an area of about 38.500 Km^2 (8.8 million feddans). The main feature of the state is the Blue Nile river that is running through it (Yahia, 2004).

The state is located at the savannah zone with a good wealth of natural resources and vegetation cover that increases from north to south due to increased amounts of rainfall. These resources include, range land, soils, water, wild life and minerals. These resources make the state participates highly in the National economy, census.

3.2. Administrative Divisions:

The Blue Nile State is divided into four administrative units, these are Eddamazin Province, Elrosaris Province, Kurmok and Bao Province**.**

3.3. Climate:

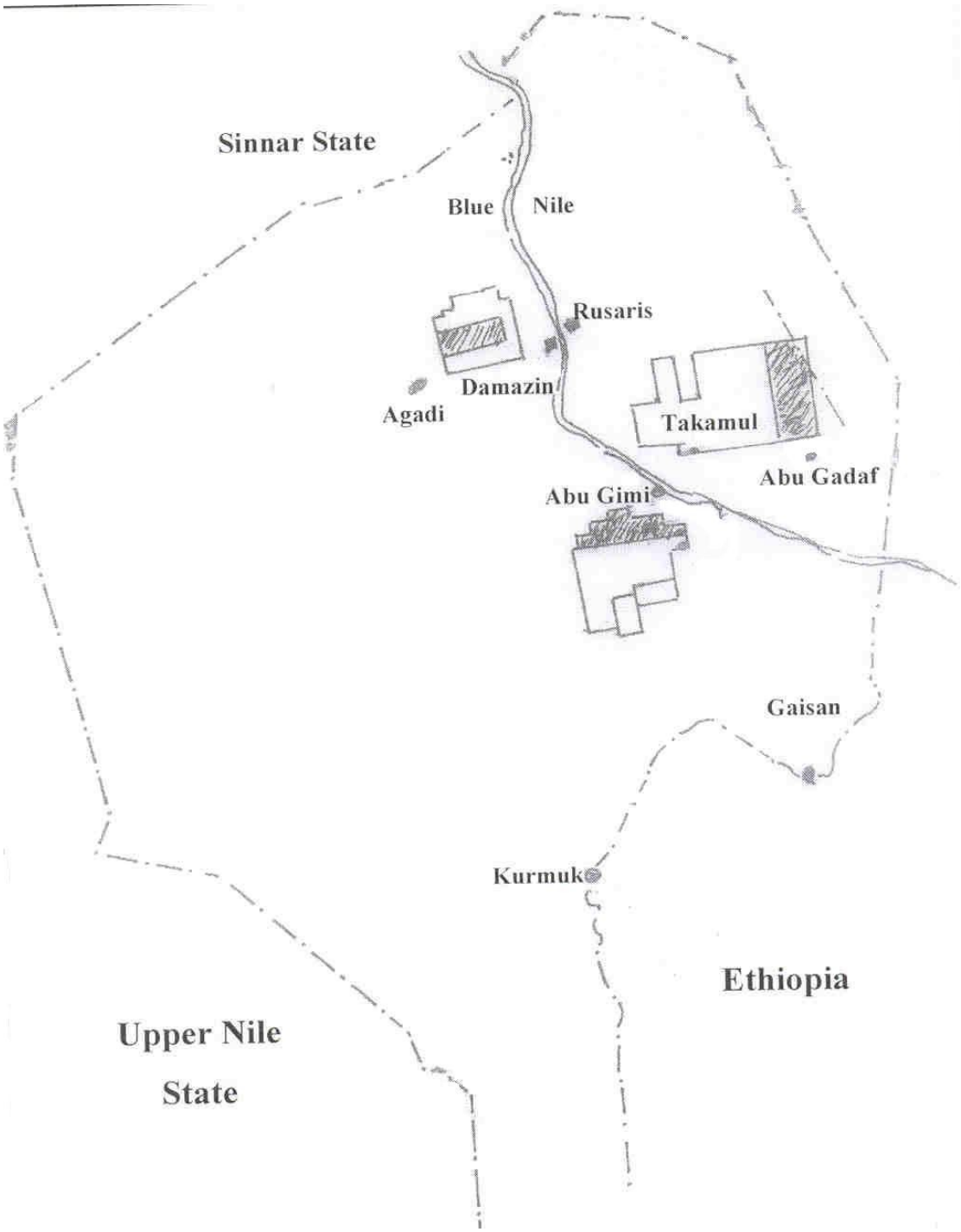
3.3.1. Temperature:

Normally temperature is ranges between 10-40°C during rainy season (June-Sep), while in dry season (Feb-April) is increasing and sometimes more 40° C is recorded.

