

CHAPTER ONE

INTRODUCTION

1.1 General

Development of local economy while conserving the environmental Non-timber forest products (NTFPs) are one category of resources that have resources has become an integral part of sustainable development policy. a potential for contributing to the local economy and improved natural resource management, leading to conservation of the ecosystem and biodiversity of an area. The role and contribution of NTFPs have been crucial in subsistence as livelihood support, in rural economics and biodiversity conservation since times immemorial due to their richness of variety. About 80% of the population of the developing world depends on NTFP for their primary health and nutritional needs (FAO, 1995).

Non-wood forest products derived from the forests and woodlands of Africa play different roles in the livelihood strategies of different types of users ranging from being a source of food for subsistence, materials, medicines and equipment to safety nets (Belcher and Kusters, 2004). Depending on circumstances, they can be treated as ‘daily net’ and a ‘safety net’. The ‘daily net’ describes everyday use, with products meeting current household needs, offering a reliable source of income to purchase agricultural inputs, or fodder for livestock herds. A ‘safety net’ comes into play when other sources of household income (e.g. agriculture) fail to meet dietary shortfalls, or whenever a quick cash option is required (Emmanuel, etal, 2010).

1.2. Problem Statement:

About 80% of the population of the developing world depends on NWFPs for their primary health and nutritional needs. Several millions of people all over the world depend on these products for meeting their subsistence consumption and income needs (FAO, 1995). In Central Darfur State, new economic opportunities for local people have been sought for last years, so the majority of poor households in rural communities particular in Wadi Saleh Locality depend on harvesting of NWFPs to cope with shortage of agriculture crops. Thus NWFPs provide as sources of food, fodder, medicines, gums, resins, construction material, etc. In addition to local consumption and economic development in many villages. However, very limited information's and data are currently available on the exploitation, marketing, consumption and trade of NWFP by local people. Therefore this study assess the contribution of NWFPs in rural household economy and poverty alleviation of rural communities

1.3 Objectives

1.3.1 General objective:

To assess the useful information on contribution of NWFPs in improving the livelihoods of local communities in Central Darfur State.

1.3.2 Specific objectives:

- 1 .To assess the direct and indirect contribution of NWFPs in improving the livelihood of household in Wadi Saleh Locality.
2. To identify the sources, types and uses of NWFPs utilize by local people in the study area.
3. To assess perception and awareness of local people about the importance of NWFPs as sources of income.

4. To identify the main constraints faced the local people in collection and marketing the NWFPs at Wadi Saleh Locality.

1.4. Research questions:

Some questions are formulated according to the objectives of study:

1. How the NWFPs contribute directly and indirectly in the livelihood of household?

2. What are the types, uses and current status of NWFPs in the study area?

3. Are the NWFPs an integral part for constitute rural households livelihood and contribute to them significant?

4. What are the main constraints that affect the collection and marketing of the NWFPs by rural people?

CHAPTER TWO

LITTERATURE REVIEW

2. 1. Back ground:

Non-wood forest products derived from the forests and woodlands of Africa play different roles in the livelihood strategies of different types of users ranging from being a source of food for subsistence, materials, medicines and equipment to safety nets (Belcher and Kusters, 2004). Depending on circumstances, they can be treated as ‘daily net’ and a ‘safety net’. The ‘daily net’ describes everyday use, with products meeting current household needs, offering a reliable source of income to purchase agricultural inputs, or fodder for livestock herds. A ‘safety net’ comes into play when other sources of household income (e.g. agriculture) fail to meet dietary shortfalls, or whenever a quick cash option is required (Emmanuel, etal,2010).

Non-wood forest products are goods of biological origin derived from forest , wooded lands and trees outside forests .The modern scope of forestry is being reported to have expanded ,reflecting the fact of the importance of many non-wood forest products which has increased .Leading to new interfaces with related disciplines (L.F.c.c.,1999).

most tropical countries, non-wood forest products (NWFP)—play an important role in the daily life and well being of the local population. In particular rural and poor people depend on NWFP as sources of food, fodder, medicines, gums, resins, construction material, etc. In addition to local consumption. However, very limited statistical data are currently available on the exploitation, management, consumption and trade of NWFP. Unlike timber and agricultural products, no regular monitoring

and evaluation of the resources and socio-economic contribution of NWFP at the national level is being carried out. Therefore, information is limited to NWFP of main national importance (e.g. gum Arabic in Sudan). http://www.fao.org/forestry/fo/country/nav_world.jsp

2.2. Concept and definition of Non-wood Forest Products:

NWFPs can be defined as all goods and services for commercial, industrial and subsistence use, other than wood, derived from forests and their biomass which can be sustainably extracted, i.e. extracted from a forest ecosystem in quantities and ways that do not alter its basic reproductive functions (FAO, 1992).

NWFP are products of biological origin other than wood derived from forests, other wooded land and trees outside forests (FAO, 2008).

2.3. Classification of Non-wood Forest Products:

2.3.1. Importance and Scope:

The word class refers to a group of things having the same or similar characteristics, and classification refers to assignment to or arrangement by, hierarchical classes. In arranging by classes, classifications provide a rational system of relationships wherein distinction and coherence between elements are put into shape by a logical structure and ordering, within defined boundaries. Classifications are essential to help in providing data by homogenous categories and to display interconnections between categories. By providing boundaries to classes and avoiding overlaps and inconsistencies, classifications add to the clarity and comparability of information. Classifications are thus important for data gathering and management, scientific investigations, analysis and

evaluation of trends and outlook, aggregation and dissemination of information, planning and policy making. By following classification systems, bridges can be built between various statistics even when different units are used. To simplify the classification, NWFP were categorized according to their end use, as described in Table 1 (FAO,1992).

Table (1): Main categories of NWFPs

Plant products		Animals and animal products	
Categories	Description	Categories	Description
Food	Vegetal foodstuff and beverages provided by fruits, nuts, seeds, roots, mushrooms, etc.	Living animals	Mainly vertebrates such as mammals, birds, reptiles kept/bought as pets
Fodder	Animal and bee fodder provided by leaves, fruits, etc.	Honey and beeswax	Products provided by bees.
Medicines	Medicinal plants (e.g. leaves, bark, roots) used in traditional medicine and/or by pharmaceutical companies	Bush meat	Meat provided by vertebrates, mainly mammals
Perfumes and cosmetics	Aromatic plants providing essential (volatile) oils and other products used for cosmetic purposes	Other edible animal products	Mainly edible invertebrates such as insects (e.g. caterpillars) and other "secondary" products of animals (e.g. eggs, nests)
Dying and tanning	Plant material (mainly bark and leaves) providing tannins and other plant parts (especially leaves and fruits) used as colorants	Hides and skins	Hide and skin of animals used for various purposes
Utensils, handicrafts and construction materials	Heterogeneous group of products including thatch, bamboo, rattan, wrapping leaves, fibers	Medicine	Entire animals or parts of animals such as various organs used for medicinal purposes
Ornamentals	Entire plants (e.g. orchids) and parts of the plants (e.g. pots made from roots) used for ornamental purposes	Colorants	Entire animals or parts of animals such as various organs used as colorants
Exudates	Substances such as gums (water soluble), resins	Other non-edible animal	e.g. bones used as tools

	(water insoluble) and latex (milky or clear juice), released from plants by exudation	products	
Other	e.g. insecticides, fungicides		

Source: (FAO, 1992)

2.4. Importance of NWFPs at Household Level:

The importance of Non Wood Forest Products (NWFPs) that contributing to rural livelihoods and alleviating rural poverty is well known. It is estimated that about 60 million highly forest dependent people in Latin America, West Africa and Southeast Asia, with an additional 400 to 500 million people especially communities living inside and on the fringes of forest areas depend on NWFPs for food, shelter, medicine, cash income etc. Apart from meeting subsistence and cash income needs of the dependent communities, NWFPs also support large number of small to large-scale enterprises engaged in processing and/or trading of NWFP and NWFP based products (FM,2011).

Non-wood forest products are a key resource for many poor communities. In western Africa, for example, bush meat provides 25 per cent of protein requirements, and can be the principal source for some indigenous groups. While there is some truth in the above statement, increased poverty and food insecurity are leading many people to turn to wildlife as a source of food. It was that bush meat is more important for income than food and hunters often sell their catch to buy cheaper alternative foods. In addition, poor households may not benefit, as often they may not even have males to carry out the hunting. In eastern and southern Africa, where the sale of wildlife products is commonly outside the formal economy the contribution of bush meat goes unnoticed (Emmanuel, et al,2010)

2.5. Role of NWFPs in National Economics:

At the national level, NWFPs production and use, both in the informal and formal sectors, involve large numbers of people in harvesting, collecting, processing, marketing and in some cases even exporting. The informal natures of NWFPs-transactions often result in the rural producers not receiving an equitable share of the benefits/profits, especially in situations where exploitative trade relationships exist. NWFPs activities are in many situations perceived as a sponge, and their use transitional, giving way to other enterprises and products as economy improves. Much of the production and trade in NWFPs are local in nature. Rural markets for most NWFPs do not grow rapidly if it caters only to local needs. Generally, growth of rural markets for NWFPs depends on growth in urban demand, which often tend to grow faster. Urban markets for NWFPs tend to encompass a narrower range reflecting competition from alternative products and changing consumption patterns, even though there is increasing demand for some products like traditional medicines and some forest foods

www.fao.org/docrep/V7540e/V7540e27.ht.(FAO,2000)

2.6. The Socio-economic of NWFPs for local people

NWFPs deserve special mention because of their great potential to support an economic development consistent with the principles of Sustainable Forest Management (SFM). NWFPs cover a wide range of products (goods and services) from thatching materials to medicinal plants. These products are the essential needs of local communities. Some NWFPs, such as latex, gums, resins, essential oils, flavors, fragrances and aroma chemicals help to promote value-added processing, niche marketing and export trade.