3.3.2. Humidity:

The average relative humidity is decreasing to less than 5% in the dry season. Then start to increase upto 20-25% in Feb-April and rises up to 30 -35% during winter time and reaches maximum 70-80% in the rainy season (August-Oct) Geziera Company (2004).

Map (1). Acacia company planting sites



Source: Gandail company (2005).

3.3.3. Wind:

Wind volicity is very low due to dense vegetation and ranging from 1-2 m/sec. (at 2 meter above the sea level).

3. 3.3. Rainfall:

The annual rainfall is ranging between 400-800mm (Fig. 1 & 2).

3.4 Soil:

The soil of Blue Nile state is classified into the following categories according to their location.

3.4.1. South central clay plain:

3.4.2. Soil mapping (SMI):

This represent the common soil types in the state with an area of about 2.7million feddans (1.1 million ha). It contains clay plains and other types of soil. The Blue Nile river flood slope/depressions with its sediments areas near it and along its various branches. This soil is described as dark cracking clay soil or vertisols with dark grey or grey-brown colour.

3.4.3. Soil Mapping (SM2):

This soil cover an area abut (1.25 million feddans 525000 ha). It is extended in Dindir Park and its surroundings. The SMI seams to be like A-SMI but it so pumpy and hilly towards Ethiopia and this is because of presene of myaa and karab land.

3.4.3. Areas along Blue Nile river:

This is the soil type that found North Damazin close to the Blue Nile. It has slope and high areas in some places integrated with Karab land, this type of soil is most affected by surface erosion and clay soil eroded by running water from the Karab.

3.4.4. Hilly areas:

This also another common soil type that cover area of about 2-5 million feddans (882000 ha). It comes from Ethiopian mountains and sloppy areas around due to water erosion at quite times, some other accumulated form of these soil cover areas along the river until Karab land.

3.4.5. Locally formulated soil:

It is a red clay soil formed at parent rock in areas that a little bit higher than its surrounded clay plain. It's pH is an acid in clay plain areas and alkaline in below layers that contain some rocks.

3.4.6. Hills and Mountains:

Hills and mountains are the areas that extended from Ethiopia Mountains and constituted of a big rocks of which some one is acid guranite and other one is a parent rock. The texture of this soil is silty clay to clay. This type of soils found in Bao areas (Land and Water Research Center, 1999).

3.5. Vegetation cover:

The optimal rainfall in the state gives opportunity to annual and perennial grasses to complete their life cycle which results in a good range production. Vegetation types are formed according to variation in the rainfall. So vegetation cover in the area is as follows:

According to different divisions (6divisions).

Divisions 1: Northern Blue Nile State.

Dominant trees are *Acacia mellifera*, *Balanites aegyptiaca*

Divisions 2: Trees in medium Blue Nile State

Acacia seyal vari seyal, Acacia senegal, Anogeissus leiocarpus.

Divisions 3: Trees in southern Blue Nile State.

Dominant trees species are:

Tamarindus indica, Cordia africana, Diospyros mespiliformis.

Divisions 4: Trees in hilly areas:

Dominant trees species are:

Sterculia setigera, Boswellia papyriera

Divisions 5 : Trees along valleys.

Dominant trees species are:

Oxytenanthera abyssinca

Divisions 6: Trees along the rivers.

Dominant trees species are:

Acacia nilotica, ziziphus spina-christi.

Concerning grass cover, divisions are as follows

Divisions 1: Dominant grass in deep clay soil.

Dominant grass species are:

Cymbopogon nervatus, Sorghum perpureo-screcium

Divisions 2: Dominant grass in clay soil.