NWFPs can provide increased employment opportunities and income-earning capabilities. Deriving the full benefits of some of the high value NWFPs, requires specialized/sophisticated skills ranging from Bio-prospecting at the resource end, to quality control, storage and packaging at the market end. Management of NWFPs will, in all likelihood decide the sustainability of forestry in the future (M E F, 2001).

The economic and statistical services have the important role of calculating into the national, regional and local economies the economic contribution of forests in general and NWFPs in particular. This integration has been far from adequate and much effort is still needed; new orientations of national statistics in their endeavor to include most natural resources and their products in national accounts will probably improve the situation. The NGOs have contributed in documenting local knowledge, collecting traditional technologies, promoting use of NWFPs and income-generation activities. They have organized local groups. Their role is central in the future development of NWFPs (www.fao.org/docrep/V7540e/V7540e27.htm).

2.7. Harvesting of Non- wood Forest Products:

There is variation in the system of organization NWFPs harvest. One common system is the collection by local people under rights bestowed for sale in the local market, or with some form of patronage and financial help from purchasing agent. Another is by the employment of casual or contract labour by those who have obtained collection right on lease. The collectors of non-wood forest products are often exploited by middlemen who control access to the resource. There is considerable variation in the way in which non-wood forest products are harvested and utilized. This

cause differences in the nature of linkage and these differences vary from product to product, region to region and locality to locality (FAO, 1999). Harvesting is central to the sustainability of the resource and the economics of the product it sustains. It is essential to overall conservation of the producing ecosystem and to biological diversity. Yet only sporadic institutional support, if any, is currently provided to the harvesting of NWFPs. In many cases harvesting takes place in the realm of free and uncontrolled access, and with the pressure of urban markets has become destructive and turned to real plunder of resources. This is especially true in the case of edible products, the sale of which makes easy cash possible. In many cases, however, local groups have organized harvesting to minimize degradation of the resource and secure proper, balanced and equitable access (www.fao.org/docrep/V7540e/V7540e27.htm). (FAO, 2012)

2.8. Types and uses of Non- wood Forest Products:

The use of NWFPs is as old as human existence. In subsistence and rural economies, the role and contribution of NWFPs are crucial because of their richness of variety, as sources of food, fodder, fiber, fertilizers, herbal potion, contraction material and cosmetic and cultural products. They support village level artisanal and craft activity. NWFPs provide raw material to support processing enterprises, they include internationally important commodities used in food products and beverages, confectionary, flavourings, perfumes, medicines, paints and polishes. About 8% of the population of the developing world depends on NWFPs for their primary health and nutritional needs. Several millions of people all over the world depend on these products for meeting their subsistence consumption and income needs (FAO, 1995).

Trees are direct food source as they produce fodder and fruits, such as Dom, Higlig, Godaim, Nabag and Daleib. They also contribute with their flowers, which produce honey and other useful products such as tanning materials, pesticides and drugs. The following features characterize them:

- Available for all limited income to communities.
- Do not need complicated technologies.
- More stable than other agricultural food products because they are part of permanent plants.
- Do not need many inputs for sustainable production.
- Their natural composition enables them to have limited secondary side effects on the human beings and animals as well.
- A very important nutritional source for animals especially the wild ones that are equally another source of food for people, in addition to their provision of supplementary income source from their products (Al- Hourri. et al. 2000).

2.9. Marketing of Non-Wood Forest Products:

The term marketing and trade are often used interchangeably. Trade in its limited sense is the act of exchange of products for money or other products. Market oriented production often goes through several level of processing. The higher level of processing carried out at or near the source, more of the products value can be retained locally. This offers the prospect for improving local employment, income and livelihood (FAO,1995).

NWFPs are also important traded commodities, which can be found on local, regional, national as well as international markets. Traded NWFPs contribute to the fulfillment of daily needs and provide employment as well as income. Internationally traded NWFPs, such as gum Arabic,

aromaticoils and medicinal plants, can achieve high prices in comparison with NWFP traded on national markets and thus contribute to the economic development of the respective country

<http://www.fao.org/forestry/FON/FONS/outlook/Africa/acpro-e.stm>

(FAO,2000).

The most common NWFPs put on the market in the northern parts of Sudan, in addition to gum Arabic, are listed in Table 2. The main markets for these products are in towns, with Om durman supposed to be the main national trading centre.

Table (2): Main NWFP products on the market in northern Sudan

Species	Local name	Part used	Utilization
<i>Acacia nilotica</i>	Garad	Pods	Medicine, tannary
<i>Adansonia digitata</i>	Gongleiz	Fruits	Beverage, food, medicine
<i>Balanites aegyptiaca</i>	Laloub	Fruits	Food, fodder
<i>Borassus aethiopum</i>	Daleib	Fruits	Food, basket
<i>Boswellia papyrifera</i>	Gum loban	Resins	Fragrances, perfume industry, chewing gum production
<i>Commiphora sp.</i>	Gum loban	Resins	Fragrances, perfume industry, chewing gum production
<i>Cassia senna</i>	Sanameca		Medicine
<i>Cordia africana</i>	Gimbeel	Fruits	Food
<i>Grewia tenax, G. mollis</i>	Gudiem		Beverage, food, medicine
<i>Hyphaene thebaica</i>	Dom	Fruits	Food, fodder, basketry
<i>Tamarindus indica</i>	Aradeib	Fruits	Beverage, food, medicine
<i>Ziziphus spp.</i>	Nabag	Fruits	Food, fodder
<i>Salvadora persica</i>	Arak	Bark stem roots	Tooth brush
<i>Azanza garkenna</i>	Jaghjagh	Fruits	Food
<i>Detarium macrocarpum</i>	Abu Leila	Fruits	Food
<i>Ximena Americana</i>	Um dika	Fruits	Food
<i>Lawsonia inermis</i>	Hina	Fruits	Cosmetics

Source: Sulieman and Eldoma (1994)

2.10. Non-wood Forest Products and poverty alleviation:

Forest foods can offer vital insurance against malnutrition or famine during times of seasonal food shortage or emergencies such as droughts, floods or wars. It is common for rural households to depend on forest foods between harvests, when harvested stocks have been consumed but before new crops will be matured. Women, in particular, count on these resources for supplementary nutrition, emergency foods, fuel wood for cooking and many other important products they need to ensure the nutritional well-being of their families. Probably the majority of rural households in developing countries, and a large proportion of urban households, depend on plant and animal products of forests to meet some part of their nutritional, cooking and/or health needs. There is a wealth of wild fruits and flowers that have great potential for local use as well as commercial development. Trees and forests contribute to improving the well-being of local populations by providing a wealth of food, flavourings, medicines and beverages (www.conserveafrica.org.uk/non-wood-forest-products).

2.11. Management of Non-wood forest products

Due to their variety and to the large range of uses in which they are solicited, NWFPs interest a number of statal institutions whose interventions are needed in many areas: harvesting, processing and final utilization. The issues to be considered relate to identifying the administrative units that should be responsible for the sector and the local organizations that should be set up to assist in development activities. Some preliminary considerations include:

- Due to the decentralized nature of the activities generating NWFPs, one could expect to have many institutions involved in the economic channels covering their handling from production to consumption.
- These institutions should serve as facilitators in resolving problems affecting the common access to and use of resources, the conservation and management of resources, technology assessment and transfer, and organization of the framework in which activities will be developed (www.fao.org/docrep/V7540e/V7540e27.htm).

2.11.1. Subsistence and Cultural Uses of NWFPs:

In terms of subsistence use, NWFPs are critical for health, food, nutrition, shelter and energy. Considering food security and nutrition alone, poor people depend on NWFPs for many regularly utilized foods, for crisis or famine foods, for firewood to cook, for nutrients and vitamins, for grazing, for genetic resources, for inputs into agricultural production, such as implement handles and ploughs, and for the raw material for manufacturing such items as canoes for fishing. Non-wood forest products make significant contributions to livelihoods for the poor and more so for remote area dwellers. These areas are physically or frictionally distant from locations of strong economic activity and may lie behind ecological barriers such as mountains or disease prone areas (Emmanuel, et al, 2010).

2.12. Contribution of NWFP in Household Food Security:

Food security has been given different definitions and received vary interest in the past. The committee on world food security defined food security as an economic and physical access to food for all people at all

time. The World Bank defined food security as the access by all people at all time to enough food for health and active life. Conventionally, food security is defined as the balance of food supply (mainly cereals supply) and effective demand for food. Furthermore World Bank definition of food security is access by all people at all times to enough food for an active and healthy life accepted. This definition encompasses two elements:

- a) Food supplies
- b) The access or ability of household to acquire food, through their own either production or purchase.