Dominant grass species are:

Seltaria spp, pennisetum polystachion

Divisions 3: Dominant grass in commercial farming

Dominant grass species are:

Pnnisetum vamsum, Danebere spp.

Map (2). Vegetation cover in Blue Nile State

Source: Blue Nile State , ministry of agriculture (2005).

Table (3) Dominant grasses in the study area:

Dominant grasses in deep clay soil	
Scientific name	**Arabic name**
Cymbopogon nervatys	النال
Sorghum perpureo-screcium	أنيس
Prachiaria-spp	أم كويعات
Rottboellia spp	(ذري (أم بليلة
Ipomoea spp	التبر بأنواعه
Echinochloa pyramidatis	أم جر
Dominant grass in clay soil	
Scientific name	**Arabic name**
Dactlyocteniem spp	أبو أصابع
Seltaria spp	ضنب كديس
Pennistum polystachion	أم خميرة
Dominant grass in commercial farming	
Pennisetun vamsum	البعشوم
Ischaemum afrum	أنكوج
Esmodiyn spp	أبو عريضة
Danepere spp	أم مليحة

Source: Gazira company

3.6. Population:

The state has a total population of about 675.484 (1992) inhabitants. The main ethnic groups are Fung, Hamag, Angasna, and Fallata, besides more than 30 tribes living in this state. Arabic is the main language, but most tribes have their own local languages. The population distribution according to province are found to be 39% in Eddamazine, 28% in Rosairis, 20% in Bao and 13% in Kurmuk Riboberstion, (1922-1932).

3.7. Economic activities:

3.7.1. Agriculture:

Most of the state land is suitable for crop cultivation which represents about 10% of the total area. More than 80% of the population depend on agriculture for their livelihood which involve about 75% of labor, Yahia. (2004).

3.7.2.Foresty:

Forest represents one of the most dependable source of livelihood to the people of the state specially in the last 10 years when agricultural production declined. The people tend to invest in forestry but without close control because they only seek benefits (Table 4) The areas under forest include.

Government forest	1074816.6 feddans.
State forest	11871595.14 feddans.
Private forest	0371921.8 feddans.
Community forest	200.8 feddans.

3.7.3. Pastoralism:

The total area of the Blue Nile State is 8.5klm^2. eighty percent of this area is flat clay plains which is suitable for agriculture and pasture. According to the future of agriculture and forest study, by Gaziera

Company (2004).the total livestock at the state is approximately as follows:

Cows	2977600 heads
Sheep's	3965000 heads
Goats	222600 heads
Camels	130000 heads

Form live stock number above we can say the state is very rich in animals. Therefore great number of the people are pastoralists their main job is keeping and grazing animals. So grazing is directly comes after agriculture practicing. G. C. (2004).

Table (4) Trees in the study area:

A	**Trees in northern Blue Nile State**
Scientific name	**Arabic name**
Acacia mellifera	كتر
Balanites aegyptiaca	الهجليج
Acacia nubica	اللعوت
B	**Trees in medium Blue Nile State**
Scientific name	**Arabic name**
Acacia seyal var seyal	الطلح
Acacia senegal	الهشاب
Acacia seyal var fistula	الصفار
Anogeissus-leiocarpus	الصهب
C	**Trees in southern Blue Nile State**
Tamarindus indica	العرديب
Lonchcarpus laxifloris	الخشخاش الأبيض
Dalbergia melanoxylon	الأبنوس
Cordial africana	الغمبيل
Diospyros mespiliformis	الجوغان
Podocarpus leucans	الطرايا
Commiphera Africana	ال قفل
Hyphaene ihebacia	الدوم
Adansonia digitata	التبلدي
Pseudocedrela cotchyi	الدروبة

D	**Trees in Hilly areas**
Scientific name	**Arabic name**
Sterculia setigera	الترتر
Boswellia papyrifera	الطرق طرق
E	**Trees along valleys**
Scientific name	**Arabic name**
Oxytenanthera abyssinca	ال قنا
F	**Trees along the rivers**
Acacia nilotica	السنط
Zizyphus spina-chrtisti	السدر

CHAPTER FOUR
MATERIALS AND METHODS

4.1. General:

Two methods of sampling techniques have been used. The first method is purpositive technique, and this is used for villages selection, the three villages purpositively selected lie within a Gum Arabic belt. The second method is simple random sampling techniques for the selection of the respondents.

4.2. Selection of the villages:

Selection of villages was done according to the distribution of existing employment and community forestry activities in the study area. Three villages were selected, *EIsirajea, Haron* and *Aburmad.* The first one was 40 Kilometers north of *Eldmazin* town, the second was located at 50 kilometers Northwest of Eldamazin, and the last one was ten kilometers west Eldamazin town.

According to the census (2002) the population were 6181, 2179 and 1807 for Elsirajea, Haron and Aburmad respectively.

4.3. Questionnaire:

A questionnaire was prepared after some discussion with Acacia company officials and groups discussion with some of the targeted group. The survey was conducted among the sedentary farmers, pastoralist, foresters and other people. 100 of the respondents in three village were selected. This number is equivalent to 1% of the total population for the three villages. Questions were prepared to give answers to fulfill the objective of the research to collect informations such as age, occupation, and level of education. Other set of questions were about the factors that contribute to socio-economic studies (Appendix). Observation together with group were undertaken as a tool for data collection.

Relevant secondary data were collected from archives reports of the project and previous studies. The perception of expert forms an important element in the study area such as average of rainfall, population, production of Gum Arabic, number of live stock and others.

4.4. Data analysis:

The information collected from study area was analyzed in qualitative way according to the nature of the study. The data analyzed by using Statistical Package of Social Science (SPSS).

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1. Background:

The study was carried out in Blue Nile State within the Gum Arabic belt. Main purpose of the study is to investigate the role that Acacia Company plays-specifically for the local people. It was well known that gum Arabic gains a high return if compared with other cash crops. The interest of Acacia company (Gandail) is the planting of hashab tree *(Acacia senegal)* for Gum Arabic production. Data was collected, analyzed and the result will be discussed in this chapter.

Table (1). Shows that, the classification of respondents according to age group 53 of them lies in the age group less than 30 years followed by 26% of them lie in the age group 30-45 years and 21% of them in the age group more than 45 years. The reason behind this is the fact that 53% of respondent lies in the active group less than 30 years age may be due *to* the attractiveness of Acacia company because it provides employment with high payment. The respondents in this group were previously working as herd keepers around surrounding cities with low rate of payment.

Table(1): The distribution of respondents according to age groups (2005).

Percentage	Frequency	Age
53%	53	Less than 30 year
26%	26	30 - 45years
21%	21	More than 45 years

Taking gender issue into consideration, 90% of the respondents were males because the type of work in Acacia company does not lie in the field of females interest. Only 10% of respondents were females. The

marital status of respondents indicated that 67% were married, while 16% were single and 17% of respondents were divorced.

Table (2): Respondent's sex and marital status

Respondent's			**Respondent's marital status**		
Sex	Frequency	Percentage	Status	Frequency	Percentage
Male	90	90	Married	67	67%
Female	10	10	Not Married	16	16%
Total	100	100	Divorce	17	17%
			Total	100	100%

Table (3) shows that respondents are either farmers herders, traders or doing other jobs as the work in Acacia company. In the rainy season the composition of the respondents are farmers who constitute 30%, herders 33%, traders 12% and other jobs constitute 25%. The majority of the respondents are farmers and herders 63%. This indicates the strong relationship between respondents and the forest. Because all farmers practicing agro-forestry system and herders depend on forest in grazing.

Table (3): Respondent's occupation.

Occupations	Frequency	Percentage
Herder	33	33%
Farmer	30	30%
Other occupation	25	25%
Trader	12	12%
Total	100	100%

Most of the respondents 72% were exposed to different educational level while 28% of them are illiterate. The level of education starting from basic school up to university.16% of respondent are Khalwa level, 20% are basic school 32% are secondary school, and 4% are university, level Histogram (3). The reason is that because most of respondents are animal herders and consequently their children help them in guarding the animals and other services. Also they assume that education at school isn't useful so some of them send their children to the Khalwa.