Access to food security concerns the microeconomics of the household. In particular it describes the use of food in the household, access to it by various members in the household, household survival strategies and the role of gender ((NFP,2000).

NWFPs are important in household food security. They supplement household agricultural production. They are particularly important in reducing the shortages suffered during the hunger periods of the agricultural cycle. They also help to even out seasonal fluctuations in availability of food. They often contribute essential inputs for household nutrition. They are also valued as components of social and cultural identity. NWFPs are important in household food security. They supplement household agricultural production (see Table 3). They are particularly important in reducing the shortages suffered during the "hunger periods" of the agricultural cycle. They help to even out seasonal fluctuations in availability of food. They often contribute essential inputs for household nutrition. They are also valued as components of social and cultural identity. However, these uses and values vary enormously from one area to the next (FAO, 1995).

Table (3): General contributions of forest foods to human nutrition

Type of forest food	Nutrient
Fruits and berries	Carbohydrates (fructose and soluble sugars), vitamins (especially C), minerals (calcium, magnesium, potassium); some provide protein, fat or starch
Nuts	
Young leaves, herbaceous plants	Oils and carbohydrates
Gums and saps	Vitamins (beta-carotene, C), calcium, iron
Invertebrates (insects, snails)	Proteins and minerals
Vertebrates (fish, birds, mammals)	Protein, fat, vitamins
	Protein

Source: Food and Nutrition Division, FAO 1994.

2.13. Environmental Dimensions of NWFPs:

The environmental dimensions of NWFPs cover a wide range of roles and aspects such as: generally non-destructive nature of NWFPs harvests supporting sustainable management of forest resources and conservation of biodiversity, their contribution to the socio-economic welfare of communities living in upland and watershed areas, their amenability to be integrated with the management of protected areas and buffer zones and compatibility of management objective, allowing controlled extraction of non-wood forest products, eco-tourism and other services which are environmentally sound and safe and which can generate income especially in marginal areas and for local population (FAO, 1995).

2.14. Medicinal Plants:

2.14.1. Description, processing and use of medicinal plants:

Wild plants were recognized as being an important component of health care throughout human history. In 1999, the FAO identified medicinal

plants as being among the most valuable non-wood forest products (Osemeobo and Ujor, 1999).

It is currently estimated that as many as 35,000 to 70,000 species of plants worldwide have been used at one time or another for medicinal purposes (Hamilton, 1992), resulting in thousands of kilogram's of medicinal plants and/or their parts being collected and used every day (Lambert, 2001). Of the 40,000 or so flowering plants found on the African continent, an estimated 15–25 per cent are used in traditional medicines (Maundu et al, 2005). Users themselves, bought from, may collect traditional medicines traders or administered through consultation with a traditional healer. In many countries large markets for these NWFPs exist. For example, the informal trade in medicinal plants and products in southern Africa is dominated by 400,000 to 500,000 traditional healers. The volume of plant material traded is estimated to be between 35,000 and 70,000 tonnes per annum, with a market value of US\$75–150 million (Mander and Le Breton, 2006).

All plant parts are used for traditional medicines. These include roots, corms, bulbs, tubers, bark, wood, leaves, flowers, spores, fruits, seeds, seedlings and latex. Within the same plant the use of parts may vary depending on the treatment of the ailment (Osemeobo and Ujor, 1999).

2.14.2. Medicinal Plants and Their Importance:

The term "medicinal plants" is used to determine the plants or plant products used by human beings in the protection against, or treatment of, illnesses. This clarifies that not every plant is a medicinal plant. Further research is needed to identify other plants with useful medicinal properties. The term "herbal drug" determines the part/parts of a plant

used for preparing medicines (for example: leaves, flowers, seeds, roots, barks, stems etc.). According to the World Health Organization (WHO), 80% of the world population uses medicinal plants in the treatment of diseases and in African countries, this rate is much higher. Medicinal plants contain biologically active chemical substances such as coumarins, volatile oils, alkaloids etc. In addition to these substances, plants contain other chemical compounds. These can act as agents to prevent undesirable side effects of the main active substances or to assist in the assimilation of the main substances. Opium juice, for example, contains other chemical compounds in addition to morphine, and reports show that it gives fewer side effects than morphine administered on its own. The saponins found in the leaf extracts of *Digitalis purpurea* also assist the cardio-active heterosites to penetrate the blood more easily. Folk medicines including herbal medicines and teas, in which the active compounds of the plants are directly used, are the most commonly used of medicinal plants? The use of pure active compounds, obtained from medicinal plants, is also widely used. 400 compounds, derived from plants, are currently used in the preparation of drugs such as vincristin and vinblastin. These compounds are used in the cure of cancer and can only be obtained from the plant *Catharanthus roseus* (Rose periwinkle). They cannot be produced synthetically, and their market price per year is 100 million dollars (Eltohami, 1972).

Forest provide essential component of the traditional health treatment used throughout West Africa forest zone. They supply the medication for the vast majority of both rural and urban dwellers (an estimated 75-90% of the population rely on traditional medical treatment). Although there are a great variety of healing practices and beliefs, common to most system is the use

of plants in conjunction with ritual and mystical practices. These systems do not distinguish between physical and psychological elements of an illness, and thus rely largely on faith. It is important to note that forest plants are a component of a medical system, rather than the sole medical resources. Common plant treatments are known and used by the majority of rural people in addition to these used by specialist healers (FAO, 1990).

CHAPTER THREE

THE STUDY AREA

3.1. location:

Central Darfur States is located in western Sudan. It lies between latitudes $11^{\circ} 13' 7''$ N and longitudes $21^{\circ} 24'$ E. the state borders Northern Darfur State on the north, Southern Darfur State to the east, western Darfur State on the Northwest, Republic of Tchad to the west and Republic of Central Africa to the southern part. The total area of the state is about 44.906 km. (MOA, 2013).

3.1.1 Geographical of the study area:

The study area is in the surrounding lowland of Jebel Marra which is a dormant, late tertiary, volcanic massif resting on a base of Archaean rocks at the summit of an up warping between the Chad and Nile basins. The lowland of the basement complex have been formed by the more easily weathered Schists and gneisses, while the hill lands such as Tebella massif (1413m) and the Kongyo hills (1359m). lying to the south east and north of Zalingei ,respectively, are from the more resistant paraschists and gneiss, and represent the remnant of higher and older land surface (Wickens, 1976).

General Geology of study area was superficial deposits, alluvial deposits and basement complex rocks.

3.1.2 Administrative Structure:

Administratively Central Darfur State (CDS) comprises Nine's localities, namely: Zalingei - Azom – wadi salih – West of Jabel Marra – North of Jabel Marra – Um dokhon – Mokjar – Central of Jabel Marra – Bendesi. The village leaders are entrusted with responsibilities for

administrative and judicial functions within their own areas. The Umda is the judicial authority for more than five villages, this traditional system of dimingawy, sheikh and Omda is known as local administration, which

Originated early in the 1900s and presently provides assistance to the localities (CDS.2016).

3.2 Population:

About 553,515 inhabitants, according to the fifth population census, estimated population of CDS, which did not, include JM localities and IDPs camps,(CDCO, 2008).

3.3 Soil of the study area:

The soils of the study area derived from the gneisses and shists and granites of underlining basement complex. The soils include those of drift alluvial and dry plains. These few sedentary soils and when found are generally truncated (Wickens, 1966).

In many case transported soil material overlies a weathering zone, becoming a part of depositional layering. The predominant top soils is sandy loam. Becoming loam or sandy clay (Hunting Technical service).

Other soils range from grey to brown gravely of pedi plains to alluvial and colluvial soils (clay loam) in depressions and along the main valley and water courses to volcanic ash and sandy loam pediments plains. The soil of Wadi Saleh area is mostly neutral or slightly acid with little or no lime content. Soil organic matter and the available phosphorous are low ,with relatively highly soluble potassium and the carbon/ nitrogen ration i wide(Ali,2002).

3.4 Climatic features:

The main factor determining the climate of the region is the seasonal shift of the inter-tropical Convergence Zone, the front of which moves with changing zenithal position of the sun, with a time lag of between four to six weeks. During the winter months, from October to March, pressure is high over the sahara and the dry north winds blow across the Sudan towards the inter-tropical convergence Zone, which may lie as far to the south as the tropic of Capricorn.

With the advance of the sun towards the summer solstice, the zone of convergence of northerly and southerly air streams moves northwards across the Sudan and moist, unstable air is drawn in from the south Atlantic Ocan.(Bar bour, 1961).

The relative humidity is generally low. At Wadi saleh and Zalingei the potential evopo-transpiration is probably in the order of 170 cm per annum, with a maximum of 20 cm in May and a minimum of 8 cm in December and January.