There are some differences between the respondent according to the income sources. 29% of respondents reported that they were farmers 26% of them were herders 22% of them reported that, they were traders and 23% of respondents were working in other jobs. They are showed in histogram (4).

Table (4) shows that there are differences between the respondents investigated according to the monthly income 25% of respondents lie in group of income 0-10000 thousand SD 23% of them lie in group of income 11000 -20000 SD, 21 % of them in group of income 21000-30000, 10% of them in 31000- 40000, 8% of them -in 41000-5000, 2% of respondent in 51000-60000, 1% of them in group of income 61000-70000 and 10% of the respondent are in group without income. The reason that the 60% of the respondent's income less than 3000SD that because most of them were herders and farmers.

Table (4). Monthly income:

Range in thousands Sudanese dinnars	Frequency	Percentage
0 -10000	25	25%
11000 - 20000	23	23%
21000 - 30000	21	21%
3 1000 - 40000	10	10%
41000 - 50000	8	8%
51000 - 60000	2	2%
61000 - 70000	1	1%
Nothing	10	10%
Total	100	100%

There are differences between the respondents according to the services improvement in the study area 92% of the respondents have improved services such as clinic establishment pump station, Hafeer (reservoir) rehabilitate and other irrigation of water pump stations, digging one Hafeer and maintenance of 8 old ones and establishing one basic school and secondary one.

From table (5) it is obvious that Acacia Company had improved the services in the area and consequently improved their standard of living.

Table (5): Services improvement in the study areas.

Answer	Frequency	Percentage	Services
Yes	92	92%	Establishment of clinic
No	8	8%	Pump stitch, Hafier
Total	100	100%	Reservoir, rehabilitate

Table (6) shows that there are differences between the people in terms of their income percentage, 19% of the respondents were of high level income, 36% of them of medium level income, 35% of them of minimum level income and 10% of the respondents have nothing. According to this table the project has increased income for people who live in surrounding area.

- High level 1,5%.
- Medium level 10%.
- Minimum level less than 10%.

Table (6): Income percentage.

Answer	Frequency	Percentage
Medium level	36	36%
Minimum level	35	35%
High level	19	19%
Nothing	10	10%
Total	100	100%

Table (7): Income upgrading

Answer	Frequency	Percentage
Yes	90	90%
No	10	10%
Total	100	10%

From table (6) it is obvious that more the 50% lie in high and medium levels. In table (7) 90% of the respondents said that the project had up grade their income. These figures indicated the positive influence of the project regarding up grading their income and consequently their standard of living.

There are difference between respondents investigated towards the influence of work in Gum Arabic on other activities. 80% of respondents said that there is an influence and 20% of them their answer is negative.

Table (8): The influence of other activities in the work in Gum Arabic Company.

Answer	Frequency	Percentage
Yes	80	80%
No	20	20%
Total	100	100%

The reason that why most of the respondents said that there is an influence between work in Gum Arabic on other activities. The demand for labors by agriculture's activities can also affect the supply of labors for gum Arabic production, the major activities demanding seasonal labor supply in the Sudan include the irrigated cotton, sugar schemes, mechanize commercial farming and charcoal burning. Unfortunately the competition between these activities and Hashab tree tapping and collections is high, the most of the activities are taken at the some time of the year.

Table (9) shows that 94% the respondents said that planting of Hashab by Acacia Company has provided opportunities of grazing for

local people in the area under study. Generally camels and goats grazing is harmful for Hashab trees while cattle grazing is not. Being all most entirely grass eaters, cattle can help in reducing and breaking the tall grass cover in the savannah and consequently good conditions for favoring the establishments of hashab trees.

Table (9). The impact of A.C. on grazing provision:

Answer	Frequency	Percentage
Yes	94	94%
No	6	6%
Total	100	100%

Table (10). Shows that 74% the respondents are aware about Hashab tree benefits while 6% are not aware.

Table (10). A worseness raining towards hashab tree benefits in the study area:

Answer	Frequency	Percentage
Yes	74	74%
No	26	26%
Total	100	100%

There are differences between respondents according to their income generated from working in Acacia Company. It is higher than in other activities. 96% of the respondents agreed that the profitability of working in Acacia Company is better than other disciplines, but 4% of them disagreed with that. The reason for that is hashab tree is a multipurpose tree species.

Table (11) shows the attitudes of the respondents to wards income generation in A.C.

Answer	Frequency	Percentage
Yes	96	96%
No	4	4%
Total	100	100%

There are differences among respondents to employment opportunities provided by Acacia Company in the study area. 99% of the respondents said opportunities of work are increased and only 1% of them said no, the reason that most respondents said the project increased opportunities. This attributed to the services provided by the company at the study area.

Table (12). Employment opportunities at the area provided by A.C. in the study area:

Answer	Frequency	Percentage
Yes	99	99%
No	1	1%
Total	100	100%

Table (13) shows that there were differences among the respondents to wards the environmental improvement as a result of planning Hashab trees as perceived by the respondents. 52% of the them said that the environment is improved, 47% of them said there is no environment improvement and only 1% of them said they don't know. The respondents explained this improvement by the increase of humidity, rainfall and the reduction in temperature.

Table (13): Environmental improvement as perceived by the respondents.

Answer	Frequency	Percentage
Yes	52	52%
No	47	47%
Don't know	1	1%
Total	100	100%

Table (14). shows that there are difference between the respondents 79% of the respondents explained that there were no conflicts. This is regarding conflicts according to the benefits they provided by the company. But 21% of the respondents said there is conflict, this may be due to that they do not want hashab plantations to extend on their agricultural and range lands.

Table (14). Conflicts arise due to existence of A.C. in the study area.

Answer	Frequency	Percentage
No	79	79%
Yes	21	21%
Total	100	100%

CONCLUSION AND RECOMMENDATIONS

Conclusion:

From the answers of the respondents, according to age groups. The study showed that the age group less than 30% years age seemed to see that project is attractive to young people. The frequency and percentage of the gender showed that in the study area those who are working in Gum Arabic production are mainly males.

The study investigated that respondent's occupation are either farmers, herders or traders. Most of the people are poor and depend upon marketing of some forest products (Gum, Doom, Saafe, etc) to improve their life.

The Socio-economic survey of the respondents concluded that the illiteracy is high among the young generation in the study area, it also showed that the work in Gum Arabic influenced the work on other activities.

The project provided many services such as school buildings, water provisions and clinics.

The project in study area created chances for employment opportunities and also the Acacia company created some grazing needs.

Income generated from working in Acacia company is higher than the other activities.

Recommendations:

The study recommended that extension is needed among the people so as to know more about the Hashab tree, such as tapping collection, and production and the suitable time for pickings.

There may be need for methods that help in adapting planting Hashab tree as diet and also need research about spacing between Hashab tree, rows and within tree.

More rainfed plantations of Hashab tree, investment in forest, and a biological protections are needed.

REFERENCES

Abedelazim, M. I. (2002): Gum production in Africa with special reference to Sudan, emphasis on potential for poverty alleviation, un published.

Badi, *et al* K. A. A. E, Ahmed and A.M.S. Bay Oumj (1989): The forest of Sudan agricultural research council (A.R.C). Khartoum.

Ballal, M.M. (1991): *Acacia senegal* amulti purpose tree for arid and semi arid propics MSc. thesis University of Wales Bangor. UK.

Elamin, M.H. (1990): Trees and Shrubs of the Sudan.

Elamin, M.H. (1976): Gerographical distribution of the Sudan Acacias Bulletin No.2 forest administration. Khartoum.

Elfeel, A.A. (1996): Provenance variation in seed characteristics, Germinations and early growth trails of *Acacia senegal* L. wid. In Sudan (MSc)

Eltaib, A.D. (2005): Acacia Company (interview).

G.A.C (2000): Gum Arabic company, for report of quality and marketing.

G.C. (2004): Geziera company for National Unite of experts investment map for Blue Nile State.