3.4.1 Temperature:

The average temperature at Wadi Saleh and Zalingei varies between 20°C in winter and 27°C at the beginning of the rains in May – June. The average diurnal variation is greatest during the winter dry season (28°C) and least during the rains (August, 10°C). The average maximum temperature are lowest in the rains (August, 29°C), rising to 34°C in December and 38°C in April. The average minimum temperatures are lowest in December and January, 6°C, and highest in June and July 19°C. (FAO, 1968).

3.4.2 Rainfall:

The rainfall amount in the study area is ranging between 400 mm and 800 mm and duration of rain season begins in the month of May and ends in October (JMRDP, 2016).

3.5 Topography:

3.5.1 Drainage:

The water resources of Jebel Marra can support the settled population, it is a unique region covering the area from the North-West of Darfur and continuing in to Chad. Jebel Marra forms a ridge between the Nile Basin and lake Chad. The drainage to the Nile Basin is mostly through Behar El Arab, while the drainage to lake Chad is through wadi Azom and wadi Kaja (Barsi, 2008). However, due to the aridity, high seepage and evaporation losses and the runoff from Jebel Mrea reaches Behar El Arab only during high rainy season.

The streams in Darfur are ephemeral, usually running during and shortly after the rainy season. The flow records of most of these wadis are short, discontinuous and have a poor quality. Numerous wadis originate from the high lands of Jebel Marra and from eight major wadis.

3.5.2 Tree species in wadi saleh forests:

The study of woody biomass by (Adam,2009) revealed that thirty one tree species were identified and recorded in the survey area reflecting a low biodiversity. The number of trees per hectare was found to be only 42 trees. *Albizia amara* and *Balanites aegyptiaca*,), *Zizyphus spina Christi* (nabag), *Acacia nilotica*(garad). *Faidherbia albida*(Haraz)...etc. were the most abundant and dominant species followed by, *Boswellia perepera* (trag trag), *Cordia africana*(gimbeel), *Kaya senegalensis*(mohogni). *Tamarindus indica*(ardeb),*Acacia Senegal* (Hashab),...etc.

A wide variation between sites in terms of species composition and number of trees per unit area was found. Focusing on the natural regeneration, the study illustrated a total number of 8598 seedlings/ha from 31 species in the whole survey area. However some tree species were only found in the main plots and were completely absent in the regeneration plots. In contrast, other species showed natural regeneration where as they did not occur in the main plots.

3.5.3 The woody vegetation of Wadi Saleh:

Rainfall and soil textures are the most important determinants of the vegetation in the area under study. The total number of regeneration in the study area was found to be 3047 seedlings and the average number of natural regeneration per hectare for the whole survey area was calculated as 14509 seedlings. This number of regeneration accounts for 31 different tree species. The highest number of natural regeneration was recorded in wadi saleh area. Also the study revealed that *Acacia Senegal* is the high number of natural regeneration and formed thicket stage followed by *Balanites aegyptiaca* and then *Albizia amara*. The high regeneration of *Acacia senegal* gives signs of vegetation change to spiny species. The occurrence of natural regeneration from *Calotropis procera* and *Dichrostachyos cinerea* indicates forest and woodland degradation .

Only natural regeneration of *Balanites aegyptiaca* and *Zizyphus spinachristi* were found and recorded in the ten study sites and some species such as *Xeromphis nilotica*, *Cordia africana*. And *Grewia villosa* did not show up in the list of mature trees.

There are many different types of trees were found in several parts of wadi saleh locality area such as: *Acacia nilotica*, , *Acacia seyal*, *Khaya*

senegalensis, *Tamarindus indica*, *Burkea africana* *Faidherbia albida*,
Anogeissus leiocarpus, *Grewia tenax*, *Acacia seiberana*, *Acacia nilotica*.



Natural regeneration of *Acacia senegal* forming thicket stage in Nabagaya- Garsila- Wadi Saleh(2009).

3.5.4 Wood products in the study area:

Wood may be the most important forest product used by communities of Darfur in general and Wadi Salah area in particular, beside their Contribution in the supply of fuel wood and poles. The forest produces Sawn timber and sawn logs from several species; however, saw logs Production from natural forest is not based on management plans in spite of the presence of two government mills that provide commercial service to the communities (FNC, 2001).

3.6 Land use and economic activities:

Agriculture has been practiced in the study area for centuries and crop production is based on rainfall through various traditional farming systems. Then the agriculture land which exploited by communities ranges between 225000 to 230000 Feddan almost in the study area in the study area. And also average total cultivated land per farmer, from about 3 to 5 Feddan on the wadi alluvial and sandy clay land. While the main crops produces are Sorghum, Millet, Groundnuts, Beans, Semsem, Okras, greenpaper.(MOA, 2016).

3.6.1 Livestock Population:

Animal product also considered as economic activity, with animal wealth Estimated by 9.500.000 head of cattle, in all over the state in addition to some forests and forestry production and border trading. (MAR, 2016).

Table (4): Estimate Livestock population in Central Darfur State
(2013 – 2016)

Type of livestock	2016	2015	2014	2013
Cattle	1420216	40002894	40002894	40002791
Sheep	1030429	100041697	10004194	100041691
Goat	2060222	20021597	200021594	200021591
Camel	235870	22899997	22899994	22899991
Total	4746737	182966288	272928676	362966064

Source: Ministry of Animal Resouce(2016)

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 General

In order to achieve the objectives the following methods were applied:

4.2 Primary data:

The primary data include the following:

4.2.1. Personal field observations:

General survey and visits to the study area were adopted to assess the visual indicators or aspects such as NWFPs sources, vegetation cover, products diversity, types and quantity, besides the general characteristics of rural communities in the study area.

4.2.2. Households Interviews:

This is were based on structured questionnaires covering different parameters

I: Sample Selection:

Five villages namely (Fogo, Amargadeed ,Mando ,Garsyla and Daleeg) were randomly selected from the total number of villages which are about (20) villages, representing a locality on the basis of similarities in socio-economic activities and livelihoods levels (small-scale agriculture ,charcoal production, animal husbandry and collection of forest products).

II: Sample Size:

Systematic Random Sample was applied as a sample technique to determine a sample size. The sample size was selected according to the number and list of all households in these villages. The sampling unit in

the household survey was the household head. Ten percent was taken from the total numbers of households in these villages for interviews.

4.2.3. Key informants:

Direct interviews were carried out with key informants to provide informations on NWFPs uses and changes in use and utilization links with sustain livelihoods and increase the income generation of rural communities.

4.2.4. Focus group discussions:

This was conduct to obtain a broader understanding on what kinds of benefits, dos household get from collection and marketing of NWFPs at the village levels.

4.3 Secondary data:

The information's about the NWFPs in contributing to rural economy and poverty alleviation was collected from different documents which were included the scientific papers, researches, reports, text books..... etc.

4.4. Data analysis:

Quantitative data was analyzed using statistical Package for Social Sciences (SPSS). The main statistical analyses applied were frequency and descriptive statistics. Chi- square test for independence would used to determine associations between categorical var

CHAPTER FIVE

RESULTS AND DISCUSSIONS

5.1 General

Non- timber forest products have in the past been referred to ‘minor’ forest products. And now even perceived to be of importance to some local and national economies as well as being important elements in sustainable forestry and for their “contribution to Environmental objectives, including the conservation of biological diversity”. Example of NWFPs include products used as food and food additives (edible nuts, mushroom, fruits, herbs, spices and condiments, aromatic plants, and game) fibers (used in construction, furniture, clothing or utensils), resins, gums, and plant and animal products used for medicinal, cosmetic or cultural purposes. Some NWFPs are also important export commodities. At present, at least 150 NWFPs are significant in terms of international trade, including honey, gum Arabic, rattan, bamboo; cork, nuts, mushrooms, resins, essential oils, and plant and animal parts for pharmaceutical products (FAO, 2003).

5.2 Social characteristic of local communities:

Table (5): Kind of respondents in the study area

Sex	Frequency	Percentage
Male	76	84
Female	14	16
Total	90	100

Df = 1, sig = ***, chi-square = 42.711

*= significant **= high significant ***= very high significant

The result in table (5) showed that there were very high significant differences at $p < .000$, among the respondents. About 84% of the respondents were male, while 16% of them were female. The reason that there were very high significant between the respondents investigated due to involving male in the forest activities more than female and also the male is the leader of households which depend on NWFPs to meet their basic needs.