Harrison, M.N. and Jackson, J.K. (1985): Ecological classification of the vegetation of the Sudan. Forest Bulletin New series No.2, Forest Department. Sudan-Khartoum.

IIED, (1990): Gum Arabic belt rehabilitation in the Republic of the Sudan. Study inception report for the project preparation unite of the Ministry of finance and economic planning. The Republic of the Sudan.

I.I. (1990) International Institute for Environment and Development Endskeigh Street London WCIH-ODD England.

L.W.R.C (1999) Land and water research center in (agency of

agricultural technical of research.

N.A.S (1979): Torpical Legumes a resource for the Future, National Academy of science. Washington DC 20418.

Nimer, A.M.M. (2000): Effects of *Acacia senegal* L. wild on sandy soils and Assessment of its foliage nutrient content. Case study of damokeya forest Northern Kordofan State.

Palma B.G.F. Vogt and Veville P. (1996): Combine invitro method for improvement of grafting in *Acacia senegal* L. wild. Journal of Hort. Sci: 379-381.

Ribobertson, J.M. (1922-1932). Africa surrounding P56.w.

Seif-Eldin, A. and Obeid M, (1970): Ecological studies of the vegetation of the Sudan. The germination of seeds and establishment of seedling of *Acacia senegal.* L. Wild. Under controlled condition. In the Sudan Journal of applied Ecology 8:191-201.

Seid Ahmed, H.A. (1996). The development of furniture industry in Singa, Sudan. M.Sc. Thesis, University of Khartoum.

Sudan Finland afforestertation program June (1988): Factors affecting the attitude of villagers towards the afforestation program, Socio-economic case study in the Tendelti-Kosti area. Technical Report No.11.

WilliM, L.P. (1979): Properties and management of forest soils, John Wiley and Sons New York.

Yahia, S.M. (2004): Future of the Gum Arabic in Blue Nile State, Gum Arabic Company in Blue Nile State un published.

Appendix

Socio-Economic questionnaire to study the effects of Gandail Company, for Hashab trees plantations project.

Study area Blue Nile State

Please answer all questions, put mark ( ) between the brackets

In case the answer dose not mentioned please answer the nearest answer

Date:…….. age:……

Sex: Male ( ) Female ( )

Area:……..……...

Occupation:……...……

Education level:

Illiterate ( ) Basic / Khalwa ( )

Secondary ( ) University ( )

Post graduate ( )

Marital Status:

Married ( ) Single ( ) Divorced ( )

Monthly income:……..……

Monthly income sources:……...

(1) What was your income before project establishment?

(a) Agriculture ( ) (b) Pastoralist ( )

(c) Trading ( ) (d) Others ( )

(2) Does the project improved your life standard?

(a) Yes ( ) (b) No ( )

(3) Does the project increased your income?

(a) Yes ( ) (b) No ( )

(4) In-case you answered Yes. Please explain the increased percentage?

(a) High 15% ( ) Moderate 10% ( ) Low less than 5% ( )

(5) Does the project affect your occupation?

(a) Yes ( ) (b) No ( )

(6) In-case you answered No. Explain the reasons?

(a) ……

(b) ……

(c) ……

(d)……

(7) What type of services that project provided?

(a) ……

(b) ……

(c) ……

(d)……

(8) Dose the project improved the pasture at the area?

(a) Yes ( ) (b) No ( )

(9) Does the project contributed in raising community awareness?

(a) Yes ( ) (b) No ( )

(10) Does work in Gum Arabic project more profitable in comparison with other crops growing or with other occupations?

(a) Yes ( ) (b) No ( )

(11) Dose the project provided any chance for working?

(a) Yes ( ) (b) No ( )

(12) Does the project improved the environment at the area?

(a) Yes ( ) (b) No ( )

(13) In-case your answer is Yes. Explain it?

(a) ……

(b) ……

(c) ……

(d)……

(14) Does the project created problems in the area?

(a) Yes ( ) (b) No ( )

(15) In-case your answer is Yes. Mention these problems?

(a) ……

(b) ……

(c) ……

(d)……