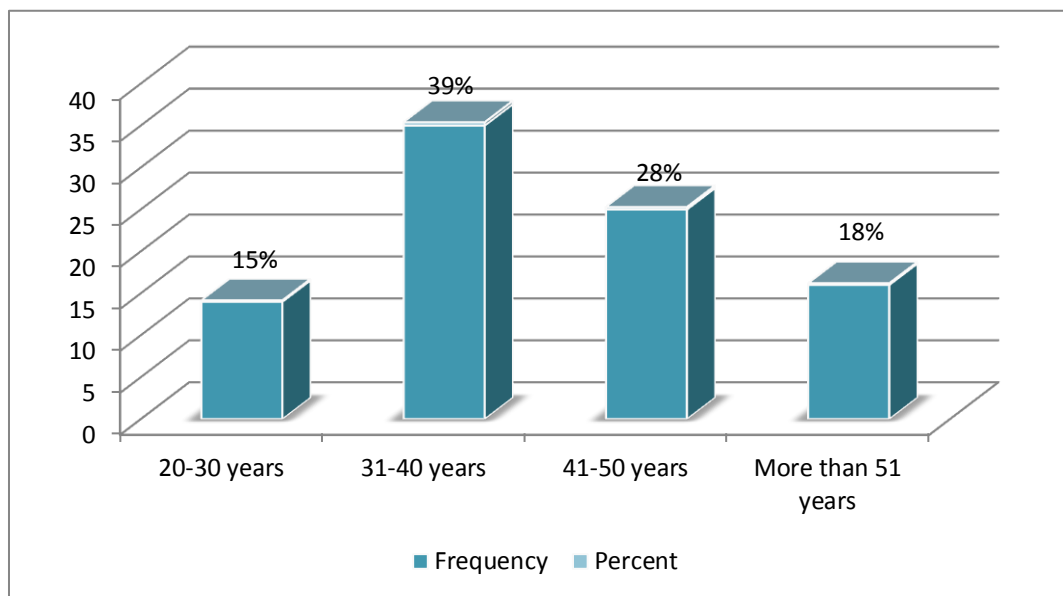


Figure (1): Age group in the study area

DF = 3, sig= **, chi-square = 12.311

NS=not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant

According to the result in figure (1) which showed that there were high significant differences at ($p < 0.006$) among respondents ages groups. About 67% of them fall within range of 31-50 years, followed by 18% of the respondents more than 51 years and only about 15% their ages range between 20-30 years. The reason that respondents between 31-50 years

due to more have been involved in activities of forests particularly NWFPs. While the respondents more than 51 years and youth's their participation in forest activities is very minor because the forests is far from the villages and routes from the forests it's very inaccessible and not safe.

Table (6): Education level in the study area

Levels	Frequency	Percentage
Illiterate	26	29
Khalwa	20	22
Primary	8	9
Secondary	19	21
University	17	19
Tot	90	100

DF = 4, sig = *, chi-square = 9.444

Ns = not significant ($p < 0.05$), * = significant, ** = high significant, *** = very high significant.

Table (6) showed that there were significant differences at ($p < .51$) between respondents education level. About 51% of the respondents were educated at Khalwa and Illiterate level, followed by 21% of them were secondary, while 19% were educated at university and only 9% at primary level. This mean that the majority of the household in the area depend on NWFPs may be consider as a monitor to detect the possibility

of creating changes in attitudes and raising of awareness among the local people about importance of NWFPs resources.

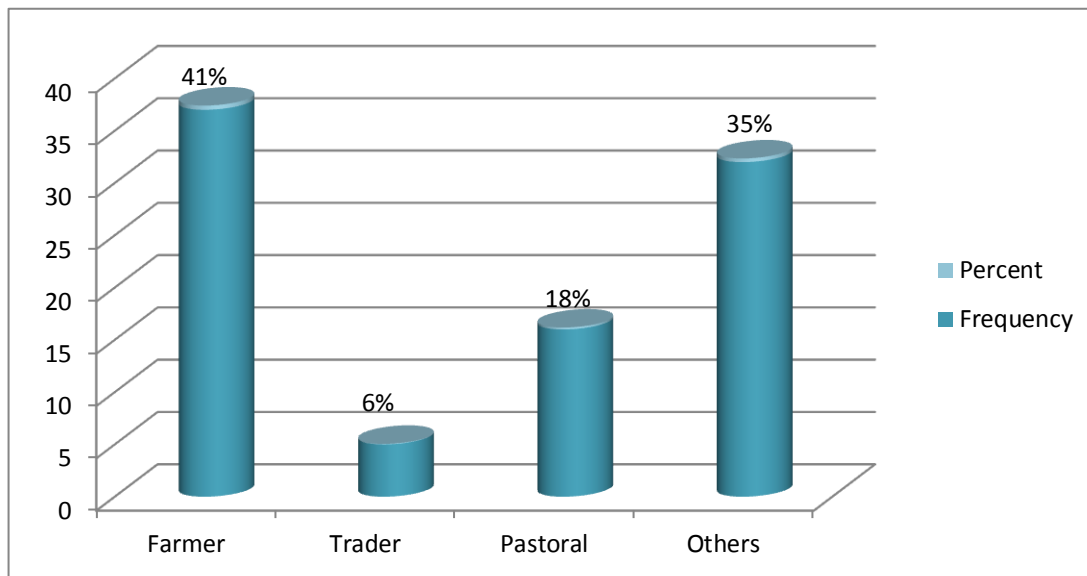


Figure (2): Occupation of respondents in the study area

DF= 3, sig = ***, chi-square = 28.844

Ns = not significant ($p < 0.05$), * = significant, ** = high significant, *** = very high significant

The figure (2) describes the occupation of the respondents in the study area, and also showed that there were very high significant differences at ($p < .000$) between respondents occupation. About 41% of respondents were farmers, while 35% of the households were depending on another occupation such as: drivers, tailors, carpenters, butchers, cooks, employees...etc, followed by 18% of them were pastoral and only 6% of the households are traders. This explained that the most of the respondents were farmers in the area according to the (MOA, 2016), stated that the majority of the people in wadi saleh locality were farmers and which depends on the agricultural activities and forest products as main source of food and income.

Table (7): Marital status of respondents in the study area

Status	Frequency	Percentage
Married	80	89
Single	8	9
Widow	2	2
Total	90	100

Df = 2, sig= ***, chi-square = 125.600

Ns = not significant (0.05), *= significant, **= high significant, ***= very high significant.

The result in table (7) showed that there were very high significant differences at ($p < .000$) among the respondents. About 89% of the respondents were married, followed by 9% of the respondents were single, while only 2% of them were widow. The reason behind that the majority of the respondents were married this reflected that they were settled in the study area, and depend on collection of NWFPs to increase their income beside their main occupation.

5.3 Sources of livelihood of local communities in the study area:

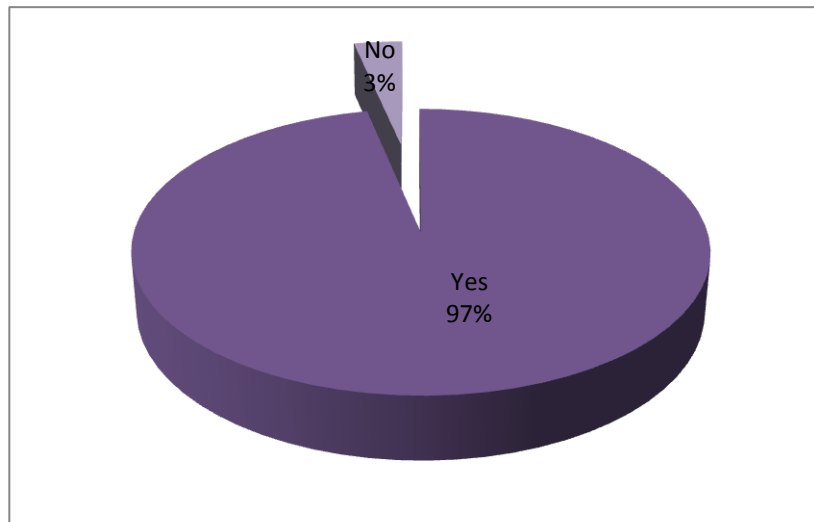


Figure (3): Collection of NWFP by respondents

DF = 1, sig = ***, chi-square = 78.400

Ns = not significant, *= significant, **= high significant, ***= very high significant.

According to the figure (3) there were very high significant differences at ($p < .000$) between respondents about the practice of collection of NWFPs. 97% of the respondents were collectors, while only 3% of them practice other activities. The reason that the majority of people depend on NWFPs collection may be attributed to the significant social value of NWFPs to improve their standards of living through preparing local foods and food additives. Beside these NWFPs provide raw materials for small scale industrial processing. The study found that the respondents were collected many types of the NWFPs in the study area which includes : *Balannites aegyptiaca*(laloab), *Zizyphus spina-christii*(nabag), *Faidherbia albida*(haraz), *Tamarindus indica*(aradieb), *Acacia senegal*(gum Arabic tree), *Cordia africana*(gembeel), *Acacia nilotica*(garad), *Albizia amara*(Arad), *Boswellia perezpera*(tragtrag), *Khaya senegalensis*(mohogani) and honey , according to FAO, (2000), trading of NWFPs contributes to the

fulfillment of daily needs and provision of employment as well as income.

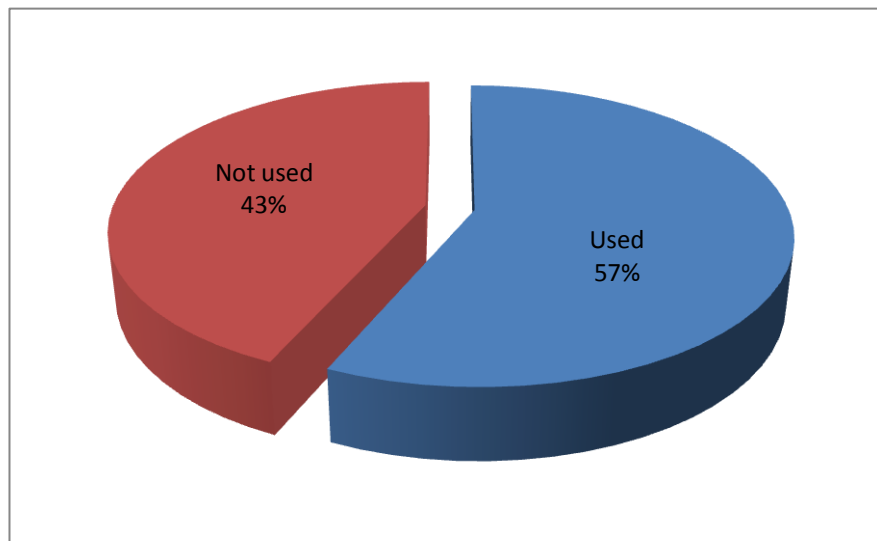


Figure (4): Utilization of NWFPs in handicrafts

Df = 1, sig = not significant, chi-square = 1.600

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

According to the result in figure (4) which showed that there were no significant differences at ($p < 0.05$) among the respondents. The result indicated that 57% of the respondents used some products for preparing the handicrafts, such as: fencing, chairs, beds, sticks, ornaments, sebha, oils, honey from fruits of *Zizyphus spina-christii* (Nabag), and different tradition foods. While about 43% of the households in the study area

Were used the Non-wood forest products as a raw material in other simple tradition processing like handicrafts.

5.4 Collection, harvesting and processing of NWFPs by local people:

Table (8): Seasons of collection and harvesting of NWFPs in study area

Seasons	Frequency	Percentage
Winter	23	25
Summer	26	29
Both seasons	41	46
Total	90	100

Df = 2, sig = *, chi-square = 6.200

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***=very high significant.

The result in table (8) explaining that there were significant differences among households investigated at ($p < .045$). About 46% of the people in the study area answered that they were collecting the majority of NWFPs in two season winter and summer, followed by 29% of them said that suitable time for the collection of NWFPs in summer, while only 25% of is them answered they were collected in winter season. The high collection of the NWFPs by the households in two season mean that the diversity of collecting seasons, different types of non-wood forest products in the study area and high marketing of products along the year, were a main reasons for collection of NWFPs by the local people to improve their income.

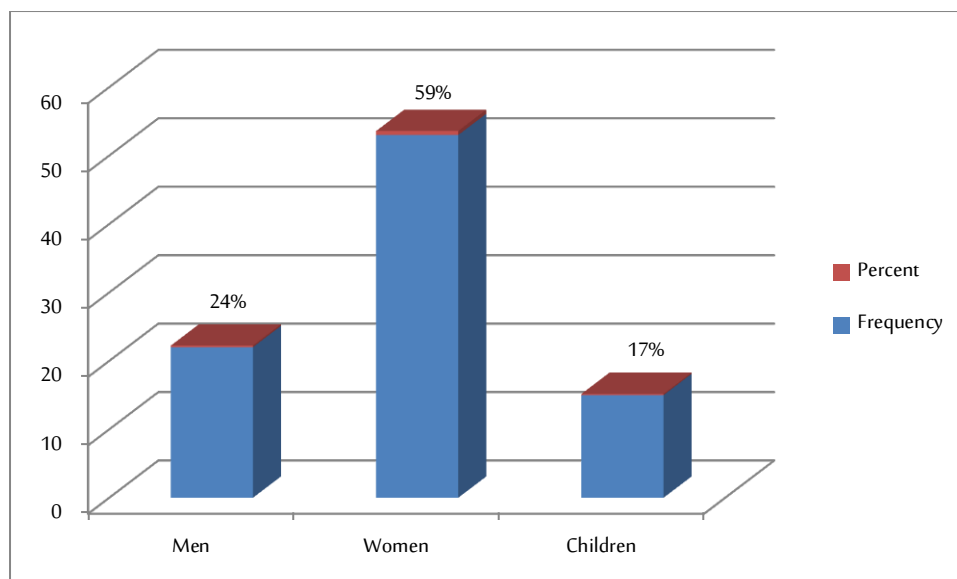


Figure (5): Process of collecting of NWFP

DF = 2, sig = ***, chi-square = 27.267

Ns= not significant, *= significant, **= high significant, ***= very high significant.

The result in figure (5) showed that there were very high significant differences among respondents investigated at ($p < .000$). 59% of the household were women, followed by 24% of them were men, and while 17% of the respondents were children. This means that women play a vital role in stating the essential needs for household's food beside men. as stated by FAO (2008), women from poor households are generally those who rely more on NWFPs for household use and income

Table (9): Ways of collection NWFPs by respondents in the area

Ways of collection	Frequency	Percentage
From the ground	61	68
From the trees	29	32
Total	90	100

DF = 2, sig = ***, chi-square = 56.867

Ns = not significant ($p < 0.05$), * = significant, ** = high significant, *** = very high significant.

According to the data in table (9) there were very high significant differences at ($p < .000$) about 68% of the respondents said that the easy methods for NWFPs collecting is from the ground, followed by 32% of them collecting from the tree. The reason behind that majorities of respondents were collected the non-wood forest products from the ground, these because they were used the traditional tools like (Konjara, stones, and shake), and climbing trees for collection, beside the characteristic of some trees that lead them to used these methods.

Table (10): Tools used in Collection of NWFPs in the area

Tools	Frequency	Percentage
Konjara	68	76
Shake	12	13
Stones	8	9
Other	2	2
Total	90	100

DF= 3, sig = ***. Chi-square = 124.933

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

The result in table (10) indicated that there were very high significant differences among respondents at ($p < .000$). The result explained that majority of respondents used traditional tools such as: 76% of them were used Konjara, followed by 13% were shaking the trees, while 9% used stones and only 2% of them answered they used another tools like axes, but use of these tools particularly axes and stones need extension program from FNC to the rural communities in the study area because the use of these tools have breaking for trees branches and dropping non-mature fruits.

5.5 production and marketing of non-wood forest products:

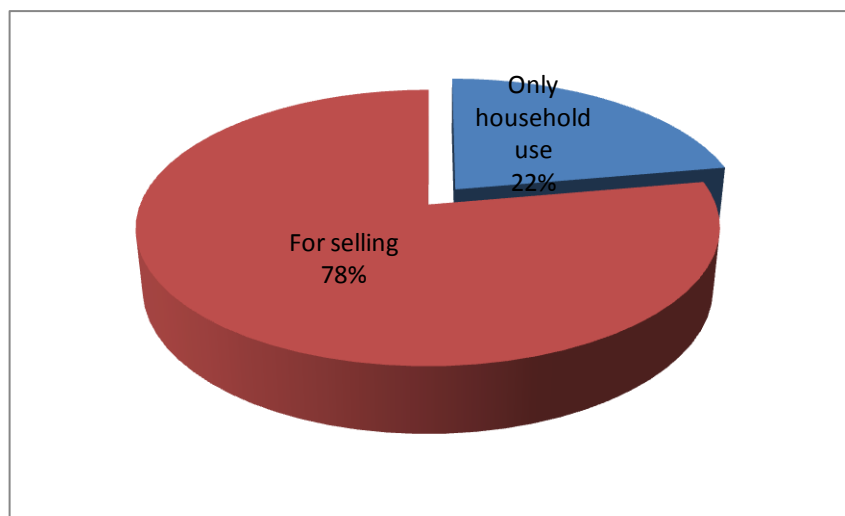


Figure (6): The purpose of NWFPs collection by household

DF = 1, sig =***, chi-square = 27.778

Ns= not significant ($p < 0.05$), *=significant, **= high significant, ***= very high significant.

The result in figure (6) showed that there were very high significant differences at ($p < .000$) among the respondents. About 78% of the

households were mainly collected the non-wood forest products for selling, while 22% of them were consumption the NWFPs at their home. This was according to (FAO, 1995) which stated that several millions of people all over the world depend on NWFPs for meeting their subsistence consuming, primary health and income needs.

Table (11): Addition value for NWFPs by respondents

Sorting of NWFPs	Frequency	Percentage
Sorting	59	65.6
Not sorting	31	34.4
Total	90	100

DF= 1, sig = **, chi-square = 8.711

Ns =not significant ($p < 0.05$), * = significant, ** = high significant, *** = very high significant.

The Table (11) showed that there were high significant differences at ($p < .003$), between respondents. 65.6% of the households said they were practicing grading, packaging and sorting for NWFPs which significantly help in improving the market of these products, while 34.4% of them mentioned that they were not adding value for these products. The high percentage of respondents confirmed that the addition value for these products improve the quality of goods, which increase the prices of these products to improve their income.

Table (12): Shapes of product introduce for marketing

Shape of product	Frequency	Percentage
Raw material	75	83
Processed	15	17
Total	90	100

Df = 1, sig = ***, chi-square = 56.390

Ns = not significant ($p < 0.05$), * = significant, ** = high significant, *** = very high significant.

The analysis of data in table (12) indicated that there were very high significant differences among respondents at ($p < .000$). About 83% of the respondents said they were sold their products as raw material, while 17% of them processed their NWFPs. This means a large percentage of the respondents sold their products in a raw material because the quantities being collected were small, and the prices in the markets were acceptable, this were due to provide their daily requirements.

Table (13): Types of market for selling NWFPs

Types of market	Frequency	Percentage
Village market	78	87
Town market	12	13
Regional market	0	0
Total	90	100

DF= 1, sig = ***, chi-square = 69.44

Ns = not significant ($p < 0.05$), * = significant, *** = high significant, *** = very high significant.

The result in table (13) showed that there were very high significant differences at ($p < .000$). About 87% of the respondent mentioned that they were sold major products in village markets because there were high cost of transportation, followed by 13% of the respondents sell products of *Tamarindus indica*(Ardeib), *Zizyphus spina Christi* (Nabag), *Balanites aegyptiaca* (laloab), Honey and Gum Arabic in town markets such as Zalingei and Nyala market and none of them sold their NWFPs in regional markets. This explained that the majority of the respondents would sell their NWFPs in the village markets to avoid a high cost of transportation and tax by FNC and locality.

Table (14): Trader of NWFP in the study area

Types of seller	Frequency	Percentage
Village trader	43	48
Town trader	37	41
Associations	0	0
Companies	10	11
Total	90	100

DF= 2, sig= ***, chi-square = 38.222

NS= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

According to the result in table (14) which showed that there were very high significant differences at ($p < .000$), among the seller of non-wood forest products. About 89% of the respondents sell their products to the village and market traders, followed by 11% of the households sell to the companies such as :(Gum Arabic and luban Gum), and there were absence for associations in the study area to buy any products from the

households. A large percentage of respondents sold their products for village and market traders; because the transportation of NWFPs was very high, beside of FNC and locality taxes, and also the majority of the collectors were women's and they were unable to travel away from their villages.

Table (15): Constraints faced the collecting and marketing of NWFPs

Answers	Frequency	Percentage
Yes	27	30
No	63	70
Total	90	100

DF = 1, sig = ** chi-square = 10.133

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

The analysis of data in table (15) showed that there were high significant differences among respondents ($p < .001$) according to the collecting and marketing of NWFPs. About 70% of the households said there were no any constraints faced them in collection and marketing of NWFPs in the area, followed by 30% of respondents mentioned that there were many constraints that faced them during the collecting and marketing process .The reasons that majorities of respondents stated that there were no constraints faced them, because they were living near the forests and have accessed to collect the products near their farms and villages ,beside these the study found that most of them sold their products to the villages traders, while some of them mentioned there were constraints in collecting and marketing of NWFPs such as: remote distances for some

products, low prices, problems of transportation, different taxes and security status.

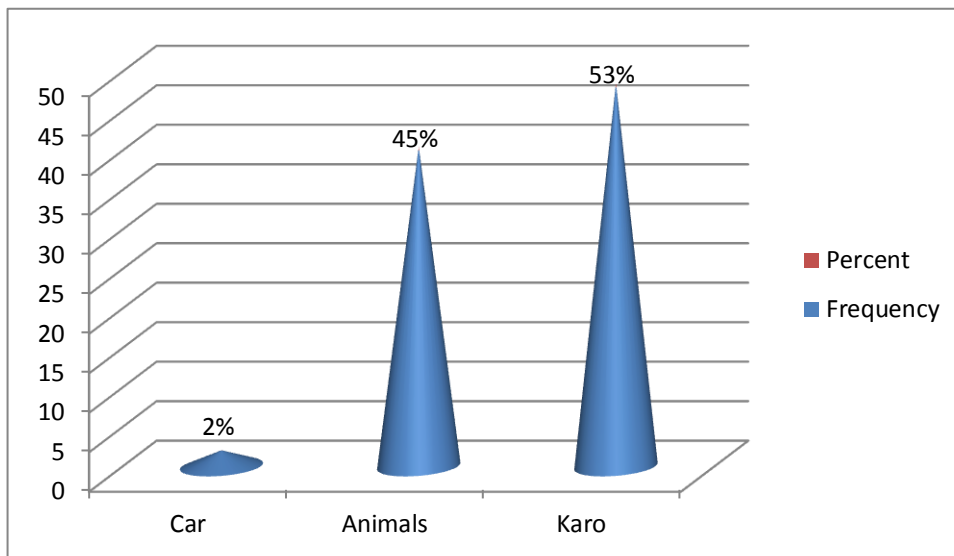


Figure (7): Types of transportations for NWFP in the study area

DF= 2, sig = ***, chi-square = 40.267

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

The result in figure (7) showed that there were very high significant differences among respondents ($p < .000$). The result indicated that 53% of the respondents used the common types like animals carts (karo) to transportation to reach their products to house and market, followed by 45% of them said they were used some animals, while only 2% of the respondents were used cars. The reason that the majorities of rural people in the study area were transport their commodities by the traditional means such as: animals carts and animals these due to the topography of the regions dominated by Hills, Mountains, high Slope and dense trees, beside the high cost of transportation by cars.

Table (16): Storage of NWFP in the area

Storage of NWFP	Frequency	Percentage
Storing	44	49
Not storing	46	51
Total	90	100

DF = 1, sig = not significant, chi-square=.044

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

The result in table (16) showed that there were no significant differences at ($p < 0.0$). About 51% of the respondents mentioned that they were not storing their NWFPs, while 49% of them storing the products. The reason behind that they are storing to gain suitable prices in order to meet their necessary needs, to collect enough quantity of products and be used through the year when availability of NWFPs is markedly reduced, particularly fruits of *Cordia africana* (**Gembeel**), *Grewia tinex* (**Gudiem**) and *Tamarindus indica* (**Ardeib**) to use during fasting season (Ramadan).

5.6 Contribution of NWFPs in food security and income generation of local people:

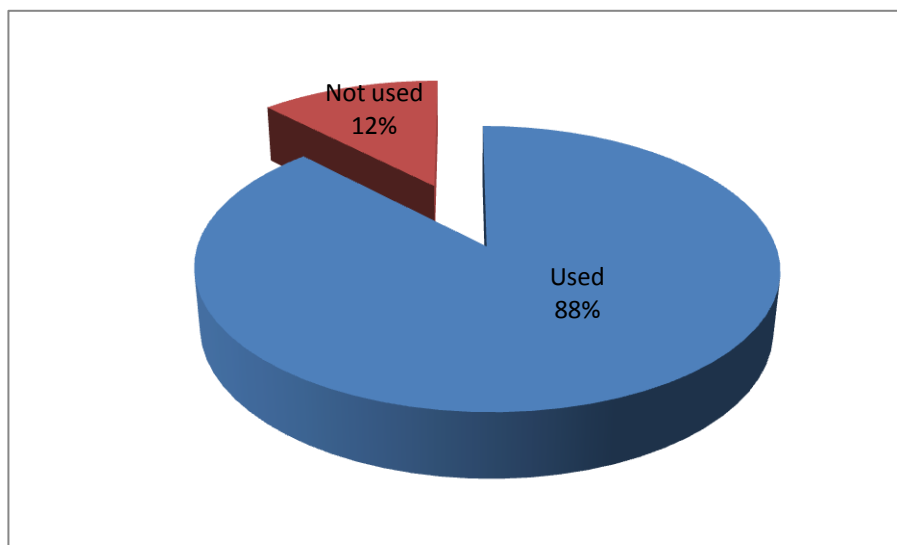


Figure (8): Use of NWFP in food security

Df= 1, sig = ***, chi-square = 51.37

Ns= not significant ($p < 0.05$), *= significant, **=high significant, ***= very high significant.

The result in figure (8) indicated that there were very high significant differences among the respondents at ($p < .000$). About contribution of NWFPs in used of these products in food security, 88% of the respondents stated that NWFPs have significant role at household's food security; this due to increases in their awareness about the direct consumption and nutrition value of NWFPs resources which include different types of products such as: *Balanites aegyptiaca* (Hajleeg), *Zizyphus spina Christi* (Nabag), *Grewia tinex* (Gudeim), *Tamarindus indica* (Aradeib), *Sclerocarya birrea* (Hemeid), *Ficus sycomorus* (Jemeiz) and *Cordia africana* (Gembeel), while 12% of them said that was no clear role in used of NWFPs in food security. As stated by Olawoye (1996) NWFPs make significant direct contributions to food security of the rural population by providing a wide range of food which provide

essential nutrients especially at times when other food sources are not available.

Table (17): Contribution of NWFP in livestock feeding

livestock feeding	Frequency	Percentage
Contribute	84	93
Not contribute	6	7
Total	90	100

DF= 1, sig = ***, chi-square = 67.600

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

According to the result in table (17) showed that there were very high significant differences at ($p < .000$), among the respondents about contribution of NWFPs in producing fodder for feeding livestock. 93% of the households mentioned that NWFPs contribute in feeding their livestock in study area, through many types of trees such as: *Faidherbia albida*(Haraz), *Zizyphus spina Christi*(Nabag), *Balanites aegyptiaca*(laloab), *Albizia amara*(Arad), *Sclerocarya birrea* (Hemeid), *Ficus sycoorus* (Gemeiz) and *Acacia nilotica* (Garad), while only 7% of them said that there were no clear role for NWFPs in providing fodder for livestock. (Kamwenda, 1999), stated that fodder from some trees and shrubs are particularly important during dry seasons when availability of grasses is markedly reduced. Feeding livestock inside forest therefore takes place during this season when resources within public land have been exhausted.

5.7 Role of FNC in management and protection of NWFP resources:

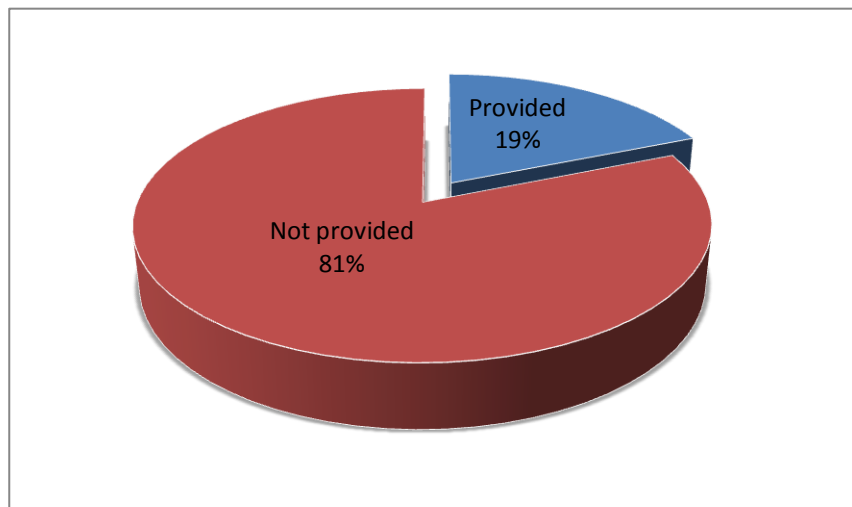


Figure (9): The role of FNC in management of NWFPs

DF= 1, sig = ***, chi-square = 34.844

Ns= not significant ($p < 0.05$), *= significant, **=high significant, ***= very high significant.

Figure (9) showed that there were very high significant differences at ($p < .000$) among the respondents. About 81% of the respondents stated that there were no clear role from FNC in management and protection of NWFPs because the all forest management planning focus in wood production, besides the recent conflicts in Darfur that took place in the study area, while 19% of them answered that there were some efforts from FNC at state level in management and protection. According to the Central Darfur State forest manger (2017), there were no specialized units in NWFPs at the state level, but he confirmed that there were several forestry activities implemented in collaboration with National and Foreign Organization in the State such as: Seedlings Production, Seeds Sowing, and workshops in importance of NWFPs and environment

conservation, Also there were great role for forest guards and community leaders (Umda and Sheikh) in Protection of NWFPs in the study area.

Table (18): The role of forest extension towards important of NWFPs

The role extension	Frequency	Percentage
Found	51	57
Not found	39	43
Total	90	100

DF = 1, sig = not significant, chi-square =1.600

Ns= not significant ($p < 0.05$), *= significant, **= high significant, ***= very high significant.

The analysis of data in table (18) showed that there were no significant differences among the respondents at ($p < 0.05$) 57% of the households found that the role of forest extension from FNC to the rural communities about the importance of NWFPs through conducted workshops to raising the awareness of local people through distribution of seedlings ,adoption of trees cultivation in their farms and encouraging them in seeds sowing for the farmers (Hashab Seeds), while 43% of them answered that there was no extension programs focus on NWFPs that conducted by FNC staff directed to the rural communities in the study area. The reasons behind that may be attributes the shortage in budget from FNC to provide extension services to local communities towards the production and management of NWFPs and the insecurity status in the study area as well.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions:

Based on the results obtained and the findings regarding to the assessment the contribution of non-wood forest products in improving livelihood of local communities, the study concluded that:

- The forest covered about 37% of the total land of Central Darfur State; particularly Wadi salih Locality which is rich in natural forest that providing various types of NWFPs that play a vital role in local economy of rural communities.
- The study revealed that majority of respondents were farmers and agricultural activities as the main components of the economy in the Wadi Salih locality.
- The non-wood forest products were constituted as the source of indirect benefits such as building materials, fodder for animals, and also use the NWFPs in handicrafts to increase the income.
- The study found that about 59% of women were main producers and collectors for NWFPs in the study area.
- Most of respondents were depend on the NWFPs as a source of income after the season of agricultural crops in the study area.
- About 62% of the respondents mentioned that were not faced any constraints during the collection of non-wood forest products in the study area.
- The study found that the main types of NWFPs used by respondents for traditional foods in the study area were include: *Balanites aegyptiaca* (Lalob), *Tamarindus indica* (Aradeib), *Ziziphus spina-christii* (Nabag) and *Cordia africana* (Gembeel),

- The majority of respondents answered that clear absence of FNC was very cleared in providing extension programs toward the production and marketing of NWFPs in the study area.
- The majority of the respondents stated that no clear role for FNC in management and protection of NWFPs in the area.
- The respondents mainly depend on traditional means for transportation of Non-wood forest products from area of products.

6.2 RECOMMENDATIONS:

The study recommends the following:

- Establishment of clear marketing channels for NWFP product will assist in increase the income of households in the study area.
- The promotion of NWFP activities may increase demand for the subsistence in general and indirect contribution of NWFP to household food security through income generation.
- Strengthening the role of forest extension and participation of communities' leaders in protection of NWFP recourses through introduce of gas cylinder, beside these conducted training and capacity building in seeds sowing and planting of seedlings of trees to sustain the production of NWFPs.
- The FNC should put a great attention for non-wood forest products in national forest strategies planning.
- Research should be conducted in order to sustain the protection of NWFPs through adoption a suitable methods and tools.
- Forest extension should be strengthened in order to raise awareness and attitude of local communities about the importance of NWFPs.
- Empowerment of women in study area about production and marketing of NWFPs through capacity building and training.
- Formation of association to contribute in production, collection and marketing of Non-wood forest products in the study area.

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APPENDIX

Appendix 1: questionnaire

**Sudan University of Science and Technology
Faculty of Graduate Studies and Scientific Research
Master of Forestry Science**

**Questionnaire to gather information from local communities – Wadi
Salih locality**

**Research entitled: Assessment the contribution of non-wood forest
products in improving livelihood of local of communities in Wadi
Salih locality-Central Darfur state**

(This information is used only for research purposes only)

Socio-economic characteristic of local communities:

1-Name:

2-Village:

3-Gender: male female

4-Age group:

20-30 years 31-40 years 41-50 years more than 51
years

5-Education level:

Khalwa Illiterate Primary Secondary University

6-Occupation:

Farmer Trader Herder Others

7-Marital status:

Married Single Widow

Sources of livelihood of local communities in the study area:

1- Did you Collection the NWFPs?

Yes No

If answer was yes what is the products you
collect.....

2-Did you practice another occupation beside NWFPs?

Yes No

If answer was yes what is the occupation you
practicing.....

3-Did you use some products for the handcrafts?

Use Not use

If answer was yes explain.....

Processing of collection and harvesting of NWFPs by local people:

1-What is the season you collect and harvest these products?

Winter summer Two season

2-Who collect the non-wood forest products?

Men Women children

3-What is the best way for collection of NWFPs?

Collecting on the ground collecting on the tree others

4-What is the tools use in collection process?

Machinery by hands

5-If the answer was by hands what is the tools you use?

Konjara Shaking Stones Others

Production and marketing of non-wood forest products in the study area:

1-What is the target of collection of non-wood forest products?

Only households use for selling

2-Did you practice sorting and categorize these products?

Sorting Not sorting

3-What are the types of products for marketing?

Raw material Processed others

4-What are the markets for selling these products?

Local markets External markets International markets

5- Who is the seller of these products?

Village traders Market traders Associations

Enterprises others

6-Did you face constraints in collection and marketing of NWFPs?

Yes No

If the answer was yes explain.....

7-What is the major instruments use in transportation of NWFPs?

Cars Animals Karo others

8-Did you storage some of these products through the season?

Yes No

If the answer was yes explain.....

Contribution of non-wood forest products in food security and income generation of local people:

1-Do you use directly some of NWFPs in food security?

Yes No

If answer was yes explain the types

2-Did the NWFPs provide fodder for the animals?

Yes No

If answer was yes explain the types for fodder.....

Role of FNC in management and protection of NWFPs:

1-Did the management of forest provide development program in non-wood forest products in study area?

Provided Not provided

If answer was yes explain the services.....

2-Do you found extension program of NWFPs in the area?

Yes No

If answer was yes explain the program.....

Appendix 2: pictures

Marketing of Some handicrafts in the study area



Source: Salah Saleh. (2017)

Honey Production in Wadi Saleh Locality



Source: Salah Saleh.(2017)

Empowering of women through NWFPs



Source: Salah Saleh. (2017)

Bamboo slattered (mats) made in the area



Source: Salah Saleh.(2017)

Faidherbia albida (Haraz) fodder for feeding livestock in Wadi saleh locality



Source: Salah Saleh. (2017)